

NEURAL TUBE DEFECTS (NTD) AND CHRONIC EXPOSURES TO LOW DOSES OF RADIATION

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Background and Objectives: Following the 1986 Chernobyl disaster, we organized a network (OMNI-Net). In 2000 population-based monitoring of malformations adhering to ICBDSR and EUROCAT methodologies was started. This report concerns the Polissia (POL) and not-Polissia (notPOL) regions in the Rivne Province in Ukraine. Two characteristics of the POL soils compared to those in notPOL are: greater contamination by Chernobyl ionizing radiation (IR) concurrent with the highest index of transfer of nuclides from soil to the food chain in Ukraine. We investigated Cs-137 whole body counts (WBC) in pregnant women and the prevalence of neural tube defects (NTD), anencephaly (AN) and spina bifida (SB) in POL and notPOL. Transition soils and radiation levels are noted in Kostopil County (KOS).

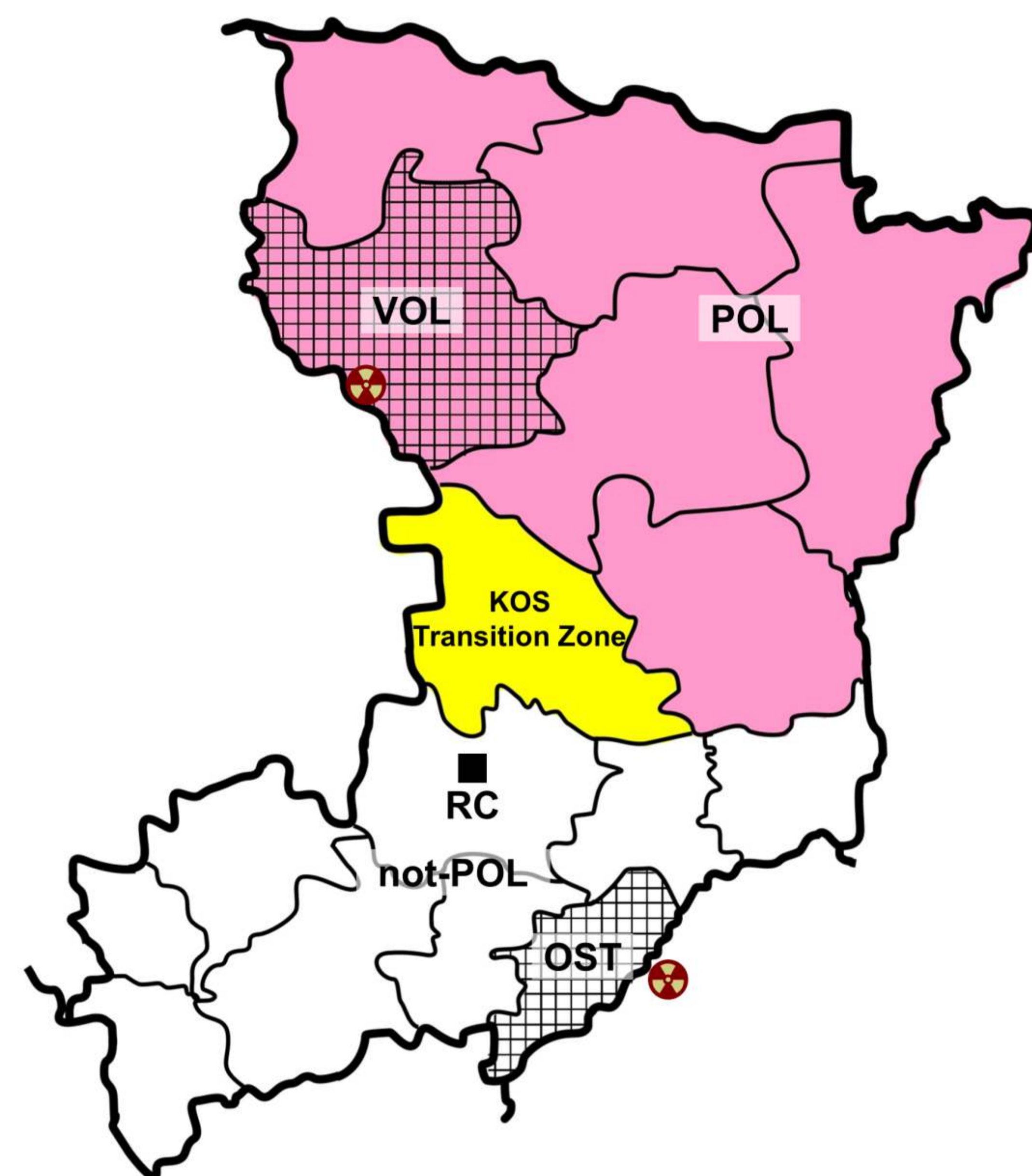
Methods: Pregnant women under the care of the Rivne Regional Clinical Diagnostic Center were asked to undergo WBC procedures (2011-2018). The WBC reflect Bq levels from incorporated Cs-137. The prevalence of NTD (2000-2017) was established through monitoring of all pregnancy outcomes in the province, through procedures established and implemented across Europe by EUROCAT and worldwide by ICBDSR.

Results: We recorded 9,792 and 6,237 WBC of pregnant women residing in POL and notPOL, respectively. Among 809 women with WBC levels above 5,000 Bq, 796 (98%) resided in POL. The prevalence of NTD, per 10,000 live births (136,695 in POL and 139,898 in notPOL), was 21.9 and 14.2, respectively. Temporal trends of NTD prevalence were not statistically significant while NTD prevalence in POL was statistically significantly higher than in notPOL.

Discussion: The concurrence of higher WBC and NTD rates in POL compared to notPOL is strong and persistent. The WBC of Sr-90 and tritium known to be present in the environment remain unmeasured. Our observations are consonant with reported NTD prevalence in Cumbria and Northern England which are the most impacted UK regions by Chernobyl and are in proximity to large nuclear complexes.

Rivne Province and Polissia soils impacted by Chernobyl ionizing radiation

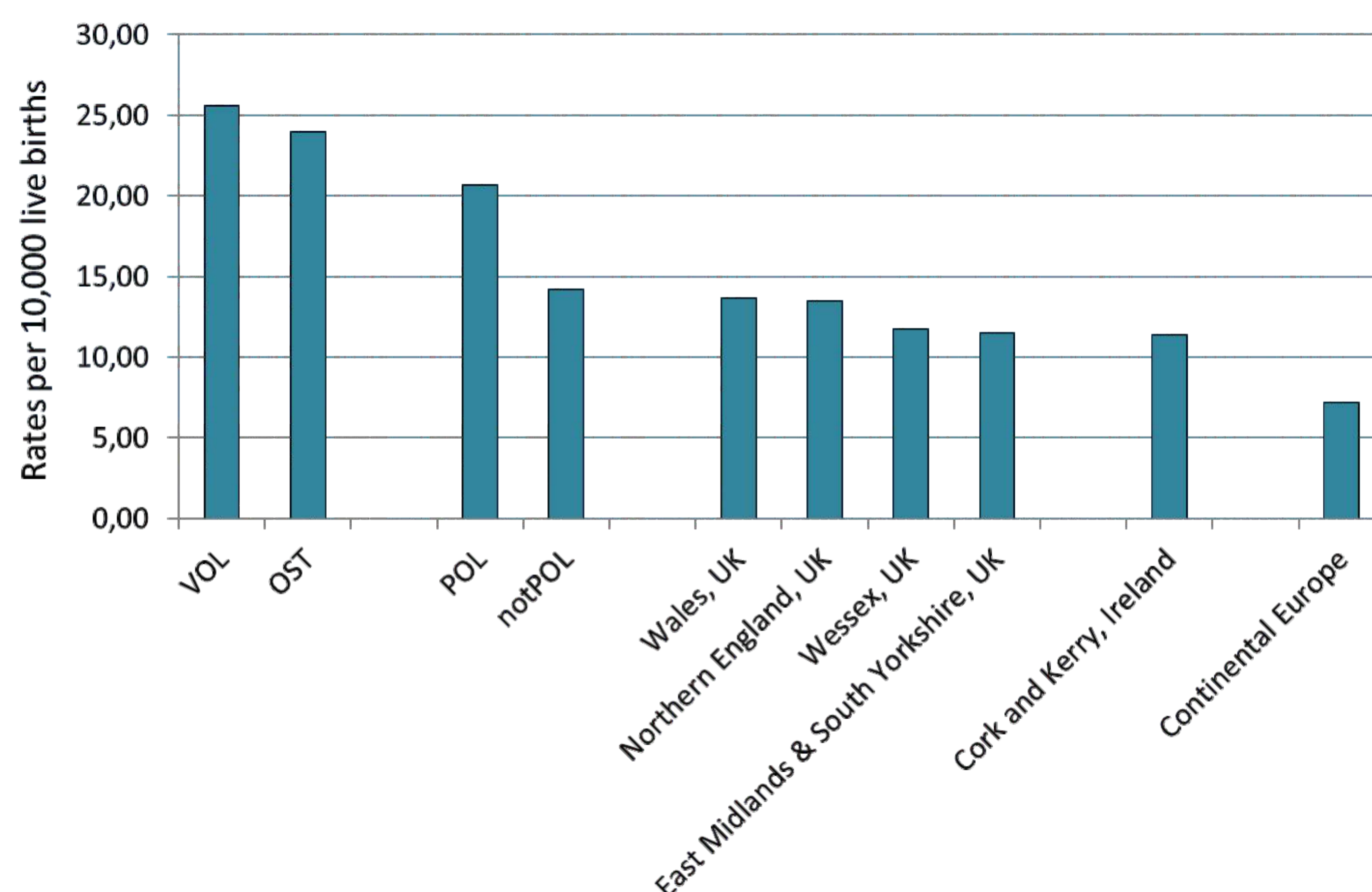
- SOILS**
- Sandy impacted by Chernobyl
 - Sandy not impacted by Chernobyl
 - Fertile not impacted by Chernobyl
- POPULATION**
- Proximal to nuclear power plants
- AREA**
- POL – Polissia Counties
 - VOL – Volodymyrets County
 - KOS – Kostopil County Transition Zone – Soils/Radiation
 - Not-POL – not-Polissia Counties
 - OST – Ostroh County
 - Nuclear Power Plants
 - RC – Rivne City (Capital)



WBC Cs-137 levels recorded during two time periods (top) and 2000–2017 prevalence rates of neural tube defects (NTD), anencephaly (AN) and spina bifida (SB) (bottom)



Neural Tube Defects (NTD) prevalence rates during the 2000–2017 period in Europe



Conclusions

The concurrence of higher WBC and NTD rates in POL compared to notPOL is strong and persistent. The nature of this investigation precludes definitive cause-effect conclusions. However, the persistence and strong contrasts between POL and notPOL are sufficient, in our view, to require substantive additional investigations, in particular concerning impacts on the genomic integrity of the affected families.