

CHORNOBYL-RELATED DEVELOPMENTAL ANOMALIES (2000-2019)
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Background & Objective. An ongoing surveillance since 2000 in Rivne province of in-utero exposures to ionizing radiation and a population-based surveillance of prevalence of developmental anomalies demonstrated a likely cause-effect association. This observation calls for further investigations, public health policies, and implementations to reduce in-utero exposures, prevalence, and impact of developmental anomalies in Ukraine.

The objective is to determine more precisely to what extent Chernobyl radionuclides had and continue to represent teratogenic risk to exposed populations.

Methods. Measurement of whole-body counts of Cs-137 incorporated by pregnant women and population-based surveillance of developmental anomalies relying on international methods implemented as a member of the consortia belonging to the European network of population-based registries for the epidemiological surveillance of congenital anomalies (EUROCAT). As members of the Collaborative Initiative on Fetal Alcohol Spectrum Disorders (CIFASD) of the National Institute on Alcohol Abuse and Alcoholism (NAAA), the monitoring of alcohol teratogenesis adhered to the same standards.

Results. The reported results confirm and expand those in 50 scientific reports published by international journals. In the Polissia region of Rivne, in-utero exposures to ionizing radiation from cell-bound radionuclides are statistically significantly higher than in not Polissia. Prevalent developmental disruptions were those the central nervous system and early stages of development of the gastro-enteric tube. There was no evidence of cardiac tubes, nor uro-renal disruptions, subject to be investigated further. In addition to severe microcephaly (<3 SD) were also observed statistically significantly reduced occipital-frontal head circumferences in accounting in Polissia with high levels of radionuclides.

A temporal decrement of the prevalence of high in-utero exposures was concurrent with a decrement of prevalence of developmental disruptions observed only in Polissia. The decrement evident during the 2010-2019 decade, is concordant with the 30-year half-life of Chernobyl-released Cs-137 and Sr-90 radionuclides. Nonetheless, the percentage of pregnant women with incorporated levels of Cs-137 exceeding 100 Bq/kg may represent teratogenic, mutagenic, and cancerogenic risks. The Cs-137 recordings do not account for in-utero exposures to Sr-90 or other radionuclides incorporated by pregnant women. Preliminary analyses also indicate the possibility of additional sources of ionizing radiation in-utero exposures related to local power plants to be further investigated.

Discussion & Conclusions. Exposures to ionizing radiation in Polissia indicated a likely association with developmental anomalies and those with alcohol did not. Teratogenic disruptions of neurulation (craniorachischisis, spina bifida, microphthalmia) were most evident. The population-based prevalence rates of spina bifida were the highest in Europe. To what extent the observations represent synergistic-ionizing radiation and alcohol teratogenic impacts remain to be investigated. Radiogenic disruptions impact all developing systems. Those investigated were limited to 15 developmental anomalies ascertained up to the age of one year. Degrees of microcephaly vary and become more evident with child growth. Further investigations of child development and microcephaly are indicated. Reductions of head circumference remain to be investigated. Likewise, ongoing exposures of gestations to ionizing radiation in Rivne Polissia and in proximities to nuclear power plants are also indicated. Furthermore, strengthening of prevention of pregnant women and children consumption of contaminated nutrients, access to anticipatory and early health care, and prevention of occurrence and recurrence policies are indicated. The ongoing prevalence rates of Neural Tube Defects, the highest in Europe, can be significantly reduced by implementation of effective folic acid fortification programs and to some degree can be partially achieved without legislative support. Legislative initiatives were submitted and their implementation was delayed.

Keywords (separated by commas): Chernobyl, developmental anomalies, ionizing radiation, microcephaly, spina bifida

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