Lead Exposure during Pregnancy

HA Convention
2016

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黃碧雲批鉛水報告調查馬虎

星島日報

星島網24小時新聞

星島網24小時新聞
7 小時前

民主黨立法會議員黃碧雲批評，房委會調查公屋鉛水事件的中期報告調查馬虎，無真相、無跟進、無時間表、無問責、無懲處，令人失望。

黃碧雲表示，報告只著眼驗出焊料的鉛份，忽略其他部件可能出現的問題，質疑未能尋出事件真相，亦無法追究相關官員。她會在下星期立法會大會復會後，動議引用《權力及特權條例》，成立專責委員會調查事件。

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6/10/2015

林鄭自稱「官到無求膽自大」

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17/10/2015

Conflict of Interest

Nil

2015/07/29 星期三 23:47

啟晴鉛超標孕婦　提早產檢增檢測

Tweet 0

啟晴邨一名孕婦血鉛驗出超標，據悉，她屬懷孕初期，已預約於廣華醫院生育及跟進。廣華會提早約見她及加密結構超聲波檢查，又會為她補充鐵、鈣和維他命等，以減少鉛輸給胎兒。

威爾斯親王醫院中毒治療中心顧問醫生王紹明指，孕婦血鉛水平超標，可能通過胎盤將鉛傳給胎兒，有風險會影響胎兒發展，造成早產或小產，會安排產科醫生進行評估及跟進。

廣華醫院婦產科主管梁永昌說，昨天才獲悉該名孕婦本已預約在廣華醫院首次見醫生，診期正排期中，但不知其孕期，因她被驗出血鉛水平超標，故會安排在今日或明天提早見面，「她一定會擔憂，所以有需要早點見她」。

Flint water crisis

From Wikipedia, the free encyclopedia

Coordinates: 43°0′36″N 83°41′24″W

The **Flint water crisis** is a drinking water contamination crisis in Flint, Michigan, United States that started in April 2014. After Flint changed its water source from treated Detroit Water and Sewerage Department water (which was sourced from Lake Huron as well as the Detroit River) to the Flint River (to which officials had failed to apply corrosion inhibitors), its drinking water had a series of problems that culminated with lead contamination, creating a serious public health danger. The corrosive Flint River water caused lead from aging pipes to leach into the water supply, causing extremely elevated levels of the heavy metal. In Flint, between 6,000 and 12,000 children have been exposed to drinking water with high levels of lead and they may experience a range of serious health problems.[1] The water change is also a possible cause of an outbreak of Legionnaires' disease in the county that has killed 10

Flint water crisis

Flint River in Downtown Flint, circa 1979

Perspective

Lead Contamination in Flint — An Abject Failure to Protect Public Health

David C. Bellinger, Ph.D.
N Engl J Med 2016; 374:1101-1103 | March 24, 2016 | DOI: 10.1056/NEJMp1601013

Comments open through March 30, 2016

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The dangers of lead exposure have been recognized for millennia. In the first century A.D., Dioscorides observed in his *De Materia Medica* that "lead makes the mind give way." The first industrial hygiene act passed in the colonies, in 1723, prohibited the use of lead in the apparatus used to distill rum, because "the strong liquors and spirits that are distilld through leaden heads or pipes are judged on good grounds to be unwholsom and hurtful." More recently, large amounts of lead were used to boost the octane rating of gasoline and improve the performance of paint. One would be challenged to design a better strategy for maximizing population exposure to a poison than to have it emitted by a ubiquitous mobile source and to line the surfaces of dwellings with it.

The dramatic reduction over the past 40 years in blood lead levels in the

Audio Interview

Interview with Dr. David Bellinger on lead contamination in Flint, Michigan, and the lack of political will to protect

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9 2015

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The Daily Telegraph
DERREN BROWN

No. 86 Situation Update as at 1500hrs on 6 October 2015: Blood Lead Level Screening

Estate	Cumulative number of appointments	No. of appointments made:			
		Children	Pregnant women	Lactating women	Others
Kai Ching Estate	966	807	51	97	11
Kwai Luen Estate	492	413	30	41	8
Wing Cheong Estate	300	245	19	18	18
Lower Ngau Tau Kok Estate	803	702	36	49	16
Shek Kip Mei Estate	267	214	16	31	6
Tung Wui Estate	131	109	12	9	1
Hung Hom Estate	369	306	12	18	33
Yan On Estate	443	400	12	23	8
Un Chau Estate Phase 2 & 4	311	245	21	22	23
Choi Fook Estate	469	380	25	29	35
Ching Ho Estate Phase 1	419	378	11	20	10
Total	4970	4199	245	358	169

No. 86 Situation Update as at 1500hrs on 6 October 2015: Blood Lead Level Screening

Session	Number of blood specimens	Normal BLL	Elevated BLL					Pending for BLL result
			Children (under 18 years old)	Lactating women	Pregnant women	Others	Total	
BLL Screening on 14 to 16 July	10	10	0	0	0	0	0	0
BLL Screening on 18 & 19 July (UCH)	302	262	27	13	0	0	40	0
BLL Screening on 25 & 26 July (UCH)	314	291	18	4	1	0	23	0
BLL Screening on 25 & 26 July (PMH)	294	261	24	8	1	0	33	0
BLL Screening on 1 & 2 Aug (PMH)	292	280	9	2	1	0	12	0
BLL Screening on 8 & 9 Aug (QEH)	277	267	10	0	0	0	10	0
BLL Screening on 15 & 16 Aug (QEH)	284	276	8	0	0	0	8	0
BLL Screening on 22 & 23 Aug (PWH)	350	346	4	0	0	0	4	0
BLL Screening on 29 & 30 Aug (PWH, KWH, UH, HKSH)	791	780	9	1	1	0	11	0
BLL Screening on 05 & 06 Sep (PYN, CMC, UH, HKSH, HKBH, SRAH, TWAH)	840	832	5	0	0	3	8	0
BLL Screening on 12 & 13 Sep (PYN, KWH, UH, HKSH, HKBH, SRAH, TWAH)	833	826	7	0	0	0	7	0
BLL screening on 19 &20 Sep (UH, HKSH, HKBH, SRAH, TWAH)	179	174	5	0	0	0	5	0
BLL screening on 26 Sep (QMH, SPH)	107	107	0	0	0	0	0	0
BLL screening on 3 Oct (SPH)	17	N/A	N/A	N/A	N/A	N/A	N/A	17
Total	4890	4712	126	28	4	3	161	17

7.8% 1.6%


RISK

Risk scoring is an integral part of Antenatal Care Model

Pregnancies	Treat as low risk	Treat as high risk
Low risk		
High risk		

Risk scoring is an integral part of Antenatal Care Model

Pregnancies	Treat as low risk	Treat as high risk
Low risk		
High risk		Appropriate

Risk scoring is an integral part of Antenatal Care Model

Pregnancies	Treat as low risk	Treat as high risk
Low risk	Appropriate	
High risk		Appropriate

Risk scoring is an integral part of Antenatal Care Model

Pregnancies	Treat as low risk	Treat as high risk
Low risk	Appropriate	
High risk	Suboptimal	Appropriate

Risk scoring is an integral part of Antenatal Care Model

Pregnancies	Treat as low risk	Treat as high risk
Low risk	Appropriate	*Private Patients*
High risk	Suboptimal	Appropriate

GUIDELINES FOR THE IDENTIFICATION AND MANAGEMENT OF LEAD EXPOSURE IN PREGNANT AND LACTATING WOMEN

National Center for Environmental Health
Division of Emergency and Environmental Health Services

CDC

GUIDELINES FOR THE IDENTIFICATION AND MANAGEMENT OF LEAD EXPOSURE IN PREGNANT AND LACTATING WOMEN

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November 2010
U.S. Department of Health and Human Services
Atlanta, GA

The American College of Obstetricians and Gynecologists
WOMEN'S HEALTH CARE PHYSICIANS

COMMITTEE OPINION

Number 533 • August 2012 (Reaffirmed 2014)

Committee on Obstetric Practice

This document reflects emerging clinical and scientific advances as of the date issued and is subject to change. The information should not be construed as dictating an exclusive course of treatment or procedure to be followed.

Lead Screening During Pregnancy and Lactation

Abstract: Prenatal lead exposure has known adverse effects on maternal health and infant outcomes across a wide range of maternal blood lead levels. Adverse effects of lead exposure are being identified at lower levels of exposure than previously recognized in both children and adults. In 2010, the Centers for Disease Control and Prevention issued the first guidelines regarding the screening and management of pregnant and lactating women who have been exposed to lead.

Prenatal lead exposure has known adverse effects on maternal health and infant outcomes across a wide range of maternal blood lead levels (1). Adverse effects of lead exposure are being identified at lower levels of exposure than previously recognized in both children and adults (2–7). In 2010, the Centers for Disease Control and Prevention issued the first guidelines regarding the screening and management of pregnant and lactating women who have been exposed to lead (8).

Background

Environmental policies and public health education programs have led to significant reductions in cases of lead exposure in the United States (9). Despite these improvements, approximately 1% of women of childbearing age (15–49 years) have blood lead levels greater than or equal to 5 micrograms/dL (8).

Although no threshold has been found to trigger the adverse health effects of lead (8), in nonpregnant adults blood lead levels less than 5 micrograms/dL are considered normal, blood lead levels between 5 micrograms/dL and 10 micrograms/dL require follow-up, and blood lead levels greater than 10 micrograms/dL are managed with environmental assessment and abatement of exposures. Chelation therapy is considered at blood lead levels greater than 40 micrograms/dL for symptomatic individuals, and levels greater than 70 micrograms/dL are considered a medical emergency. In children, treatment is recommended at blood lead levels of 45 micrograms/dL or greater.

The main target for lead toxicity is the nervous system, both in adults and children (10). High levels of exposure can result in delirium, seizures, stupor, coma, or even death. Other overt signs and symptoms of lead toxicity may include hypertension, peripheral neuropathy, ataxia, tremor, headache, loss of appetite, weight loss, fatigue, muscle and joint aches, changes in behavior and concentration, gout, nephropathy, lead colic, and anemia. Health effects of chronic low-level exposure in adults include cognitive decline, hypertension and other cardiovascular effects, decrements in renal function, and adverse reproductive outcome. The developing nervous systems in children make them more susceptible to the neurologic effects of lead toxicity.

Adverse Health Effects of Prenatal Exposure

Lead readily crosses the placenta by passive diffusion and has been detected in the fetal brain as early as the end of the first trimester (8). Elevated lead levels in pregnancy have been associated with several adverse outcomes, including gestational hypertension, spontaneous abortion, low birth weight, and impaired neurodevelopment (11–14).

Lead exposure has been associated with an increased risk of gestational hypertension, but the magnitude of the effect, the exposure level at which risk begins to increase, and whether risk is most associated with acute or cumulative exposure remain uncertain. Also, it is unclear whether lead-induced increases in blood pressure during pregnancy lead to severe hypertension or preeclampsia (11, 15–18).

Evidence shows that maternal exposure to high levels of lead increases the risk of spontaneous abortion (19). However, data for an association between low or moderate lead levels and spontaneous abortion are inconsistent. The strongest available evidence comes from a prospective study of 668 pregnant women in Mexico City that demonstrated a statistically significant dose–response relationship between low-to-moderate maternal blood lead levels and the risk of spontaneous abortion (12). Yet, another longitudinal study of 351 women in Japan showed no difference in blood lead levels between spontaneous abortion cases (n=15) and ongoing pregnancies (20). Larger prospective studies are needed to further clarify the effects of low and moderate levels of lead on spontaneous abortion risk.

More recent and well-designed studies suggest that maternal lead exposure during pregnancy is inversely related to fetal growth, as reflected by duration of pregnancy and infant size. One study that used a registry-based approach found that offspring of mothers occupationally exposed to lead had an increased risk of low birth weight (relative risk [RR], 1.34; confidence interval [CI], 1.12–1.6) compared with infants of women not exposed to lead (13). A case–control study in Mexico City found umbilical cord blood lead levels to be higher in preterm infants (mean value, 9.8 micrograms/dL) compared with term infants (mean value, 8.4 micrograms/dL) (21). A birth cohort study, also conducted in Mexico City, found maternal bone lead burden to be inversely related to offspring weight (22), length, and head circumference at birth (23).

A large number of studies provide evidence that prenatal lead exposure impairs children's neurodevelopment. Some prospective studies have included children with low levels of prenatal lead exposure and continue to detect inverse associations with neurodevelopment, although these data are less consistent than those related to the high levels of lead exposure. In one study, each 1 microgram/dL increase in umbilical cord blood lead was found to be associated with a reduction of 0.6 points in the mental development index scores of the Bayley Scales of Infant Development at age 3 months, with similar results at age 6 months (14, 24). However, another prospective cohort study found that the relationship between prenatal blood lead levels and early childhood IQ is not linear, with the strongest postnatal effects noted at low levels of prenatal exposure (25). The available data are inadequate to establish the presence or absence of an association between maternal lead exposure and major congenital anomalies in the fetus.

Lead Exposure During Breastfeeding

Although the benefits of breastfeeding generally outweigh the risks of environmental exposure, the effects of breastfeeding on infant lead levels have been studied. Lead has been detected in the breast milk of women in population-based studies; however, the availability of high-quality data to assess the risk for toxicity to the breastfeeding infant is limited (8). Although infant blood lead levels have been correlated with the duration of breastfeeding (26), the ratio of breast milk lead levels to blood lead levels has been found to be less than 3% (27). According to the American Academy of Pediatrics, because of the contribution of lead levels found in infant formula and other infant foods, breastfed infants of mothers with normal blood lead levels are actually exposed to slightly less lead than if they were not breastfed (28).

Screening and Management

Pregnancy

The Centers for Disease Control and Prevention (CDC) and the American College of Obstetricians and Gynecologists do not recommend blood lead testing of all pregnant women in the United States. Obstetric health care providers should consider the possibility of lead exposure in individual pregnant women by evaluating risk factors for exposure as part of a comprehensive health risk assessment and perform blood lead testing if a single risk factor is identified. Assessment of lead exposure should take place at the earliest contact with the pregnant patient.

Important risk factors for lead exposure in pregnant women are listed in Box 1. Lead-based paint is less likely to be an important exposure source for pregnant women than it is for children, except during renovation or remodeling in older homes. Women should take precautions when repainting surfaces with deteriorated paint or performing any remodeling or renovation work that disturbs painted surfaces, such as scraping off paint or tearing out walls (8).

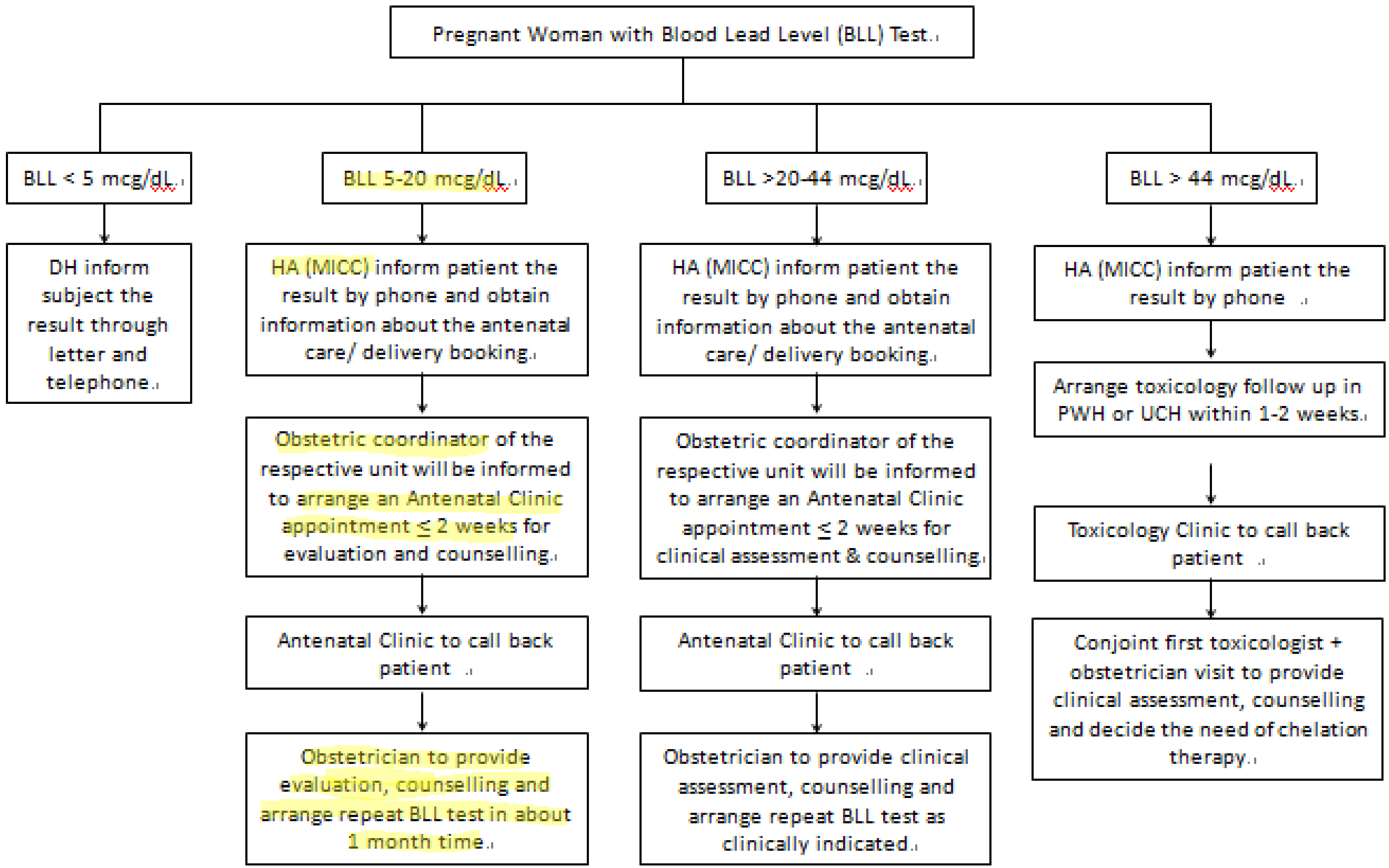
For pregnant women with blood lead levels of 5 micrograms/dL or higher, sources of lead exposure should be identified and women should receive counseling regarding avoidance of further exposure. Confirmatory and follow-up blood lead testing should be performed in accordance with the CDC's recommended schedules (Table 1) and maternal or umbilical cord blood lead levels should be measured at delivery (8). Women with confirmed blood lead levels of 45 micrograms/dL or more should be treated in consultation with clinicians experienced in the management of lead toxicity and high-risk pregnancy. Once the source of lead exposure is identified and eliminated, the initial decrease in blood lead level occurs relatively rapidly because of lead's short (35-day) initial half-life in blood (29). This initial rapid decrease is followed by a slow, continuous decrease over several months to several years because of mobilization of lead from stores in the bone (8). Recommendations for the frequency of blood lead follow-up tests are included in Table 1.

Adequate dietary intake of calcium, iron, zinc, vitamin C, vitamin D, and vitamin E is known to decrease lead absorption (30, 31). Iron-deficiency anemia is associated with elevated blood lead levels and may increase lead absorption. During pregnancy and lactation, lead from prior exposures can be mobilized from bones because

Care path for residents of public estates with elevated lead level in drinking water

Pregnant Lady

(Draft 2, 29 July 2015)



專家話你知

母嬰篇

張德康醫生
威爾斯親王醫院
婦產科部門主管

問:

若我不幸中招，會否導致早產、誕下畸胎或影響嬰兒智力發展？

張德康醫生：

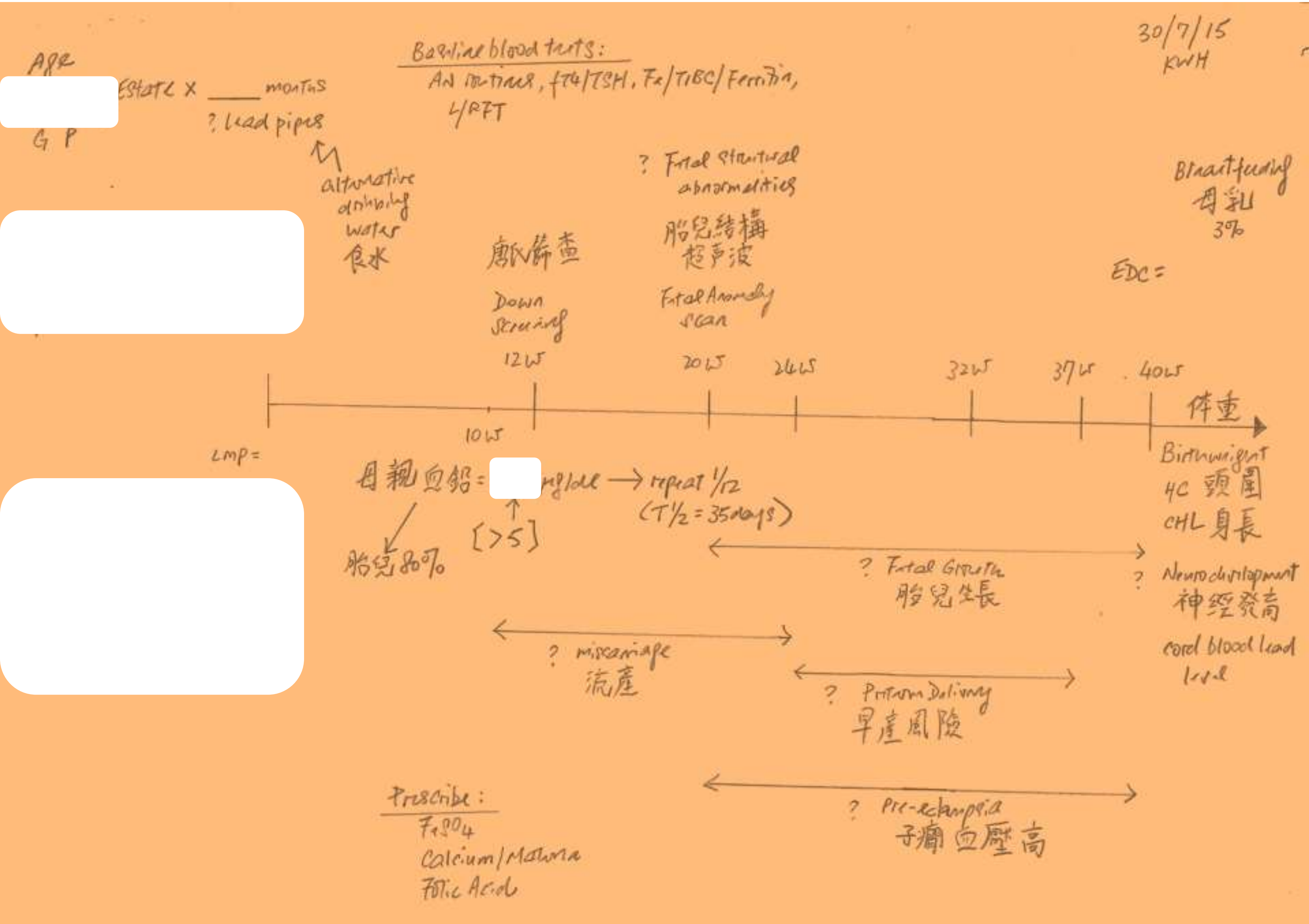
鉛可以經由胎盤傳至發展中的胎兒，當然有可能會導致小產、早產或腦部受損。不過，這些不幸事故原因有很多，若血液中的鉛只是輕微超標，相信不會增加這些不幸事故的風險。

問:

我的血液中含鉛超標，是否仍適合餵哺母乳？

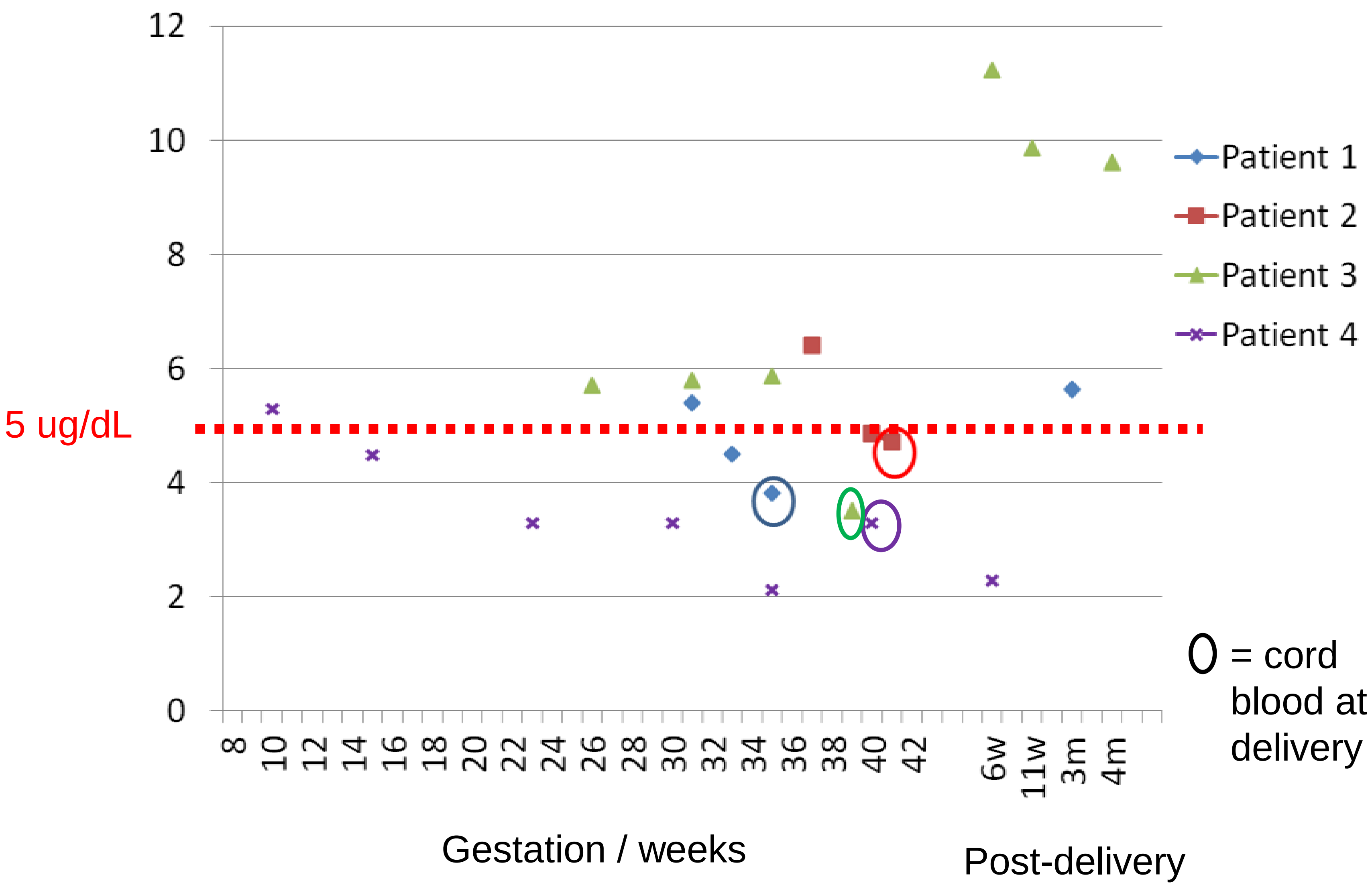
張德康醫生：

母乳中鉛的濃度只及血鉛濃度的百分三，若你的血鉛只是輕微超標，母乳含鉛水平只會更低，即嬰兒經由母乳吸收大量鉛的機會極少，你大可繼續安心餵哺母乳。



Age
Estate x ____ months
? lead pipes
G P
alternative drinking water
食水
Baseline blood tests:
AN routines, fT4/TSH, Fe/TIBC/Ferritin,
L/RFT
30/7/15
KWH
? Fetal structural abnormalities
胎兒結構超声波
Fetal Anomaly scan
唐氏篩查
Down Screening
12w
20w
24w
32w
37w
40w
10w
Breastfeeding
母乳
3%
EDC =
LMP =
母親血鉛 = g/dL → repeat 1/12
(T½ = 35 days)
[>5]
胎兒 80%
体重
Birthweight
HC 頭圍
CHL 身長
? Fetal Growth
胎兒生長
? Neurodevelopment
神经發育
cord blood lead level
? miscarriage
流產
? Preterm Delivery
早產風險
? Pre-eclampsia
子癇血壓高
Prescribe:
FeSO4
Calcium/Materna
Folic Acid

Maternal blood Lead levels



	Patient 1	Patient 2	Patient 3	Patient 4
Age	46	36	27	33
Parity	2 (both FTNSD)	1 (NEP, PET, LSCS)	1 (NEP, LSCS)	0
AN Cx	PET	-	-	-
Delivery	33w Em LSCS	40w El LSCS	40w El LSCS	40w NSD
Newborn	F/1980gm Good condition	M/3280gm Good condition	M/3660gm Good condition	M/3290gm Good condition
Feeding	EBM/BF → formula milk	BF + formula milk	Exclusive BF	Exclusive BF


T
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Avon Longitudinal Study of Parents and Children

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We have been charting the health of 14,500 families in the Bristol area since the early 1990s in order to improve the health of future generations.

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CHILDREN OF THE 90s

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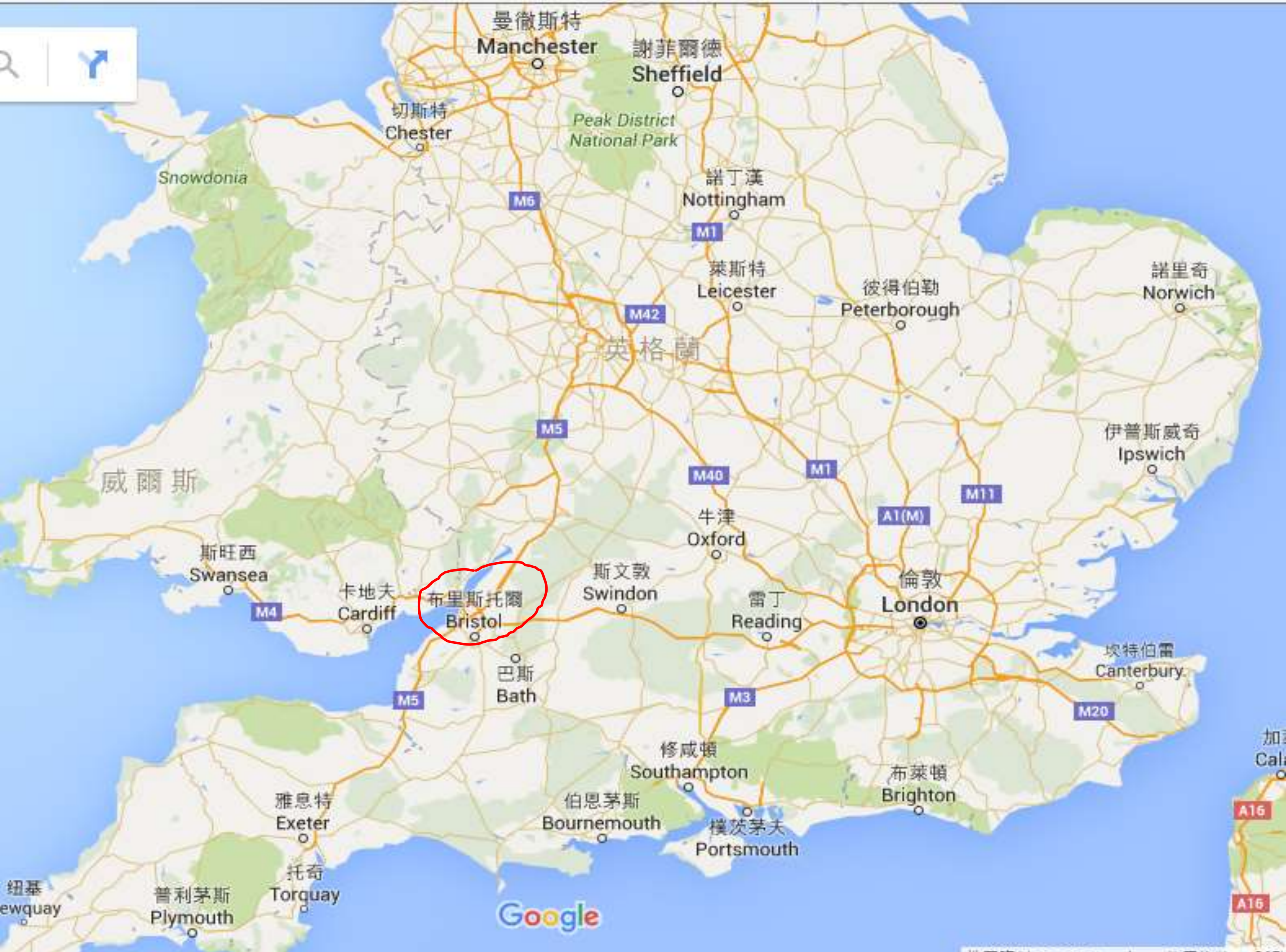
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Cardiff Story Museum
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About The Cardiff Story

English "Leadless Glaze" Stoneware Water Filter

Year:1830-1850
Country:England
“Leadless Glaze”
Height:23.5
Width:11
Style:Victorian
Materials:Stoneware

“Pure Drinking Water is Life”

DOI: 10.1111/1471-0528.12756
www.bjog.org

Epidemiology

Adverse effects of maternal lead levels on birth outcomes in the ALSPAC study: a prospective birth cohort study

CM Taylor, J Golding, AM Emond

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Accepted 12 February 2014. Published Online 14 May 2014.

Adverse effects of maternal lead levels on birth outcomes in the ALSPAC study: a prospective birth cohort study

Table 1. Birth outcomes and categorical associations of B-Pb (<5.00 or ≥5.00 μg/dl) with birth outcomes

		B-Pb (μg/dl)		***P* value**
		<5.00	**≥5.00**	
Gestational age at delivery (weeks)	39.4 ± 2.1 (*n* = 4108)	39.4 ± 2.1 (*n* = 3516)	39.3 ± 2.3 (*n* = 592)	0.207*
Birthweight (g)	3411 ± 572 (*n* = 4052)	3424 ± 567 (*n* = 3469)	3334 ± 595 (*n* = 583)	0.001*
Head circumference (cm)	35.0 ± 1.5 (*n* = 3514)	34.8 ± 1.5 (*n* = 3010)	34.6 ± 1.8 (*n* = 504)	0.031*
Crown–heel length (cm)	50.7 ± 2.4 (*n* = 3467)	50.7 ± 2.3 (*n* = 2970)	50.4 ± 2.6 (*n* = 497)	0.011*
Low birthweight (<2500 g), *n* (%)	420/4269 (9.8%)	346/3654 (9.5%)	74/615 (12.0%)	0.048**
Preterm (<37 weeks), *n* (%)	238/3870 (5.8%)	186/3330 (5.3%)	52/540 (8.8%)	0.001**

Data are given as mean ± SD unless otherwise stated.
*Unpaired *t*-test.
**Chi-square test.
[Correction added on 12 December 2014 after first online publication: The values in the row heading, pre-term (<37 weeks), *n* (%) were miscalculated and have been corrected in Table 1 and results section.]

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PLOS | ONE

Environmental Factors Predicting Blood Lead Levels in Pregnant Women in the UK: The ALSPAC Study

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1 Centre for Child and Adolescent Health, School of Social and Community Medicine, University of Bristol, Bristol, United Kingdom, 2 NIAAA, National Institutes of Health, Rockville, Maryland, United States of America

Abstract

Background: Lead is a widespread environmental toxin. The behaviour and academic performance of children can be adversely affected even at low blood lead levels (BLL) of 5–10 µg/dl. An important contribution to the infant's lead load is provided by maternal transfer during pregnancy.

Objectives: Our aim was to determine BLL in a large cohort of pregnant women in the UK and to identify the factors that contribute to BLL in pregnant women.

Methods: Pregnant women resident in the Avon area of the UK were enrolled in the Avon Longitudinal Study of Parents and Children (ALSPAC) in 1991–1992. Whole blood samples were collected at median gestational age of 11 weeks and analysed by inductively coupled plasma dynamic reaction cell mass spectrometry (n = 4285). Self-completion postal questionnaires were used to collect data during pregnancy on lifestyle, diet and other environmental exposures. Statistical analysis was carried out with SPSS v19.

Results: The mean $\pm$SD BLL was 3.67 $\pm$ 1.47 (median 3.41, range 0.41–19.14) µg/dl. Higher educational qualification was found to be one of the strongest independent predictor of BLL in an adjusted backwards stepwise logistic regression to predict maternal BLL <5 or ≥ 5 µg/dl (odds ratio 1.26, 95% confidence interval 1.12–1.42; $p<0.001$). Other predictive factors included cigarette smoking, alcohol and coffee drinking, and heating the home with a coal fire, with some evidence for iron and calcium intake having protective effects.

Conclusion: The mean BLL in this group of pregnant women is higher than has been found in similar populations in developed countries. The finding that high education attainment was independently associated with higher BLL was unexpected and currently unexplained. Reduction in maternal lead levels can best be undertaken by reducing intake of the social drugs cigarettes, alcohol and caffeine, although further investigation of the effect of calcium on lead levels is needed.

Environmental Factors Predicting Blood Lead Levels in Pregnant Women in the UK: The ALSPAC Study

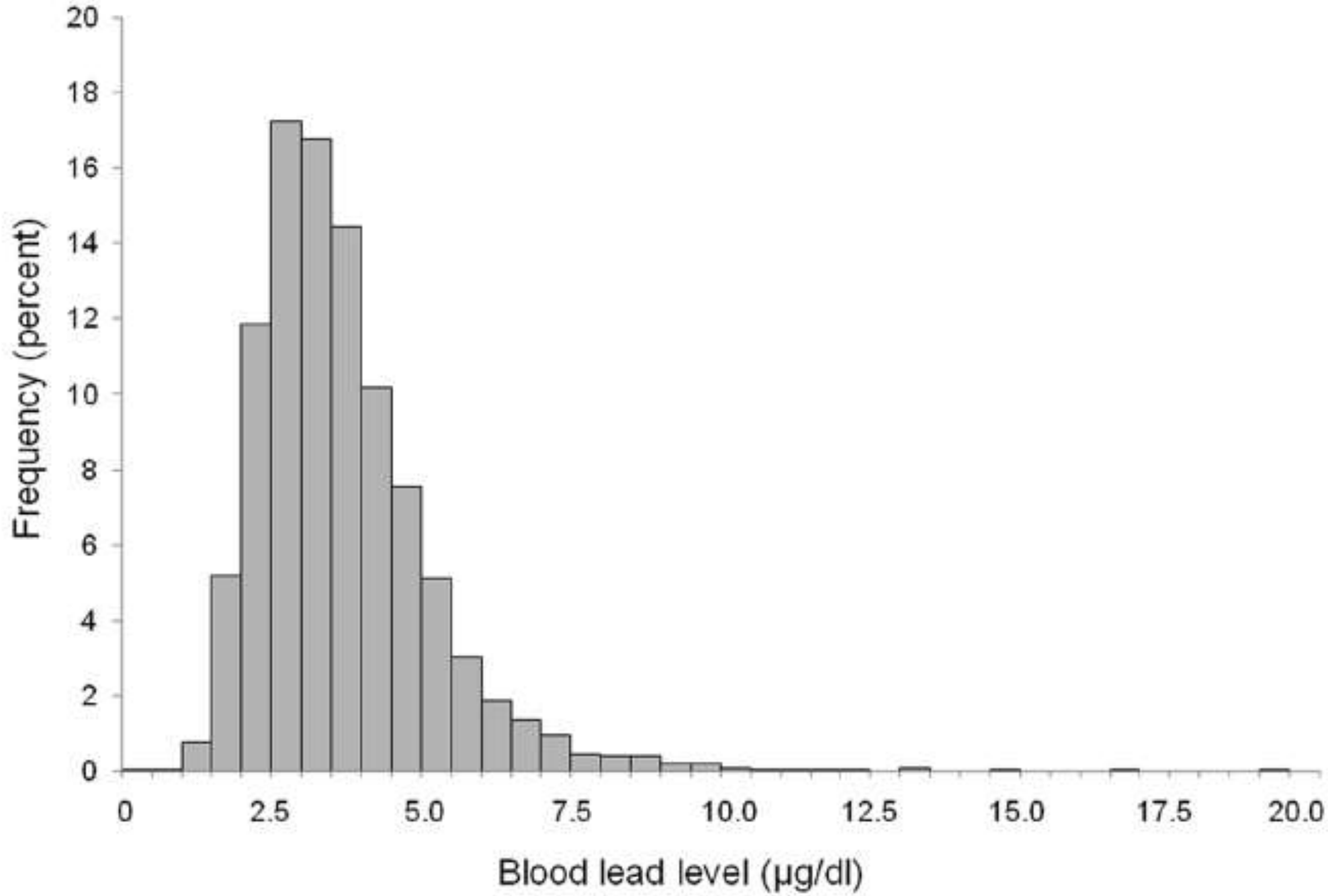

Figure 1. Frequency distribution of blood lead levels in pregnant women (n = 4285).
doi:10.1371/journal.pone.0072371.g001

Environmental Factors Predicting Blood Lead Levels in Pregnant Women in the UK: The ALSPAC Study

Table 4. Comparison of BLL in pregnancy.

Authors	Country	Blood lead (µg/dl)	n	Year of survey	Sampling time
Osman et al. (2000) [44]	Sweden (Stockholm)	1.139[a]	88	1994–1999	36 weeks gestation
Smargiassi et al. (2002) [30]	Canada (Montreal)	2.1[b]	160	–	–
Sowers et al. (2002) [45]	USA (New Jersey)	1.2±0.03[c]	705	–	Once in each trimester
Schell et al. (2003) [6]	USA (Albany, NY)	1.9±1.68 1.8±1.63 1.8±1.65	211	1992–1998	1st trimester 2nd trimester 3rd trimester
Harville et al. (2005) [46]	USA (Pittsburgh, IL)	1.93 (0.55–4.70)	140	1992–1995	At delivery
Abdelouahab et al. (2010) [47]	France (Nancy and Poitiers)	1.84±1.21	160	–	24–28 weeks gestation
Gundacker et al. (2010) [48]	Austria (Vienna)	1.04–8.4 (2.5[a])	52	2005	Week 34–38
Hansen et al. (2011) [49]	Norway	0.82±0.04 (0.22–4.11)	210	2007–2009	Second trimester
Sanders et al. (2012) [50]	Sweden	0.89[b] (0.19–7.72)	211	2009–2011	Third trimester
Present study (2013)	UK (Bristol area)	3.67±1.47 (3.43[b])	4285	1991–1992	Median 11 weeks gestation

Studies shown are those published from 2000 onwards only where there was no specific source of environmental lead exposure and the participants were not resident in major cities in developing countries (developing/developed countries were defined according to the International Monetary Fund definition [51]).
For studies reporting BLL during pregnancy in which the author identified a specific source of environmental lead exposure and/or participants lived in a major city in a developing country, see Table S7.
[a]Median; [b]geometric mean; [c]standard error; values in parentheses are ranges.
doi:10.1371/journal.pone.0072371.t004

How about our cohort of pregnant women?

Journal of Developmental Origins of Health and Disease (2014), 5(1), 16–30.

doi:10.1017/S2040174413000500

REVIEW

Lead, cadmium and mercury levels in pregnancy: the need for international consensus on levels of concern

C. M. Taylor*, J. Golding and A. M. Emond

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For heavy metals that have any degree of transfer though the placenta to the fetus, it is unlikely that there are safe limits for maternal blood levels. The only means of reducing fetal exposure is to minimise maternal exposure. There are few recommendations for levels of concern. With the exception of US recommendations for maternal Pb levels, but there are no international levels of concern or cut-off levels specifically for pregnancy for heavy metals, so that comparisons can generally only be made with national reference values relating to similar physiological statuses or age groups. These include recommendations for Cd levels by Germany (reference value for non-smoking adults aged 18–69 years, 1 μg/l) and for Hg by Germany (reference value for adults age 18–60 years with fish intake ⩽3 times per month, 2.0 μg/l) and the USA (cut-off level for women, 5.8 μg/dl). To illustrate the lack of cohesion, we present data on blood Pb, Cd and Hg levels from pregnant women enroled in the UK Avon Longitudinal Study of Parents and Children study and compare the values with present levels of concern and recommended cut-off values. We also compare the levels with those found in other groups of pregnant women worldwide to strengthen the database for the development of levels of concern in pregnancy. The need for clarity of terminology in describing levels of concern is discussed. There is a pressing need for international consensus on levels of concern for all age groups and physiological statuses, particularly for pregnancy.

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Lead, cadmium and mercury levels in pregnancy: the need for international consensus on levels of concern

Table 1. *Summary of recommendations for levels of concern for blood Pb, Cd and Hg*

	Country	Recommending body	Description of group that recommendation applies to[a]	Value (whole blood level)	Percentage of pregnant women with blood level greater than or equal to 'reference value' in the ALSPAC study
Pb	USA	Centers for Disease Control and Prevention[15]	Reference value for children[b]	5 µg/dl	14.4 (619/4285)
	USA	American College of Obstetricians and Gynecologists[12]	Pregnant women	Maximum 5 µg/dl	14.4 (619/4285)
	USA	Centers for Disease Control and Prevention[10]	Pregnant women	Maximum 5 µg/dl	14.4 (619/4285)
	USA	US Association of Occupational and Environmental Clinics[11]	Pregnant women	Maximum 5 µg/dl	14.4 (619/4285)
	Germany	Federal Environmental Agency[13]	Reference value for women aged 18–69 years	7 µg/dl	3.0 (130/4285)
	Australia	Australian Government, National Health and Medical Research Council[17]	All population	10 µg/dl	0.4 (15/4285)
Cd	Germany	Federal Environmental Agency[13]	Reference value for non-smoking adults aged 18–69 years	1 µg/l	18.9 (812/4285) (smokers plus non-smokers) 3.6 (107/2987) (non-smokers only)
Hg	Germany	Federal Environmental Agency[13]	Reference value for adults aged 18–60 years with fish intake ⩽3 times per month	2.0 µg/l	44.0 (1821/4134) (fish-eaters and non-fish eaters) 39.0 (805/2065) (eat white fish never/rarely/once per 2 weeks) 40.4 (1072/2652) (eat oily fish never/rarely/once per 2 weeks) 45.5 (1535/3374) (eat shellfish never/rarely/once per 2 weeks)
	USA	Committee on the Toxological Effects of Methylmercury, Board on Environmental Studies and Toxicology, National Research Council[9]	BMDL in cord blood	5.8 µg/l	0.9 (38/4134)
	–	Mahaffey *et al.*[16]	Reference dose level for women[c]	3.5 µg/l	8.6 (357/4134)
	USA	US Environmental Protection Agency[14]	Blood level equivalent to the EPA's recommendation for maximum oral reference dose (0.1 µg/kg per day)	5.8 µg/l	0.9 (38/4134)

Original article

Effects of early childhood lead exposure on academic performance and behaviour of school age children

K Chandramouli, C D Steer, M Ellis, A M Emond

What is already known on this topic

- Exposure to lead in childhood affects cognitive development and behaviour, but the association is confounded by environmental and socio-economic factors.
- Debate continues as to whether there is a threshold of effect below the current level of concern for blood lead of 10 μg/dl.

2009

Effects of early childhood lead exposure on academic performance and behaviour of school age children

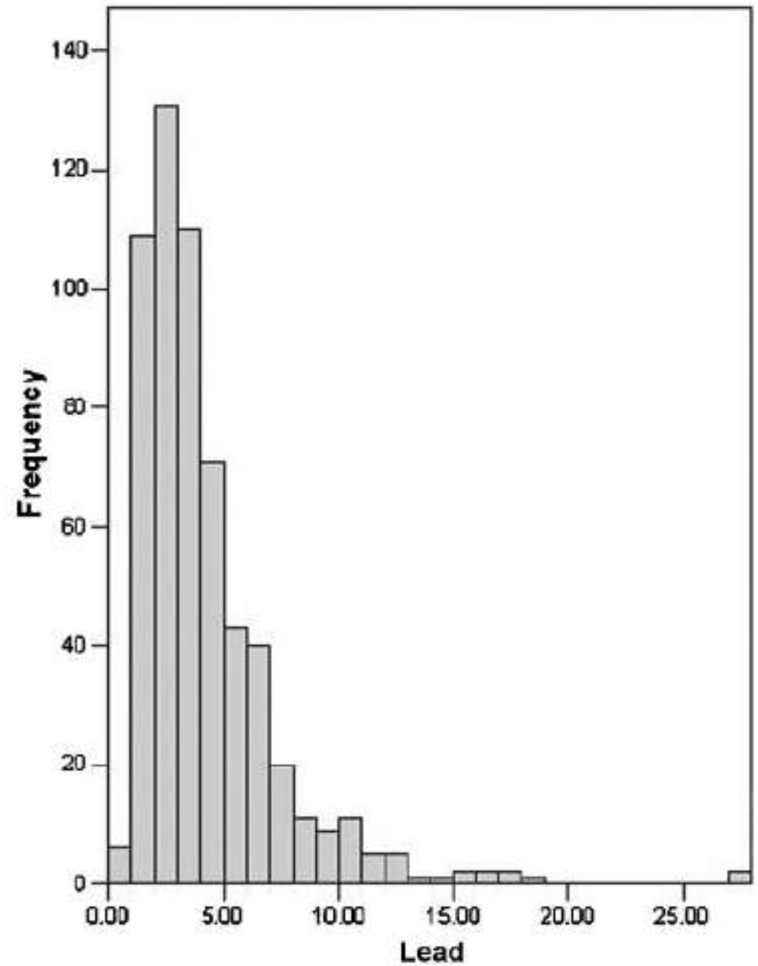


Figure 1 Distribution of lead levels (n = 582). Mean (SD) 4.22 (3.12) µg/dl; 0–2 µg/dl = 21%; 2–5 µg/dl = 52%; 5–10 µg/dl = 21%; >10 µg/dl = 6%.

Effects of early childhood lead exposure on academic performance and behaviour of school age children

K Chandramouli, C D Steer, M Ellis, A M Emond

Box 1 Sources of lead

- Lead-based paint
- Household dust
- Lead water pipes
- Soil around the home
- Herbal and traditional remedies
- Old-fashioned/ethnic make-up
- Lead glazed pottery/crystal
- Paint on children's toys
- Children's bead necklaces
- Christmas lights
- Lead smelters/industries

Original article

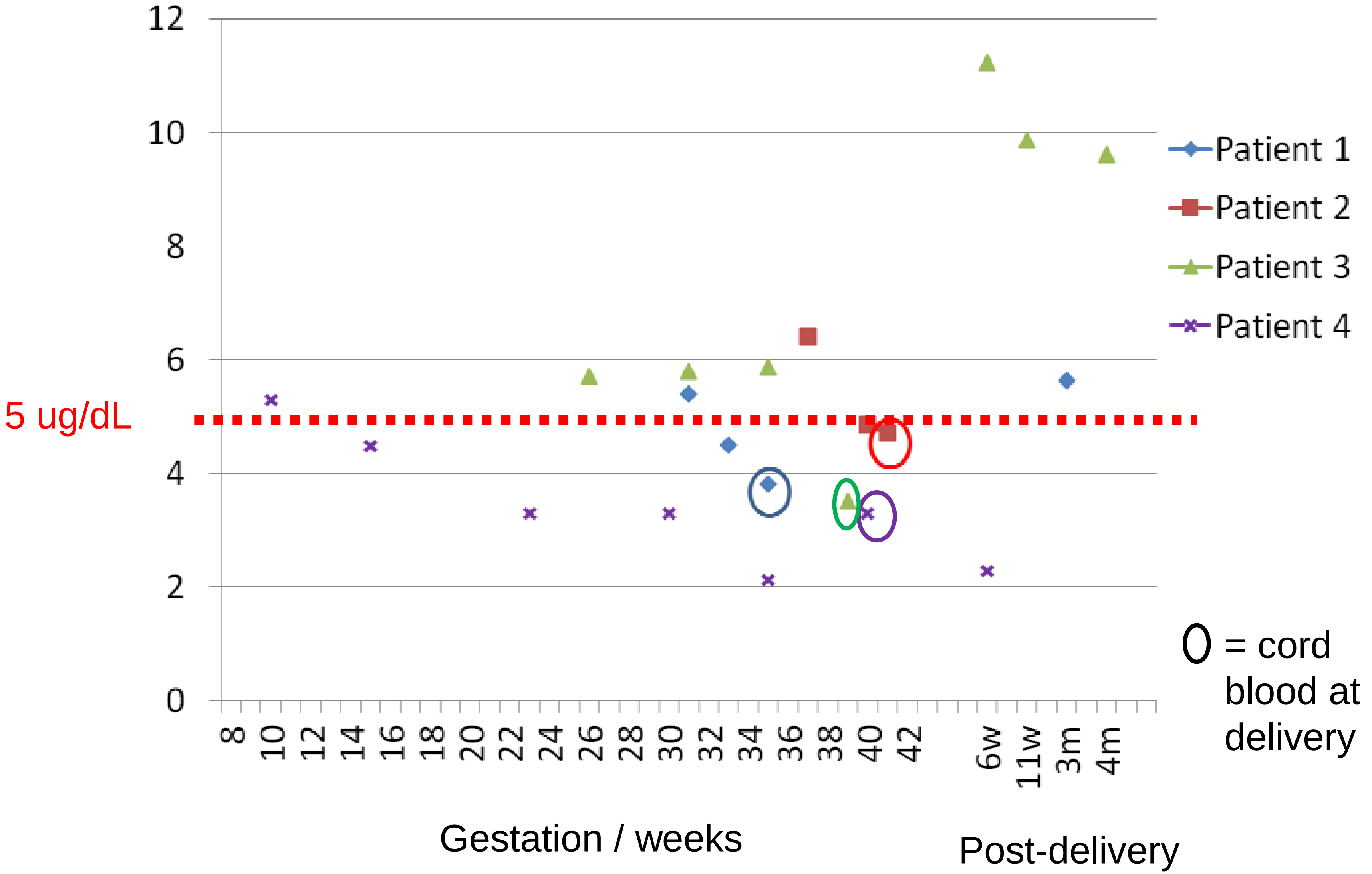
Effects of early childhood lead exposure on academic performance and behaviour of school age children

K Chandramouli, C D Steer, M Ellis, A M Emond

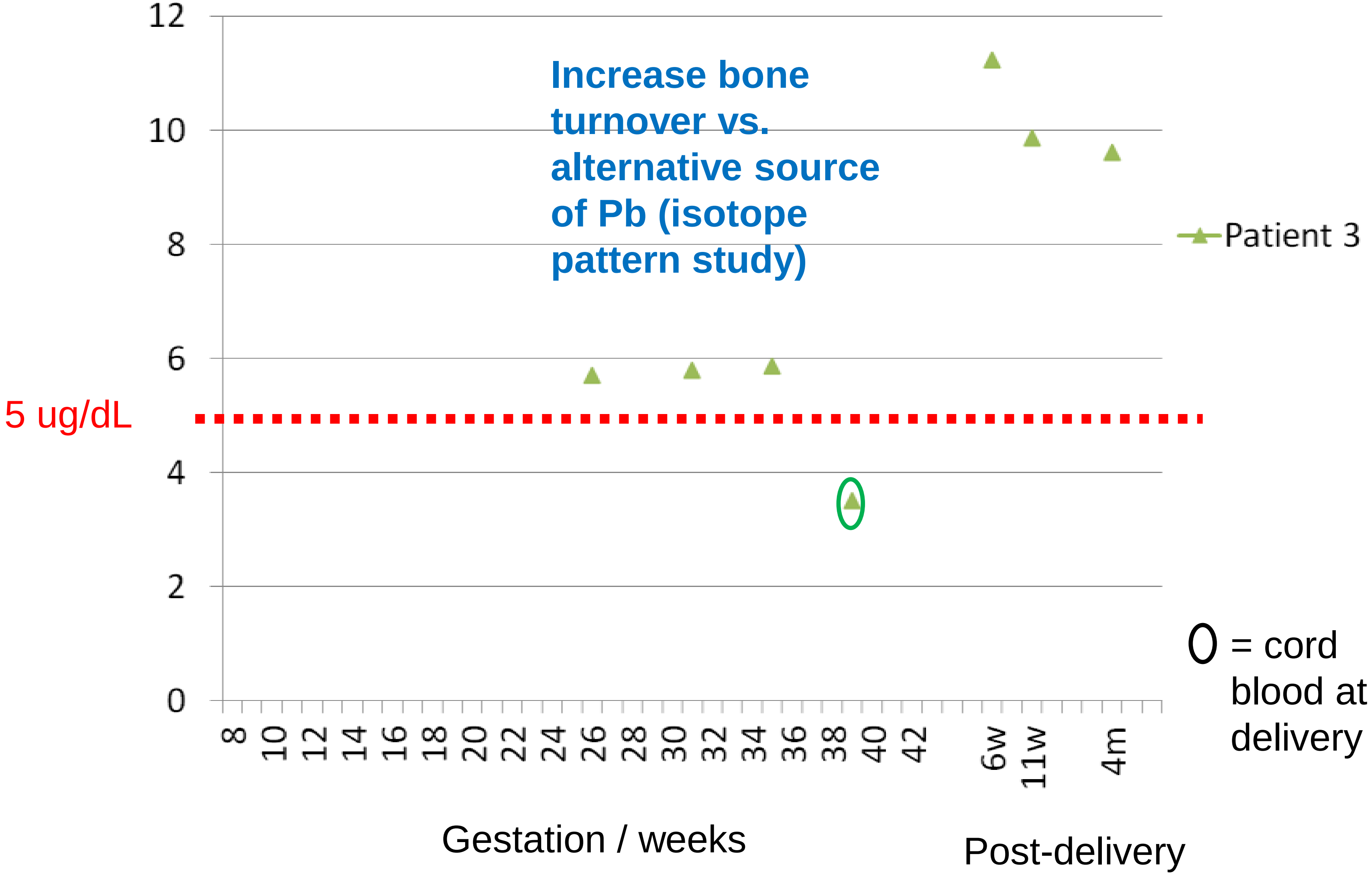
What this study adds

- After adjustment for confounders, blood lead levels at 30 months showed significant associations with educational attainment, antisocial behaviour and hyperactivity scores at age 7–8 years.
- Threshold effects were apparent, with no effects on outcomes at blood lead levels of 2–5 μg/dl.
- Blood lead levels >5 μg/dl were associated with reduced Standard Assessment Tests scores, and levels >10 μg/dl with increased scores for antisocial activities and hyperactivity.

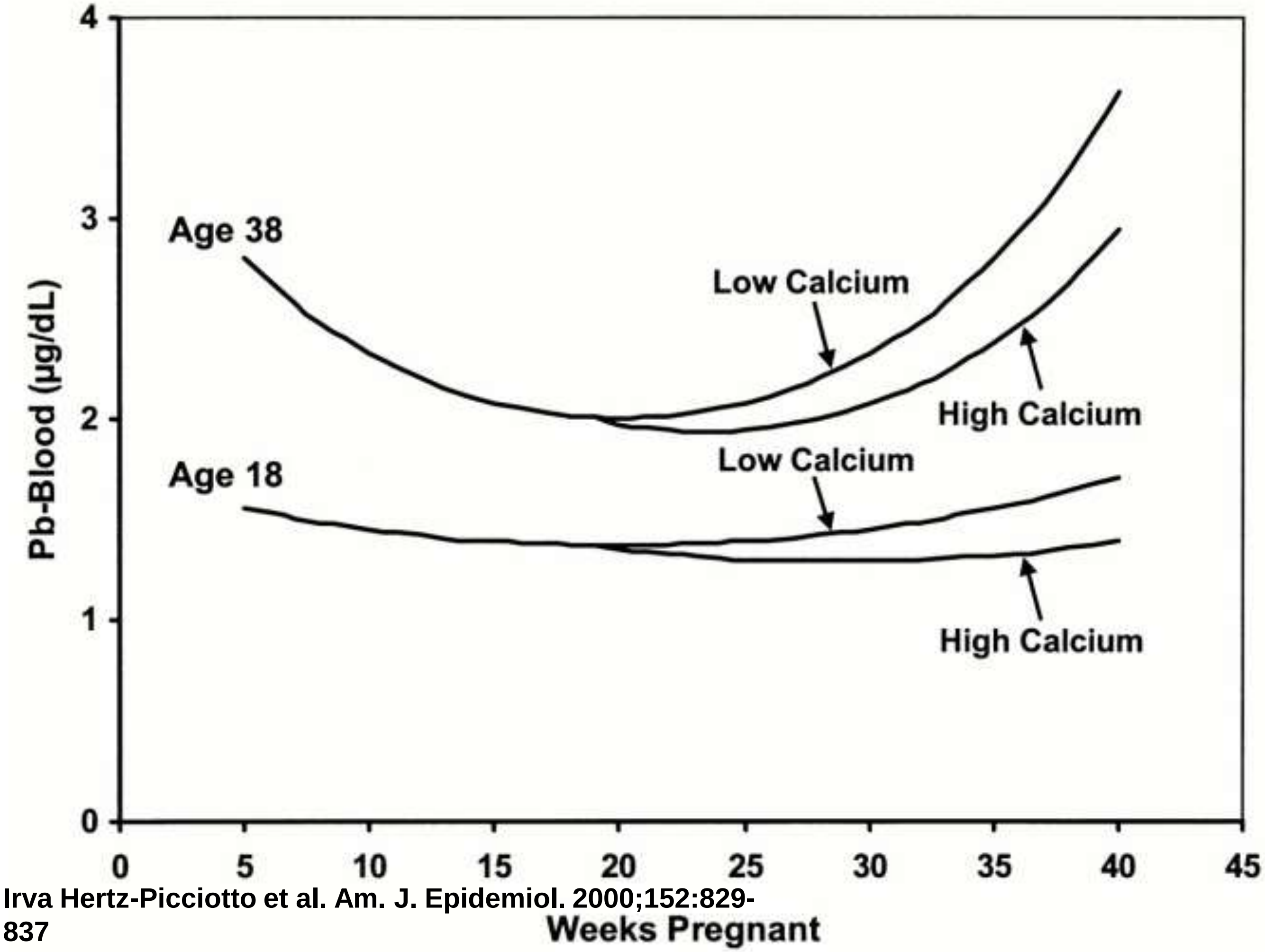
Maternal blood Lead levels



Maternal blood Lead levels



Fitted curves for blood lead (Pb-blood) levels of pregnant women aged 18 and 38 years who initiated prenatal care at Magee-Womens Hospital in Pittsburgh, Pennsylvania, in 1992–1995 and whose calcium intake levels were high (>2,000 mg/day) or low <600 mg/day).



Irva Hertz-Picciotto et al. Am. J. Epidemiol. 2000;152:829-837

American Journal of EPIDEMIOLOGY

American Journal of Epidemiology

Vol. 163, No. 1
DOI: 10.1093/aje/kwj010
Advance Access publication November 9, 2005

Original Contribution

Influence of Maternal Bone Lead Burden and Calcium Intake on Levels of Lead in Breast Milk over the Course of Lactation

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[3] Centro de Investigación en Salud Poblacional, Instituto Nacional de Salud Pública, Cuernavaca, Morelos, México.
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The authors studied 367 women who were breastfeeding their infants in Mexico City, Mexico, between 1994 and 1995 to evaluate the effect of cumulative lead exposure, breastfeeding practices, and calcium intake on breast milk lead levels over the course of lactation. Maternal blood and breast milk lead levels were measured at 1, 4, and 7 months postpartum. Bone lead measurements were obtained at 1 month postpartum. At 1, 4, and 7 months postpartum, respectively, the mean breast milk lead levels were 1.4 (standard deviation (SD), 1.1), 1.2 (SD, 1.0), and 0.9 (SD, 0.8) µg/liter and showed a significant decreasing trend over the course of lactation ($p < 0.00001$). The relations of bone lead and blood lead to breast milk lead were modified by breastfeeding practice, with the highest breast milk lead levels among women with a high level of patella lead who were exclusively breastfeeding. Dietary calcium supplementation increased the rate of decline in breast milk lead by 5–10%, in comparison with a placebo, over the course of lactation, suggesting that calcium supplementation may constitute an important intervention strategy, albeit with a modest effect, for reducing lead in breast milk and thus the potential for exposure by infants.

bone and bones; breast feeding; calcium; lactation; lead; longitudinal studies; milk, human

On 4 August 2015 at 16:34, LEUNG Wing-cheong <leungwc@ha.org.hk> wrote:
Dear Prof Taylor,

I am an maternal fetal medicine subspecialist working in HK. You might be aware that currently we are facing with a crisis of lead exposure through drinking water in a no. of public housing estates in HK. Pregnant women are involved & the no. is increasing.

I read your paper on "Adverse effects of maternal lead levels on birth outcomes in the ALSPAC study: a prospective birth cohort study" in BJOG 2014 with great interest. Your work would be most important applying to the current crisis of lead exposure in HK.

I would be most grateful if you could give us some information on the long-term physical & neurological development of children/adulthood related to maternal lead levels.

Regards,
Dr wing-cheong Leung
MBBS, MD, FRCOG
Consultant Obstetrician & Chief-of-service
Department of Obstetrics & Gynaecology
Kwong Wah Hospital
Kowloon, HKSAR

****

Dear Dr Leung,

Thank you for getting in touch. I had noticed the story on the internet although of course this may not be an accurate representation of the true situation! Various websites state that of 30 water samples from the flats, only 4 had levels above the WHO recommendation of 10 ug/l (11, 14, 17 and 23 ug/l). I have only been able to find one mention of a blood lead level in a child of 7.6 ug/dl. The USA level of concern as you will know is 5 ug/dl, although other countries have different recommendations (e.g. 10 ug/dl in Australia).

If I understand you correctly, you are interested to know if this level of exposure in pregnant women will cause any long-term effects in the offspring. The placenta does not provide a barrier to lead, so the fetus will be exposed to lead passing freely through the placenta - the fetal to maternal ratio is about 0.8. It's becoming more commonly thought that there is no lower limit for 'safe' exposure to lead, and that any exposure will cause some degree of neurotoxicity, but the effects will obviously be smaller at lower lead levels. Without having some data on blood lead levels in your sample of pregnant women, it is difficult to speculate about what the effects at a population level might be. However, the fact that 26 of the 30 water samples were below the WHO limit is reassuring. The child's blood lead level, while above the present US level of concern, is not dramatically high (the level of concern has only fairly recently been reduced from 10 to 5 ug/dl in the USA) - it would certainly not cause any visible symptoms and may not even be associated with any neurodevelopmental deficit - if there were it would be subtle - impossible to say for one individual really.

In all, I would think that whilst the situation is of concern, I don't think there are grounds for panic, from what I see on the internet. The most vulnerable populations are pregnant women/women of child-bearing age and babies/children. If the problem is from lead solder in the water supply, I would advise that these groups in particular either run the tap for a few minutes before drawing water, or perhaps use bottled water. Also good to make sure hands are well washed before eating (and foods such as fruit and vegetables are washed also), and keep dust to a minimum to reduce hand-to-mouth transmission for small children. There have also been some cases of lead-based paint being used on toys from China, so that's something to bear in mind as well.

I've attached a couple of papers from our group that you might find interesting. Please do get back in touch if I can be of any further help.

With best wishes,

Caroline Taylor

We need to publish our data !