Towards Comprehensive Economic Valuation of Health Impacts from Endocrine Disrupting Chemicals

PUBLISHED SEPTEMBER 2015

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Introduction

The European Commission is currently conducting a comprehensive impact assessment to examine different options for defining the criteria for the identification of endocrine disrupting chemicals (EDCs). The evidence linking EDCs to a variety of adverse health impacts continues to strengthen (for example, see WHO/UNEP, 2013 and Kortenkamp et al, 2011) and so it becomes increasingly important to develop accurate assessments of the relationships between EDCs and hormone-related health conditions, as well as accurate estimates of the costs to society of such conditions. The purpose of this paper is to build on recent estimates of the social costs of endocrine-related health conditions by making a contribution towards greater accuracy and comprehensiveness of those estimates.

A recent paper on the costs of EDCs in the EU produced by HEAL in 2014 reported a cost calculation for a number of health conditions that are related to the human endocrine system. These health conditions - that may be at least partially caused by EDCs in the environment - include reproductive and fertility problems, congenital abnormalities of the male reproductive system, cancers of the breast, prostate and testes, neuro-developmental disorders in children, such as autism and attention deficit hyperactivity disorder (ADHD), and obesity and diabetes. In the HEAL report, total EU costs for those conditions was calculated using cost of illness data, demographic and incidence data by country. A number of assumptions were made in arriving at the estimated economic burden, and it was noted that the cost calculation was probably an underestimate given that the costs of pain and misery associated with such conditions was not included. Furthermore, a number of papers taking a more focused approach to developing cost estimations of various health impacts of EDCs in the EU have recently been published in the Journal of Clinical Endocrinology and Metabolism. Using common methodologies EDC attributable cost estimates were derived by Legler et al (2015) for obesity and diabetes; Hauser et al (2015) for male reproductive disorders including male infertility, cryptorchidism, testicular cancer and mortality associated with reduced serum T levels, Bellanger et al (2015) for neurodevelopmental disability, and Trasande et al (2015) for the total burden of disease and associated costs for IQ loss, intellectual disability, autism, ADHD, childhood obesity, adult obesity, adult diabetes, cryptorchidism, male infertility and mortality associated with reduced testosterone.

These papers and the HEAL report estimate the costs of these hormone-related health impacts across the EU to be in the hundreds of billions. The scientific data relating their causation to EDCs is growing in quantity and quality, and in some areas is very strong, but as Woodruff (2015) observed in her editorial referencing the above journal articles, the problem remains that these cost estimates are likely to be substantial under-estimates; all of the above referenced cost estimates are based on cost-of-illness data using the human capital approach which only considers the costs of society's lost resources. A more comprehensive unit value for a given health impact is comprised of three broad components: "resource cost", "opportunity cost" and "disutility cost". See Box 1 for illustration. The cost estimates in the four recent papers referenced above comprised of resource costs and opportunity costs combined, but do not include the disutility costs of the health impact. Disutility is typically valued by estimating individuals' willingness to pay for avoiding the morbidity or mortality risk with its associated pain and suffering.

Box 1 - Components of health impact economic values

Cost Category	**Description**
Resource costs	Avertive expenditures, including, e.g., relocation to area of lower pollution, 'banking' of embryo's eggs or sperm, etc. Mitigating expenditures, including the direct medical and non-medical costs associated with treatment for the health impact (i.e. all the expenses the individual faces when visiting a doctor, ambulance, buying medicines and other treatments, plus any related non-medical cost, such as the cost of childcare and housekeeping due to the impossibility of the affected person being able to do so).
Plus	
Opportunity costs	Costs related to loss of productivity and/or leisure time due to the health impact
Plus	
Disutility costs (we sometimes refer to this as willingness to pay (WTP) to avoid disutility	Pain, suffering, discomfort and anxiety linked to the illness
Equals	
Economic value of avoiding the health impact (or social welfare cost)	

However, in applications made to date these components have either been inconsistently measured or incompletely compiled (Hunt and Ferguson, 2010). Furthermore, there are a number of potentially complicating factors in deriving accurate disutility valuations. In practical valuation exercises there is some skill required in order to ensure that the component measures (seen in Box 1) do not overlap and so result in double-counting.

With reference to the studies outlined above, this report will first outline and define the health impacts of interest and the potentially contributing endocrine disrupting chemicals. It will then assemble and summarise any disutility cost data available in the published literature in relation to each of the health conditions of interest, and finally will attempt to draw some conclusions about the relative magnitudes of costs estimates based on society's lost productivity and those from individuals disutility and how these might affect the recent economic valuations.

The HEAL report estimated the total EU costs of the following endocrine related diseases and conditions regardless of causation: Human infertility – assisted reproduction technology, cryptorchidism and hypospadias, breast cancer, prostate cancer, attention deficit hyperactivity disorder, autism, overweight and obesity, and diabetes. The four recent papers identified above developed estimates of the costs of the health impact attributable to specific EDCs. The attributable health impacts are summarized in Box 2.

Box 2 – Summary of health impacts and causative or contributing EDC from Hauser et al, Legler et al, Bellanger et al and Trasande et al.

Health Impact	Contributing EDC
Cryptorchidism	Pre-natal PBDE
Male infertility	Phthalates
Testicular Cancer	PBDE
T serum	Phthalates
Obesity and overweight	DDE, Phthalates
Diabetes	DDE, Phthalates
Autism (ASD)	Multiple EDCs
Attention deficit hyperactivity disorder (ADHD)	Multiple EDCs
IQ Loss	PBDE, Organophosphates
Neurodisability	Organophosphates

The current EC Impact Assessment is primarily focused on pesticides and biocides, and while there is a broad epidemiological literature examining the links between specific EDCs and specific health impacts, the literature valuing the disutility costs of such specific links is much scarcer. Thus, for the purposes of trying to develop some illustrative comprehensive health impacts valuations, the focus of the current paper will be on examining willingness to pay for an illustrative set of relevant health impacts, regardless of causation. Box 3 identifies and defines those impacts where economic valuation has been attempted.

Box 3 – Characterisation of Health Impacts addressed in economic valuation studies

Health impact/ definition	**Disutility valuation focus**	**Definitional notes**
Human infertility – defined as inability to conceive naturally due to either female or male infertility	Pain and suffering associated with reproduction technology (ART)	Whilst either male or female infertility can result in the need for ART, the treatment costs and the disutility of inability to reproduce generally falls on the couple rather than one or other partner
Neurodevelopmental conditions to include:		
Neurodisability - IQ < 70 - leading to general impairment in the conceptual, social and practical domains of functioning	Pain and suffering of parents and/or child, associated with cognitive and behavioural problems	This is the most recent definition; some of the older literature (>10 years) uses IQ <85 as the criterion. DSM V (2013) has removed IQ score from the diagnostic criteria, but much of the literature surveyed continues to use IQ < 70 as the key diagnostic criterion
IQ loss	Parental valuation of pain and suffering associated with a lost IQ point	
Autism - Autism Spectrum Disorder (ASD)	Parental valuation of pain and suffering from problems associated with ASD	Recent redefinition of this health condition (DSM V, 2013) from Autism to ASD means that ASD covers 4 conditions – autistic disorder, aspergers disorder, childhood disintegrative disorder and pervasive development disorder. DSM V (2013)
ADHD - Inattention and hyperactivity plus impulsiveness. DSM V (2013)	Parental valuation of pain and suffering from problems associated with ADHD	Children must show at least 6 symptoms from either or both categories, but includes no exclusion criteria for ASD. This might be a complicating factor in developing an accurate costing.
Testicular cancer	Pain, suffering and dread associated with	

	cancer. WTP for various treatment options	
Obesity - Defined as BMI >30	WTP for various treatment options	
Diabetes Mellitus - (Type I), Type II	WTP for various treatment options	Most of the valuation literature focuses on Type II diabetes as that which can be more commonly associated with endocrine-exacerbated obesity

Costs associated with the identified Endocrine-related health impacts

In the following section, we report from the evidence base on the social costs of the identified health impacts, including the resource and opportunity costs associated with the conditions, and on any available disutility valuations. Published literature was searched using PubMed, Wiley InterScience (*http://www3.interscience.wiley.com/cgi-bin/home*), the EconLit database, the EVRI database, https://www.evri.ca/ and Google Scholar (*http://scholar.google.co.uk/*). The empirical literature for cost of illness valuations in relation to some of the health conditions is substantial, so the brief review was confined to more recent estimates.

Human fertility

Cost of illness studies, as reported in HEAL (2014) have found the direct medical treatment costs of ART to constitute up to 0.25% of public health service costs. For example the cost per live birth in Denmark has been estimated at €11,310 (Christiansen et al, 2013) and in the Netherlands at €51,822 (Evers, 2010). Chambers et al (2009) estimate the cost of one IVF cycle in the US to be USD 12,513 and in Japan to be USD 3,956 (USD 2006). A review by Connolly et al (2010) reported the following costs for an ART cycle, all in €2006; US - 9961, Canada - 6766, UK - 4016-5201, Australia - 4494, Japan – 3149.

A number of studies have attempted to value fertility by estimating the willingness to pay (WTP) for various assisted reproduction technologies leading to a live birth. Neuman and Johanssen (1994), for example, arrived at an implied marginal willingness to pay per 'statistical baby' of $40640 to $1730000. Granberg et al (1995) estimate a willingness to pay for IVF leading to a successful birth of £11490, and Gardino et al (2010) estimated mean WTP for a 100% success rate of Ovarian Tissue Cryopreservation (OC) for infertility of USD 33160.

More typically studies have assessed WTP for assisted reproduction technologies in the absence of guarantees of success. Ryan (1999) estimated the willingness to pay for 1% increased probability of taking a baby home following IVF in the range £133 to £267, depending on income level. Palumbo et al (2011) estimated WTP per cycle of Controlled Ovarian Stimulation (COS) at €800, with 35.5% of respondents prepared to pay €101-300

more for a 1-2% effectiveness gain. Gardino et al (op cit) found a mean WTP for 25% success rate of OC to be USD16,304, and for 50% success rate of USD17,360. Finally Poder et al (2014) found that women between 18 and 45 valued drug treatment for ovulation induction at WTP CD4,800.

On the basis of this evidence we suggest that a conservative, representative, value for the COI components is 10,000. The WTP (disutility) component may be represented by a mid-point value between those derived by Granberg et al (1995) estimate and Gardino et al (2010). The other WTP studies are not easily interpreted in terms of a per case basis and so are not considered.

Cancer

A review of the cancer valuation literature by Hunt (2008) suggested that WTP values can be differentiated according to type of cancer; most of the studies reviewed looked at lung, skin, leukaemia, lymph or liver cancer and found significantly different values for the different cancer types. However, the findings of individual studies are not obviously consistent with each other. For example, whilst Hammitt & Liu (2004) find that the WTP for lung cancer is 40% higher than liver cancer, of the four cancers that Aimola (1998) derives values for, the lung cancer WTP is by far the lowest. Hunt concluded that the evidence base is insufficient to allow conclusions to be drawn about valuations of different cancers, or the extent to which a 'cancer premium' might exist. Furthermore, much of the data is from the US which limits its transferability to the EU. Olsson et al (2014), in a comprehensive study for the Nordic Council of Ministers, reports the direct medical costs per incidence of testicular cancer of €9800 (€2014) and the discounted indirect (productivity losses) costs of €2170 per case. DeOliveira et al (2013) estimated the treatment costs for testicular cancer one year after diagnosis to be CD 81655 in Canada (CD2007).

Cameron and DeShazo (2013) derived an annual WTP for a cancer micro-risk (1 millionth) reduction, assuming 5 years non-fatal illness of USD 3.39 (2003 prices). Adamowicz et al (2010) estimated a marginal WTP to avoid cancer illness of CD 2.433 per annum, per household (no price year). Kahneman et al (1993) found a mean WTP to reduce cancer risk of USD 12.85-25.67 (no price year). Eom (1994) estimated WTP for a reduction in cancer risk (from 0.1/50000 to 1.5/10000) from pesticides at USD 0.74-0.80 (1990 prices) per unit of produce. Buzby et al (1995) found WTP for a 50% pesticide related cancer risk reduction of USD 0.67 (1992 prices). Rojas (2009) found that WTP (monthly compensation) for cancer risk, identified as a maintenance of life satisfaction at the level prior to the disease, was USD 2695 (2004 prices). Tekesin et al (2014) estimated a WTP for reduced cancer risk (to 1/10000) of USD 53-85 (2012 prices). Li et al (2012) estimated an adjusted mean WTP for a new prostate cancer treatment with no side effects at USD 588.1. Interestingly, family members had a higher WTP of 819.4.

A Japanese study conducted to estimate the willingness to pay for reductions in the risk of dying and calculate the value of statistical life (Krupnick et al., 2005) found mean WTP for

reductions in mortality risks (5/1000 or 1/1000) associated with cardiovascular disease, respiratory illness and cancer to range from €236 to 515 (€2005).

A meta-analysis conducted by Florax et al (2005) found the WTP for cancer risk from pesticides to be around USD 75.00 (2000 prices). In attempting to understand the differences between WTP outcomes, the authors analysed the data by study methodology and found that contingent valuation studies resulted in the largest WTP, choice studies the next largest, and revealed preference the lowest. Face-to-face interviews for survey delivery resulted in substantially larger WTP than other methods.

The range of COI estimates is substantial. However, a conservative approach might lead us to adopt a value of €15,000 - close to the total derived from Olsson et al (2014). The WTP estimates are difficult to interpret in terms of deriving a result for a single cancer case. However, applying the results of the Krupnick et al., (2005) study we get a range of €47,000 to €515,000. Again, a relatively conservative approach leads us to adopt a representative value of €75,000 – though the range is clearly substantial and suggests considerable uncertainty in this estimate.

Neurodevelopmental conditions

There are strong data sets available, for example for PCBs, showing that environmentally relevant developmental exposures to EDCs have caused cognitive and behavioural deficits in humans (WHO/UNEP, 2013), and there is also a sizeable literature deriving cost of illness valuations. A literature review on IQ valuation by Rabl and Spadaro (2006) identified a range of valuations for the loss of an IQ from €3000 (Lutter, 2000) to USD 22300 (Trasande et al, 2005) and consequently take €10000 per IQ point (Spadaro and Rabl, 2008, Bierkens, 2013). Bellanger et al (2013) value a lost IQ point at €17,363 (€2008), and Bellanger et al (2015) value it at USD 19,269 (USD 2010).

There is however, a very limited existing economic literature valuing the disutility of neurodevelopmental conditions. Much of it focused on IQ impairment from Lead, Mercury and PCBs. The only studies found that derived a WTP value for an IQ point were both by von Stackleberg and Hammitt (2005 and 2009). Von Stackelberg and Hammitt (2005) conducted a contingent valuation survey to estimated willingness to pay to avoid the probability of a 6-point reduction in IQ, and the other a probability of a 7-month reduction in reading comprehension. The mean willingness to pay for a 6-point reduction in IQ was estimated at 102.8 €, and for a 7-month reduction in reading comprehension, at 120.4 €. Their (2009) estimate of WTP for an IQ point was USD446 per year. Agee and Crocker, (1994 and 1996), estimate parents' willingness to pay to avoid high levels of lead in the blood of one of their children. From Agee and Crocker (1994), in choosing averting behaviour (therapy), parents mean WTP was €32.9, and social mean WTP was €2169.9. Agee and Crocker (1996) found a mean WTP for a one part per million reduction of €7.2, and for a 1% risk reduction of €207.7 (all €2005).

A conservative estimate of the COI component values is €15,000 per IQ point – from the recent Bellanger studies. Whilst the WTP disutility estimates do not allow easy comparison, the annual value from von Stackleberg and Hammitt (2009) could be aggregated over a 40-year period – the average length of lifetime remaining across an EU population – to give a total value of is €14,000 per IQ point.

ADHD

Valuations of the costs of ADHD vary significantly in terms of the resource and opportunity costs addressed in the estimates. Le et al (2014) for example, in deriving an estimate of the cost of ADHD in children and adolescents in the Netherlands include medical, educational, productivity losses for the patient, plus medical and productivity losses for family members, and arrive at an estimate of €9,860-14,483 (€2012) per patient. Hakkart and van Roijen (2007) took a similar, although slightly less comprehensive, approach using direct annual medical costs and mothers annual productivity losses to arrive at a valuation of € 3416 per year. Pelham et al (Pelham et al,) in a review paper, derived a total annual cost of ADHD by including medical and metal healthcare costs, educational costs and the costs of crime and delinquency of USD14,576 (USD 2005). A review by Matza et al (Matza et al , 2005) valued the direct medical costs for children and adolescents with ADHD at USD 503-2567, and the costs of crime and delinquency at USD 12,868 and family member health and productivity losses at USD 2740 and USD 888 respectively. Zeidler et al (2013) in their systematic review found direct costs of ADHD (compared to a control group) of €2902 per patient per annum. Telford et al (2011) derived a mean annual cost of ADHD of £5439 (£2010) and these costs included medical, social care and educational costs. Braun et al (2013) found total annual costs of €3888 per patient (€2008). Doshi et al (2012) focused on both adults and children with ADHD and developed an estimate of annual costs for adults totaling USD 8,709, which included cost of illness and productivity losses. De Ridder and De Graeve (2006) found the annual costs of an ADHD child to be €588.3 for parents and €779 in terms of public costs.

Very little evidence was found in relation to the disutility costs of ADHD. Glenngard et al (2013) derived a monthly WTP for a fully effective drug with no side effects, taken once daily of €700 for adolescents and €360 for adults. De Ridder et al investigating the impact of order of presentation of different drug therapy options found a WTP for a new improved drug of €81.95 per month (as compared to €51.35 per month for the standard drug).

To derive a COI value, we adopt a mid-point estimate of Le et al (2014), of €12,000, though – on the basis of the other studies that present annual costs - we suspect that this is low for a whole lifetime. The WTP values do not convert to a per patient estimate and so we give no estimate for this.

Autism Spectrum disorders

There are very substantial costs associated with ASD. Landrigan et al (2002) estimated the total lifetime costs per case for autism to be USD 1.609 million (USD1997), and in a more recent study Knapp et al (2009) reported the cost of supporting a child with ASD and intellectual disability of £1.23 million and that for a child with ASD and no intellectual disability of £0.8 million. Ganz (2007) estimated the lifetime incremental societal cost of a case of autism to be USD 3.2 Million. Finally, in a recent study, Buescher et al (2014) reported figures of USD 2.4 million for ASD with intellectual disability and USD 1.4 million for ASD without intellectual disability. The corresponding figures for the UK were USD 2.2 million and USD 1.4 million respectively. These costs include annual medical, non-medical, indirect costs and lifetime costs. The greatest contributors to these costs have been observed to be adult care costs and productivity losses.

Annual healthcare costs associated with ASD have been estimated at USD 5979 (USD 2004) by Leslie et al (2007) and USD 4110-6200 (USD 2003) by Shimabukuro et al (2008) and £5160 by Barrett (2014).

To derive a COI value, we adopt a value of €1,500,000 – from the range given by the recent study of Buescher et al (2014). We were unable to identify any disutility data for ASDs.

Diabetes

In terms of the direct and indirect illness costs of diabetes, there have been a number of recent studies deriving total economic costings. For example, a study by Kanavos et al (2012) at LSE covering 5 EU countries found the total costs of diabetes, including co-morbidities, to range from €1708 to €5899 per case. Hunt and Ferguson (2014) estimated the total costs of diabetes in EU28 at €300 billion. The American Diabetes Association (2013) estimated that the direct medical costs of diabetes annually per patient were USD7,888 and the annual productivity losses varied from USD 2,322 for females to 3,813 for males (USD 2012). Legler et al (2015) estimated the total cost of adult diabetes attributable to DDE (Dichlorodiphenyldichloroethylene) to be €385 million. Seuring et al (2013) estimated the direct medical costs of diabetes to be USD 117-11917, and the productivity losses to be USD 6250 per annum in the US (USD2011). Alhowaish (2013) estimated the annual medical costs associated with ADHD to be USD 3686 (USD2010) in Saudi Arabia. In Tehran (Esteghamati et al 2009), these were USD 152.3 (USD2004), and in Spain they were €3311 (Ballester et al (2006).

There is however, much less evidence in relation to the disutility costs. A complication for valuation studies in this area is the conflation, or co-morbidity of diabetes and obesity. Many studies purport to value the disutility of diabetes, but use weight loss for the valuation metric. Lloyd et al (2011) for example, estimated the value of avoidance of a 4kg weight gain at £58. Similarly Veldwijk et al (2013) derive a valuation for 10kg per year weight loss in their study of type 2 diabetes and report a WTP of €97 per year. Other

diabetes valuation studies have investigated willingness to pay for various glucose control medications, or diet and lifestyle programmes. An example of the latter is Johnson et al (2006) who found a WTP for a diabetes prevention programme to be USD 1500 over 3 years (2005 prices. Examples of the former include Von Arx and Kjeer (2014) who estimated a monthly WTP for glucose control at USD100 (no price year), Jendle et al (2012) who derived WTP for Liraglutide (glucose lowering drug) of €2.64 per day, and Sadri et al (2005) who estimated a mean monthly WTP for inhaled insulin of CD 153.70. Pinto et al (2009) estimated a WTP for the same therapy – inhaled insulin – of USD 55.49 per month

A conservative value of €3000 is suggested for the COI components of a case of diabetes, taken from the range given in Kanavos et al (2012), as well as the Ballester et al (2006) study. A value of €16,000 is suggested for the WTP component, derived from Johnson et al (2006), assuming that the 3-year WTP value is aggregated over a 40-year period – the average length of lifetime remaining across an EU population.

Obesity

In terms of the resource and opportunity costs of obesity, Colaguiri et al (2010) reported annual total direct costs of obesity in Australia of AUSD 2788 per case (AUSD2005). Finkelstein et al (2014) in a review paper, derive a valuation for lifetime direct medical costs for a 10 year old with obesity of USD 16,310 – 39,080 (USD2012). Tsai in a systemmatic review identify direct medical costs of obesity as USD 1,723 per annum (USD2008).

The evidence base for disutility valuations is not very strong. Some illustrative studies include Doyle et al (2012), who estimated WTP of USD 10.49 per month per percentage point weight loss, and USD 30.77 per month for one pill per day treatment for obesity. Jerome et al (2014) estimated a median WTP for a weight loss programme of USD 45 per month. Fu et al (2011) found an average WTP for obesity prevention therapy delivering 5kg weight loss in 3 months of USD 362 (USD 2002) in Taiwan. Cawley (2008) reported that people were willing to pay to reduce childhood obesity by 50% a mean value of USD 46.41 (USD 2006). Liu et al (2009) estimated a WTP of USD 12 per month for weight loss medicines, and USD 6 for a calorie controlled diet in an all-female Taiwanese subject group. Narbro and Sjostrom (2000) found an average WTP of USD 3,280 for an effective obesity treatment.

A suggested representative COI value per case of obesity is €15,000, derived from the Finkelstein et al (2014) paper. For disutility WTP, applying the Jerome et al (2014) finding over a lifetime, an indicative value of €18,000 is derived, notwithstanding the many uncertainties likely to be attached to this value.

Synthesis and Conclusions

In Box 4 below we provide a synthesis of the COI: WTP relationships that can be derived from the data provided in the preceding sub-sections. In compiling this table we have pulled out the relevant data that seems to us – on a quick reading – to be the most robust in terms of quality and comparability with the other cost categories. The cost data given are judged to be defensible mid-range estimates; the significant uncertainties that attend many of these estimates are not represented here. Since the review is not comprehensive these findings should be viewed as indicative only.

Box 4 - Summary of COI and WTP data per case (€, 2014 prices)

Health Impact	Resource & Opportunity Costs	Disutility (WTP) Costs	COI:WTP ratio
Human Fertility	10,000	20,000	1:2
Cancer	15,000	75,000	1:5
Neurodevelopmental conditions	15,000	14,000	1:1
ADHD	12,000	N/A	
ASDs	1,500,000	N/A	
Diabetes	3000	16,000	1:5
Obesity	15,000	18,000	1:1.2

N/A = Not available

The synthesis of findings reported in Box 4 are extremely crude, as well as being incomplete. However, we may tentatively conclude that what limited evidence exists does indicate that the disutility component may be expected to act as a non-trivial multiplier to the aggregate cost estimates that have recently being published. Whilst the inclusion of the disutility component would seem to at least double the estimates based on the COI components, in the absence of a more considered and thorough analysis that includes proper treatment of uncertainty ranges it would a mistake to attach precise numbers to the multiplier. It does, though, highlight the fact that the existing published estimates paint an incomplete picture of the total welfare costs incurred by society, and so endorses the call of Woodruff to address this knowledge gap.

ENDS

The Health and Environment Alliance (HEAL) is a leading European not-for-profit organisation addressing how the environment affects health in the EU. With the support of more than 70 member organisations, HEAL brings independent expertise and evidence from the health community to different decision-making processes. Our broad alliance represents health professionals, not-for-profit health insurers, doctors, nurses, cancer and asthma groups, citizens, women's groups, youth groups, environmental NGOs, scientists and public health research institutes. Members include international and Europe-wide organisations as well as national and local groups. Website: www.env-health.org. Follow HEAL on Facebook and Twitter @HealthandEnv @EDCFree @CHM_HEAL

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