

## Finding appropriate reference data for formerly PCDD/F-exposed female teachers

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### 1. Introduction

In a current study we examine the correlation between dioxin-indoor-exposure and the internal I-TEQ, sum-2,3,7,8HexaCDD, 2,3,7,8HeptaCDD and OctaCDD body burden. 41 blood-samples have been analysed in this context. They originated from formerly wood preservative exposed female employees—mostly teachers—who worked in several day-care centres in the Hamburg area. All blood samples were already collected in 1987. The blood was kept frozen until analysis. The results will be reported later.

The present study deals with the methodological problem of establishing reference values for blood of women dating back to 1987. Appropriate reference data from that time are not available. On the other hand, environmental monitoring data as well as data on PCDD/F concentration in food indicate significant time trends for most of the congeners which might have lead to a relevant decrease of body burden since 1987. Results of recent studies therefore are not suited for comparison with data from former times. Furthermore, even today there is only limited data on PCDD/F levels in blood of women. In addition, dealing with women, the decreasing effect of breast feeding on internal PCDD/F load has to be taken into account. Both effects cannot be controlled for using PCDD/F-measurements in blood of women as appropriate data are not available. Results of mother milk studies, however, might be used to give a crude estimate of the magnitude of the respective effects.

In the present paper we describe methods of developing age dependent background levels as well as methods to consider the time trend and the nursing effect. Reference values for 1987 and 1994 are given and the influence of nursing during a period of ten and twenty-five weeks is exemplarily estimated.

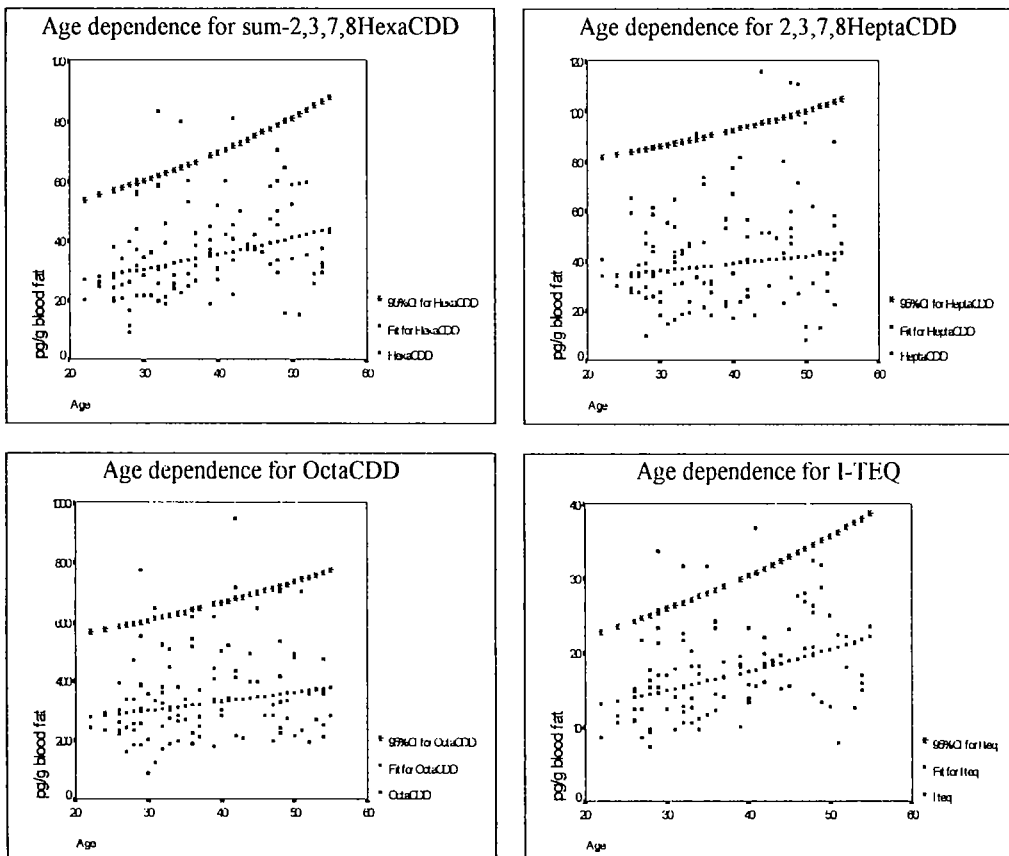
### 2. Material and Methods

A suitable cohort of German women could not be found. Therefore the calculation of the reference data is based on a group gathered by ERGO Forschungsgesellschaft, Hamburg. The group consists of 97 men and 9 women. The cohort fits with the average age of employees which were in the exposed group 1987 (23 to 55 years). For all persons involved no specific exposure, except for food consumption, has been reported.

The age dependent reference values were calculated by regression estimation (exponential model) after the distribution-testing for the congeners and the I-TEQ (log-normal-distribution). A statistically significant age dependency for the congeners sum-2,3,7,8HexaCDD, OctaCDD and I-TEQ was found.

Age dependent concentration ranges were derived from the regression model. **Figure 1** illustrates mean estimate value and upper confidence limit (95%, one tailed). The exponential model turns out to be appropriate. Based on a 95%, one tailed significance and a sample size of n=106, five cases out of the confidence limit could be expected.

The time trend was estimated using human milk data from a 8-year survey: PCDD/F concentration 1987 to 1994<sup>1)</sup>. By regression technique (exponential model) weighted on sample sizes the average decrease of the I-TEQ and the three congeners concentration between 1987 and 1994 were estimated. The relative decrease from 1987 to 1994 amounted to 48% (I-TEQ), 42% (sum-2,3,7,8HexaCDD), 48% (OctaCDD), respectively. (It is not possible to estimate the decrease for 2,3,7,8HeptaCDD because there is an intermediate increase for 1987 to 1989) It is assumed that blood concentration shows a similar time trend.



**Figure 1**

Data base: ERGO 1994<sup>1)</sup>

(Please note the differing blood fat scales.)

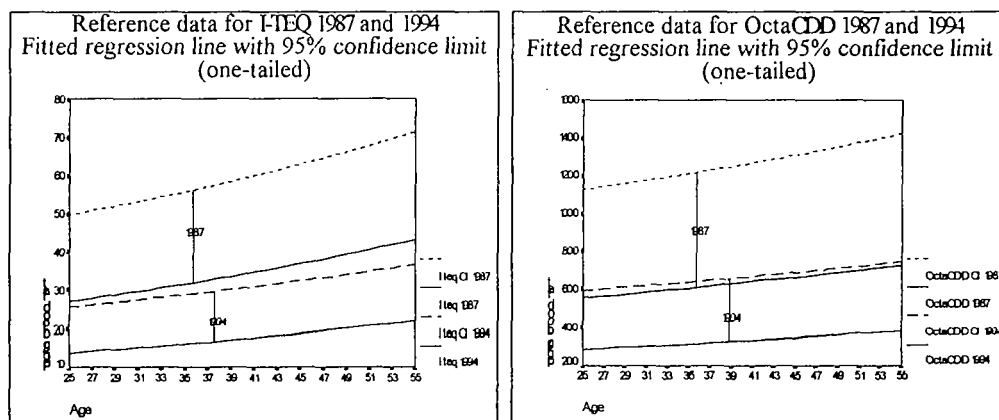
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The decrease of internal PCDD/F load induced by nursing also was estimated using human milk data<sup>2)</sup> (I-TEQ-concentration in human milk), stratified on cumulative duration of breast feeding. The mean I-TEQ-value in the milk of mothers breast feeding their first child was 34 pg/g in milk fat, whereas women after 195 weeks of nursing resulted in I-TEQ-values of 10 pg/g. Although these numbers are based on an interindividual comparison they are regarded to reflect the intraindividual decrease of TCDD/F body burden during the periods of breast feeding. For sum-2,3,7,8HexaCDD, 2,3,7,8-HeptaCDD and OctaCDD the same procedure was executed in a former study<sup>3)</sup> (Polychlorinated dibenzo-p-dioxins and furans in human milk). Again it is assumed that the decrease in blood values is similar. Based on the concentration of sum-2,3,7,8HexaCDD, 2,3,7,8HeptaCDD and Octa-CDD in the 1<sup>st</sup>, 5<sup>th</sup>, 10<sup>th</sup> to 13<sup>th</sup> and 50<sup>th</sup> to 62<sup>nd</sup> week the decrease (%) of the concentration from the first to the 60<sup>th</sup> week of breast feeding assuming first order kinetic was estimated.

## 3. Results

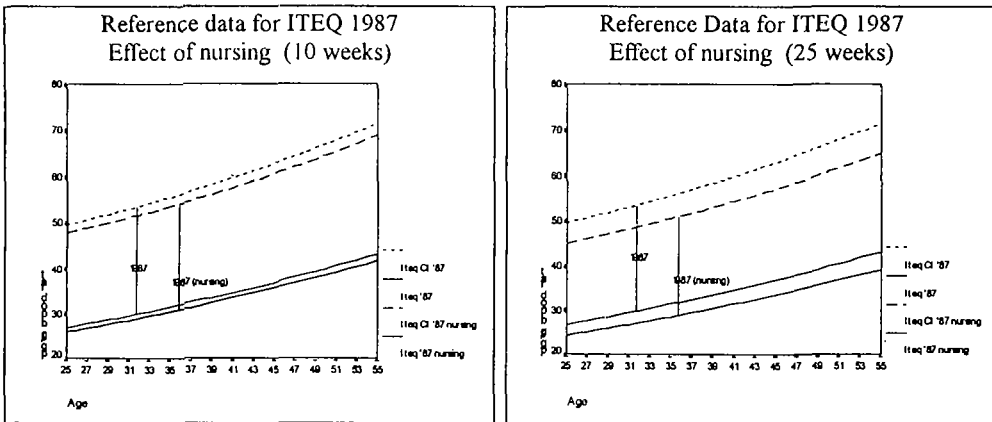
The age dependent 1994 and 1987 reference data for I-TEQ and OctaCDD are shown in **figure 2**. The graph demonstrates both reference lines (mean estimate value and the confidence limit). The decrease of the concentration from 1987 to 1994 is recognizable. For I-TEQ the 1987 line of the mean estimate value is above the confidence line for 1994. The lines of OctaCDD overlap because of its wide confidence limit. The line of the 1987 mean estimate value is still below the 1994 confidence limit.

In **Figure 3** the nursing-effect is illustrated. The influence of a ten and a twenty-five-week nursing-period is shown for I-TEQ and OctaCDD: the concentration of I-TEQ and OctaCDD evidently decreases. The calculation bases on the already mentioned human milk data.



**Figure 2**

Data base: ERGO 1994<sup>4)</sup>; Time trend estimated by Fürst *et al.*



**Figure 3**

Data base: ERGO 1994<sup>4)</sup>; Nursing effect estimates by Fürst *et al.*

#### 4. Conclusions

The reference values calculated in this study should be regarded as rough estimates which were constructed primarily for supporting the interpretation of individual results and medical consultation. The estimates obtained appear to be consistent with environmental monitoring data. For example, immission concentrations of PCDD/F-levels in Germany are reported to have decreased from 1987 to 1994 by about 60%<sup>5)</sup>, a figure well comparable with the estimate based on human milk data in the present study. We conclude that the available data based on PCDD/F-concentrations in mother milk can be used to construct reference data for historical blood samples in a meaningful way. Due to the inherent methodological problems, such data should be communicated with caution and their limitations have to be carefully taken into account.

#### 5. References

- <sup>1)</sup> The data were made available by Dr. P. Fürst, Chemisches Landes- und Staatliches Veterinäruntersuchungsamt, Münster, Germany
- <sup>2)</sup> Fürst, P., Fürst, Chr., Wilmers, K.: PCDDs and PCPs in Human Milk – statistical evaluation of a 6-year survey. In: *Chemosphere* 25(7-10) 1029-1038 (1992)
- <sup>3)</sup> Fürst, P., Krüger, Chr., Meemken, H.-A., Groebel, W.: Bericht über die Untersuchung von Frauenmilch auf polychlorierte Dibenzodioxine und -furan 1984–1986 (Bericht des chemischen Landesuntersuchungsamtes Nordrhein-Westfalen, Münster)
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- <sup>5)</sup> Heudorf, U., Salzmann, N., Angerer, J., Wittsiepe, J.: Biomonitoring auf PCDD/F und auf PCBs bei stark erhöhten Raumluftbelastungen. In: *Umweltmedizin* 1(1) 6-12 (1996)