

**Congenital Malformations - Chernobyl Impacted Area - Rivne Province – Ukraine**  
**W. Wertelecki, M.D.      [genfir3@gmail.com](mailto:genfir3@gmail.com)**



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POPULATION RATES (2000-2009)  
145,437 Pregnancies



**ELEVATED POPULATION RATES OF NEURAL CONGENITAL MALFORMATIONS  
(NTD – MICROCEPHALY ... BLASTOPATHIES)  
(RATES HIGHEST IN RIVNE-POLISSIA)  
(RATES AMONG THE HIGHEST IN EUROPE)  
NATIVE POLISSIA POPULATION – WELL DEFINED ECOLOGY and ETHNOLOGY  
(CHARACTERISTICS OF A POPULATION ISOLATE)  
IMPERATIVE - PROSPECTIVE INVESTIGATIONS OF RISK FACTORS  
(CALL FOR INTERNATIONAL PARTNERSHIPS)**

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## **ACKNOWLEDGMENTS**

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Ukrainian Universities and Research Institutes: Mohyla Academy; Lviv Medical University

U.S. Universities: South Alabama; California at Berkeley, at San Diego, at Davis; New York at Burlington (SUNY); Emory; Indiana and, South Carolina.

Provincial Public Health Authorities; Rivne; Volyn; Khmelnytsky; Kherson; Crimea.

U.S. Agencies and Foundations: Centers for Disease Control; USAID; March of Dimes; National Institutes of Health.

International Organizations

European Consortium of Malformation Monitoring Systems

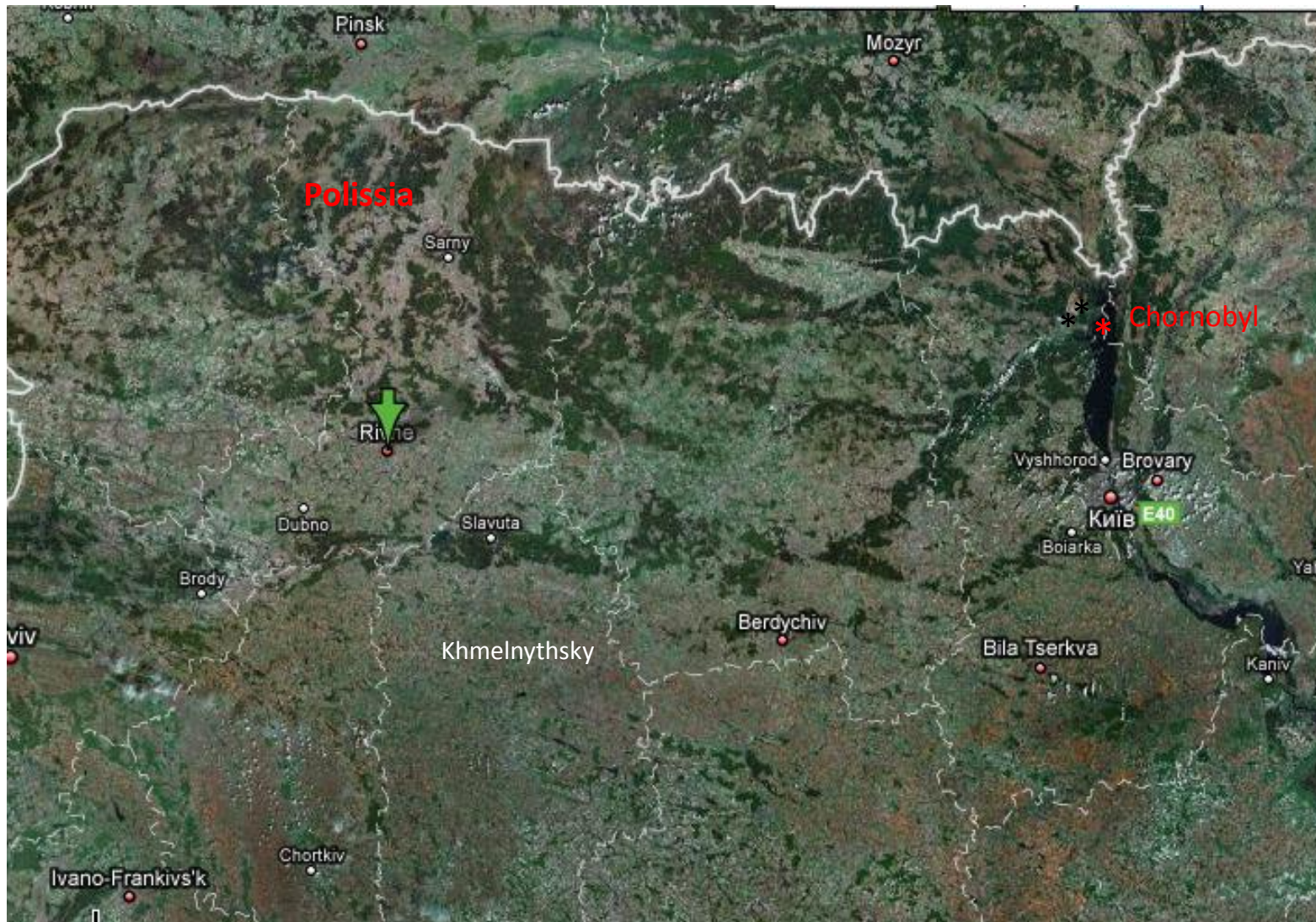
International Congenital Malformations Clearing House

OMNI-Net Ukraine Child Development Programs

## Programs and Data Collection Points



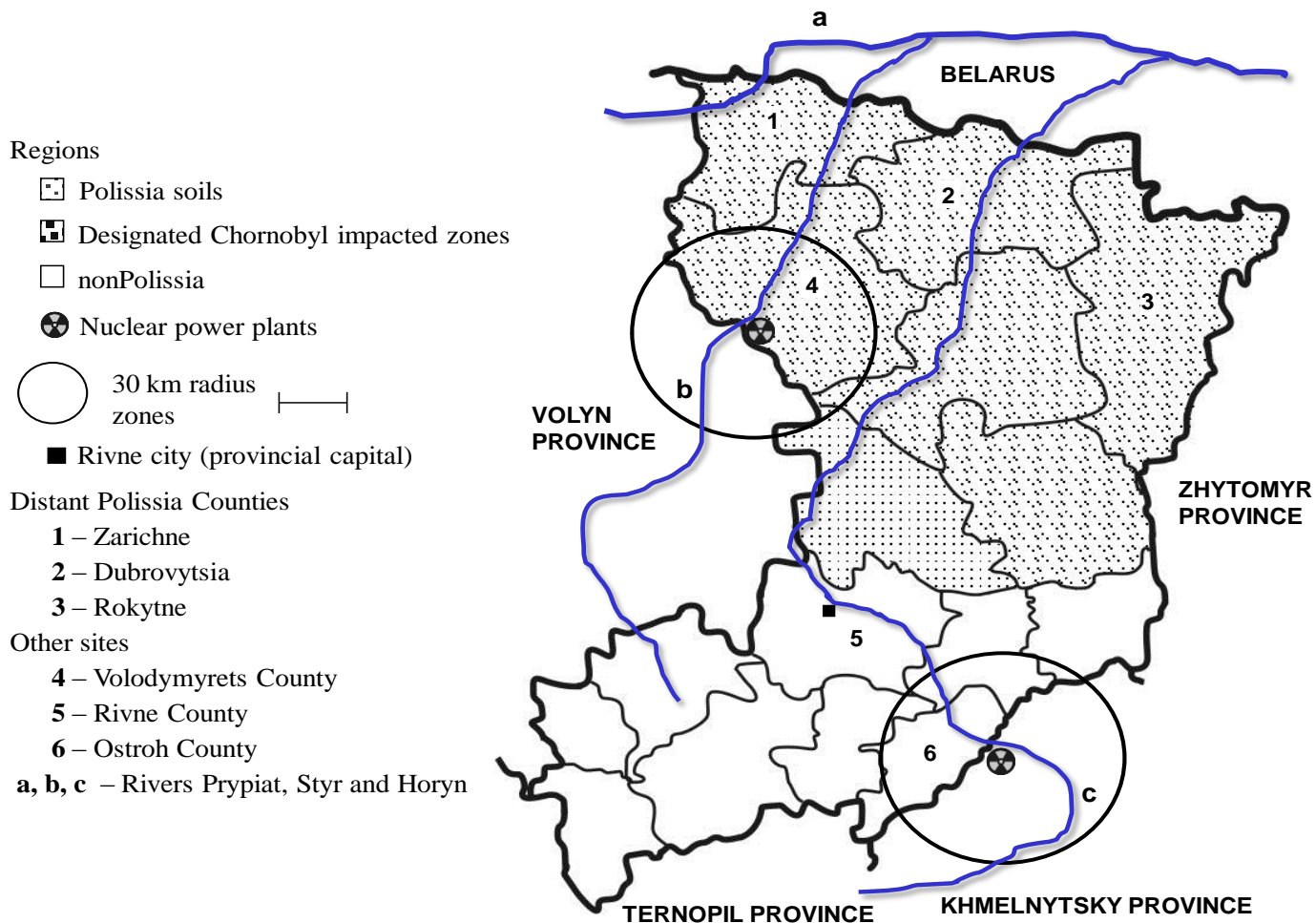




# Prypiat River and Tributaries








**Figure 1.** Schematic representation of Rivne province counties indicating those with soils characteristic of a region called Polissia and those counties designated as impacted by Chornobyl ionizing radiation. Also shown is the area of “distant” Polissia, the location of nuclear power plants and the trajectory of major rivers of the region


Regions

-  Polissia soils
-  Designated as **Chornobyl impacted zone**

 nonPolissia

 Nuclear power plants (NPP)

 30 km radius zones

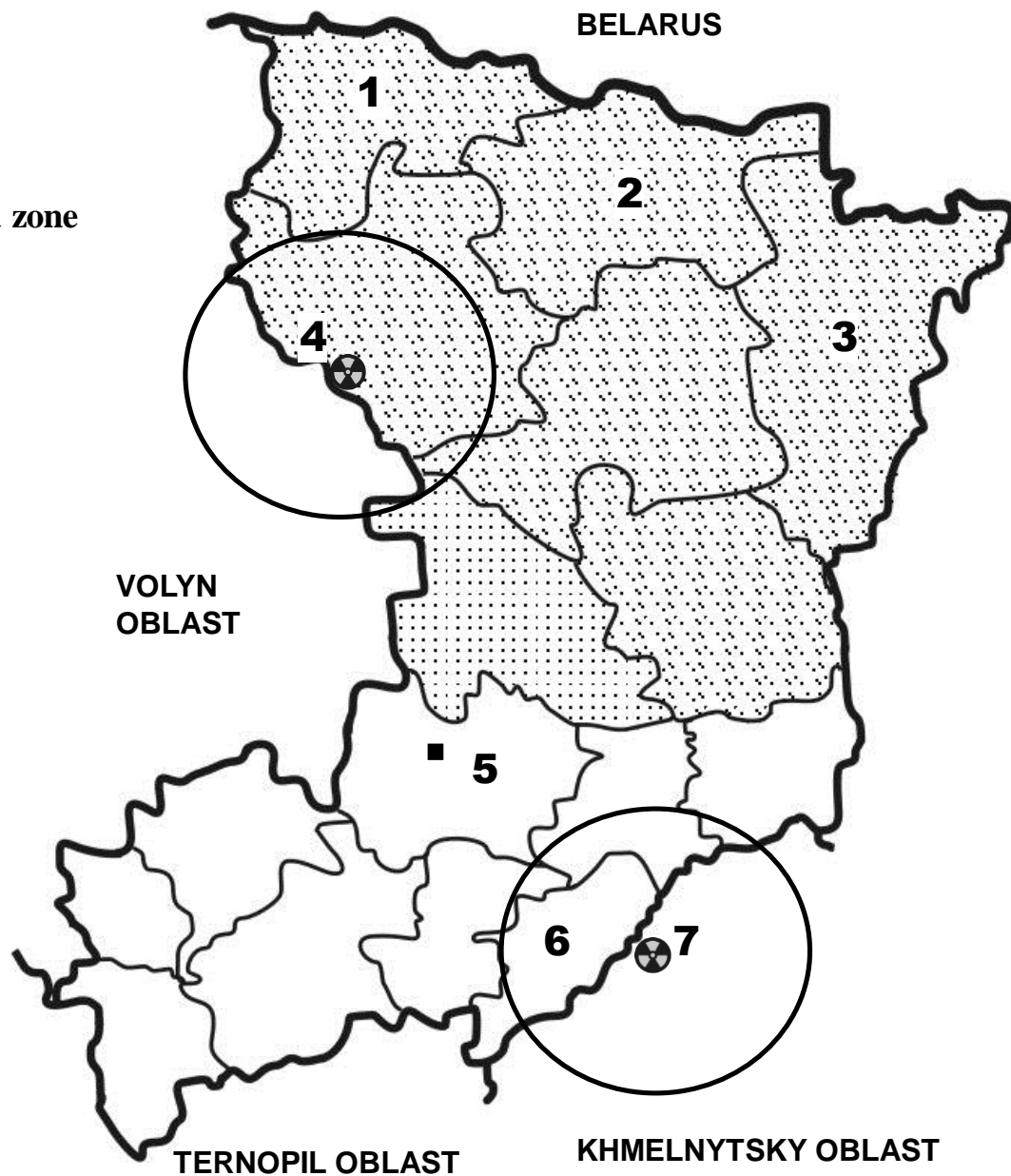
 Rivne city (capital)

**Distant Polissia**

- 1 – Zarichne County
- 2 – Dubrovytsia County
- 3 – Rokytno County

**Other sites**

- 4 – Kuznetsovsk NPP
- 5 – Rivne County
- 6 – Ostroh County
- 7 – Khmelnytsky NPP



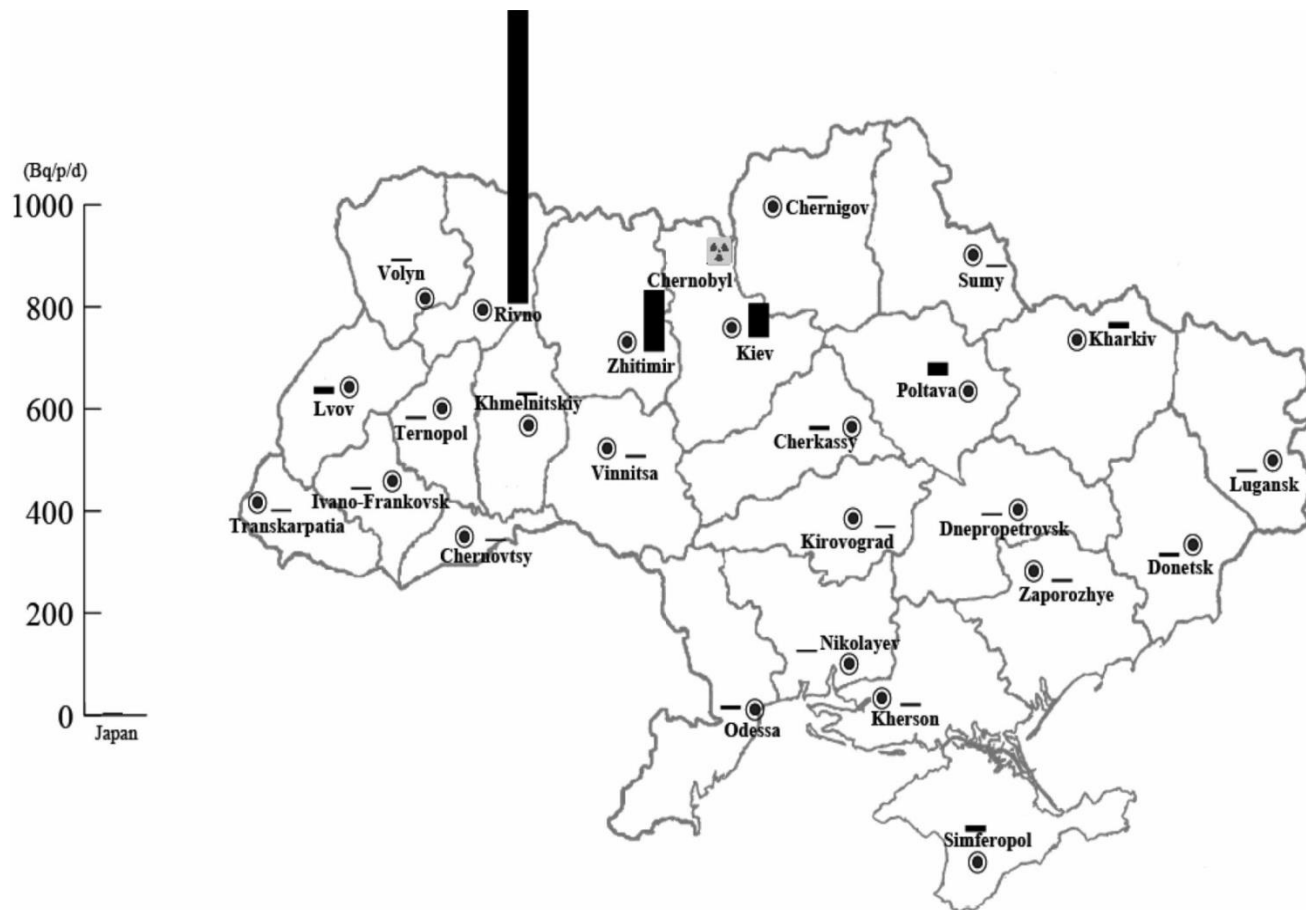
# POLISSIA

**River Prypiat – Prypiat Marshes – Polishchuks**

Cs Transfer from Soil-to-Food Chain Index  
Highest in Ukraine



*OMNI-Net Ukraine 2009*



**Fig. 1.** Twenty five regions of Ukrainian territory and their corresponding daily  $^{137}\text{Cs}$  intakes. Dietary iodine and bromine intakes • K. Shiraishi et al. - Health Physics January 2009, Volume 96, Number 1

J Appl Genet 47(2), 2006, pp. 143–149

## Birth defects surveillance in Ukraine: a process

Wladimir Wertelecki

Department of Medical Genetics, University of South Alabama, Mobile, Alabama, USA

**Abstract.** Birth defects (BD) surveillance using international standards was introduced in Ukraine by a network of five BD centers located in northwestern, central and southern regions. BD centers provide resources to access current and comprehensive information and to nurture partnerships with physicians, administrators, parental support groups, educators, and humanitarian assistance organizations. One outcome was the vigorous and popular

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Birth Defects Research (Part A) 70:400–402 (2004)

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### Brief Reports

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## High Rates of Neural Tube Defects in Ukraine

Nataliya Yuskiv,<sup>3</sup> Clark O. Andelin,<sup>2</sup> Svitlana Polischuk,<sup>3</sup> Oleksandr Shevchuk,<sup>4</sup> Zoryana Sosynyuk,<sup>4</sup>  
Tetyana Vihovska,<sup>3</sup> Lyubov Yevtushok,<sup>4</sup> Godfrey P. Oakley, Jr.,<sup>2</sup> and Wladimir Wertelecki<sup>1\*</sup>

<sup>1</sup>University of South Alabama, Mobile, Alabama

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<sup>3</sup>Volyn Regional Children's Territorial Medical Center, Lutsk, Volyn, Ukraine

<sup>4</sup>Medical Diagnostic Center, Rivne, Ukraine

Received 12 December 2003; Accepted 13 February 2004



**Table 1a. Rates\* ALL INDIVIDUALS with Congenital Malformations in Rivne Province of Ukraine<sup>(a)</sup>**

	Polissia		Non-Polissia		Polissia	Non-Polissia	Polissia vs. Non-P		
	2000-2004	2005-2009	2000-2004	2005-2009	2000-2009	2000-2009	P	OR	
Live Births	33703	38676	33205	39853	72379	73058			
Neural Tube Defects	29.08	23.53	18.37	14.80	26.11	16.43	<0.0001	1.59	1.1
Craniocervicothoracic	12.76	11.64	7.83	5.77	12.16	6.71	0.0008	1.81	1.1
Anencephaly <sup>(b)</sup>	6.23			3.01	5.11	3.97	0.3264	1.29	0.7
Isolated	5.64			3.01	4.70	3.83	0.448	1.23	0.7
Other Malformations	n/c				n/c	n/c	0.3727	3.03	0.7
Craniorachischisis <sup>(c)</sup>	3.26	5.95	2.71	1.76	4.70	2.19	0.0106	2.15	1.1
Isolated	2.08	4.14	1.81	1.51	3.18	1.64	0.0641	1.93	0.9
Other Malformations	n/c	1.81	n/c	n/c	1.52	n/c	0.0755	2.78	0.8
Spina Bifida High <sup>(d)</sup>	3.26	1.55		n/c	2.35	n/c	0.0042	4.29	1.4
Isolated	2.37	1.55		n/c	1.93	n/c	0.0187	3.53	1.1
Other Malformations	n/c				n/c				
Lumbo-Sacral Spina Bifida <sup>(e)</sup>	10.09	10.34	7.23	7.03	10.22	7.12	0.0496	1.44	0.9
Isolated	8.90	9.05	6.02	6.52	8.98	6.30	0.071	1.43	0.9
Syndromes	n/c				n/c				
Other Malformations	n/c	1.29	n/c	n/c	1.11	0.82	0.6056	1.35	0.4
Spina Bifida Isolated Undefined <sup>(f)</sup>	3.26		n/c		1.52	n/c	0.0755	2.78	0.7
Encephalocele	2.97	1.55	2.11	2.01	2.21	2.05	0.8594	1.08	0.5
Isolated	2.08	1.29	1.51	1.51	1.66	1.51	0.8381	1.1	0.4
Syndromes	n/c		n/c		n/c	n/c	0.6233	2.02	0.7
Other Malformations	n/c	n/c	n/c	n/c	n/c	n/c	1	0.67	0.0
Microcephaly	5.04	6.72	3.31	3.26	5.94	3.29	0.02	1.81	1.0
Isolated	2.67	1.29	n/c	1.25	1.93				
Syndromes	n/c	2.84	2.11	1.76	2.07				
Other Malformations	n/c	2.59	n/c	n/c	1.93				
Microphthalmos <sup>(g)</sup>	1.78	3.10	n/c	n/c	2.49	0.82	0.0142	3.03	1.1
Isolated	n/c	1.55		n/c	1.11	n/c	0.2646	2.02	0.5
Syndromes		n/c	n/c		n/c	n/c	0.3727	3.03	0.7
Other Malformations	n/c	n/c	n/c		0.97	n/c	0.0382	7.07	0.9

INDIVIDUALS

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Neural Congenital Malformations Population Rates  
Period 2000-2004 vs 2005-2005

	Pregnancies		Difference
Polissia	33703	38678	N.S.
non-Polissia	33205	39853	N.S.



	Polissia	non-Polissia	P	OR	L/U CL
Pregnancies	72379	73058			
NTD	189	120	**	1.59	1.26-2.02
Cephalad (a)	88	49	**	1.81	1.27-2.63
<b>Microcephaly</b>	43	24	**	1.81	1.07-3.12
<b>Microphthalmos</b>	18	6	**	3.03	1.15-9.32

**After Excluding Individuals with** Recognizable Malformation Syndromes, exposures to Alcohol, Genomic anomalies and Holoprosencephaly

<b>NTD</b>	186	119	**	1.58	1.25-2.01
Anencephaly + Cranio-rachi-schisis	71	45	**	1.59	1.08-2.37
<b>Microcephaly</b>	15	5	*	2.83	1.33-6.52
<b>Microphthalmos</b>	18	6	*	3.03	1.05-10.65

### Sentinel Anomalies

Cleft Lip a/o Palate	68	69	N.S.		
Down Syndrome	101	97	N.S.		

NTD = Neural Tube Defects

\* P< 0.05 \*\* P<0.01

(a) Anencephaly + Cranio-rachischisis + Cervico-thoracic Spina Bifida

**Table Ic. Individuals with Malformations **after Exclusion** of Clinically Recognized Malformation Syndromes, Likely Mutations, Chromosomal Anomalies, Holoprosencephaly Complexes, and Prenatal Exposures to Alcohol and other Teratogens**

	Polissia			Non-Polissia			Polissia	Non-Polissia	Polissia vs. non-Polissia
	2000 2004	2005 2009	P	2000 2004	2005 2009	P	2000 2009	2000 2009	P
Live Births	33703	38676		33205	39853		72379	73058	
<b>Neural Tube Defects</b>	95	91	0.2390	60	59	0.3109	<b>186</b>	119	<b>&lt;0.0001</b>
<b>Anencephaly<sup>(a)</sup></b>	21	16	0.2494	17	12	0.1916	<b>37</b>	29	0.3264
<b>Isolated</b>	19	15	0.3049	16	12	0.2557	<b>34</b>	28	0.4480
<b>Craniorachischisis<sup>(b)</sup></b>	11	23	0.1211	9	7	0.4555	<b>34</b>	16	<b>0.0106</b>
<b>Isolated</b>	7	16	0.1449	6	6	0.7792	<b>23</b>	12	0.0641
<b>Spina Bifida</b>	55	46	0.1340	28	32	0.8971	<b>101</b>	60	<b>0.0012</b>
<b>Isolated</b>	49	41	0.1398	24	30	1.0000	<b>90</b>	54	<b>0.0026</b>
Encephalocele	8	6	0.4382	6	8	1.0000	14	14	1.0000
Isolated	7	5	0.5650	5	6	1.0000	12	11	0.8381
<b>Microcephaly</b>	13	15	1.0000	4	6	1.0000	<b>28</b>	10	<b>0.0032</b>
<b>Isolated</b>	9	5	0.2836	3	5	0.7355	<b>14</b>	8	0.2080
<b>Microphthalmos<sup>(c)</sup></b>	6	9	0.7969	1	4	0.3853	<b>15</b>	5	0.0259
<b>Isolated</b>	2	6	0.2983	-	4		<b>8</b>	4	0.2646
Conjoined Twins <sup>(d)</sup>	2	-		2	3	1.0000	2	5	0.4531
Teratomas	5	1	0.1036	1	3	0.6312	6	4	0.5469
<b>Omphalocele<sup>(e)</sup></b>	5	6	1.0000	7	17	0.1501	11	<b>24</b>	<b>0.0410</b>
<b>Isolated</b>	3	2	0.6692	6	11	0.4711	5	<b>17</b>	<b>0.0169</b>
Urinary Bladder Exstrophy <sup>(f)</sup>	4	4	1.0000	3	2	0.6647	8	5	0.4218
Isolated	4	4	1.0000	3	2	0.6647	8	5	0.4218
Gastroschisis	4	13	0.0860	11	12	0.8370	17	23	0.4297
Isolated	4	13	0.0860	10	12	1.0000	17	22	0.5225

### NTD – Omphalocele Association

Noted and known

Contrast: timing - dose – repair ?

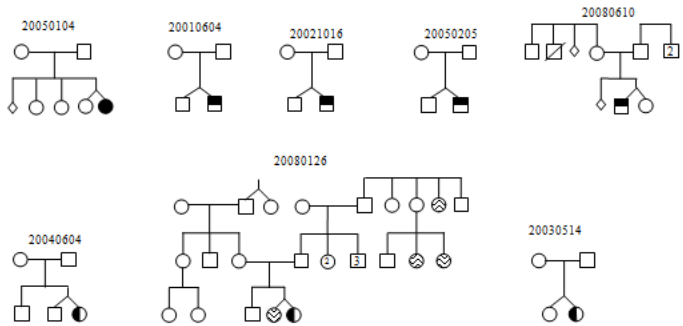
**Table 5a. Conjoined Twins and Malformations among Twin Individuals (2000-2009)**

Category	Polissia <sup>(a)</sup>				Non-Polissia <sup>(b)</sup>				Rivne Province			
	M-M	F-F	M-F	U-U	M-M	F-F	M-F	U-U	M-M	F-F	M-F	U-U
Conjoined twin sets	-	2 <sup>(c)</sup>	-	1 <sup>(d)</sup>	1 <sup>(e)</sup>	3 <sup>(f)</sup>	-	1 <sup>(g)</sup>	1	5	-	2
All Twin Pairs <sup>(h)</sup> (per 10,000 live births) <sup>(k)</sup>	216 (59.7)	199 (55.0)	164 (45.3)	1 <sup>(i)</sup> (-)	207 (56.7)	220 (60.2)	184 (50.4)	2 <sup>(j)</sup> (-)	423 (58.2)	419 (57.6)	348 (47.9)	3 (-)
<b>Malformed twin<sup>(l)</sup></b>	<b>17</b>	<b>7</b>	<b>6</b>	<b>-</b>	<b>10</b>	<b>6</b>	<b>7</b>	<b>2</b>	<b>27</b>	<b>13</b>	<b>13</b>	<b>2</b>
Holoprosencephaly	1 <sup>(m)</sup>	-	-	-	-	-	-	-	1	-	-	-
Neural tube defects	1 <sup>(n)</sup>	2 <sup>(o)</sup>	-	-	2 <sup>(p)</sup>	1 <sup>(q)</sup>	2 <sup>(r)</sup>	-	<b>3</b>	<b>3</b>	<b>2</b>	-
Ectopia cordis	-	-	-	-	-	-	-	1 <sup>(s)</sup>	-	-	-	1
Acardia	3 <sup>(t)</sup>	1 <sup>(u)</sup>	-	-	1 <sup>(v)</sup>	-	-	-	4	1	-	-
Cardiac malformations	7 <sup>(w)</sup>	2 <sup>(x)</sup>	1 <sup>(y)</sup>	-	1 <sup>(z)</sup>	3 <sup>(aa)</sup>	2 <sup>(bb)</sup>	-	8	5	3	-
Gastroschisis	-	-	1 <sup>(cc)</sup>	-	-	-	-	-	-	-	1	-
Other malformations	5 <sup>(dd)</sup>	2 <sup>(ee)</sup>	4 <sup>(ff)</sup>	-	6 <sup>(gg)</sup>	2 <sup>(hh)</sup>	3 <sup>(ii)</sup>	1 <sup>(jj)</sup>	11	4	7	1

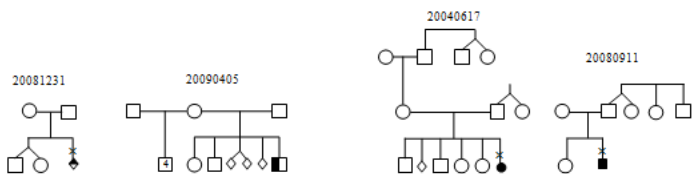
(a) Excluded 21 subjects whose twins sib is not found in the registry (prenatal loss, etc)

(b) Excluded 16 subjects whose twins sib is not found in the registry (prenatal loss, etc)

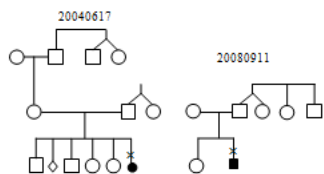
**NTD - Discordant Twins**



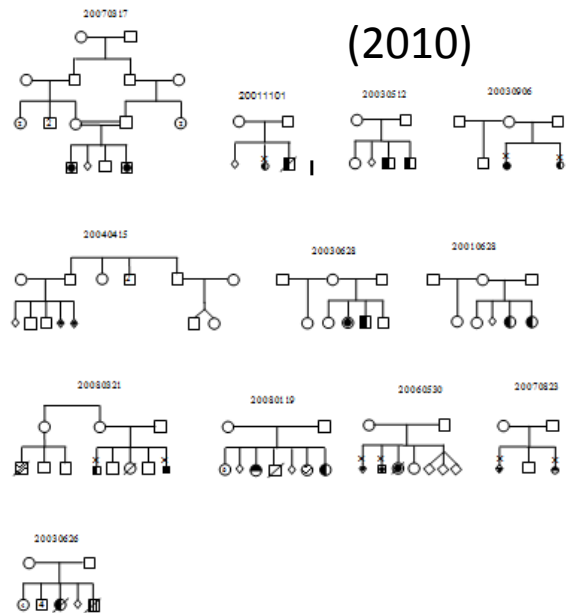
**NTD - Twin Sibs**



**NTD - Twin Father**

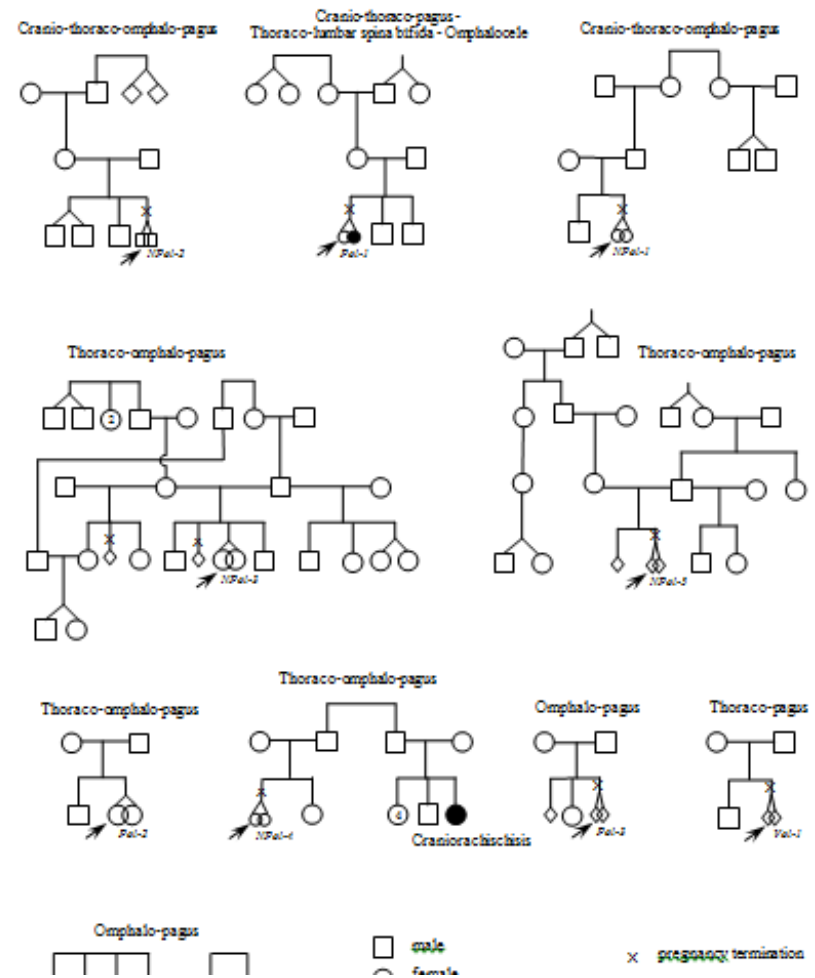


**NTD - Maternal Twin Relatives**



**Instances of Conjoined Twins (2000-2009)**

NOTE: only neural tube defects are shown in family histories (heart defects are not shown)



## Male: Females

	Rivne Oblast M:F		
Live births	74098	:68925	(1.08)
<b>NTD</b>	95:	<b>109</b>	(0.87)
<b>Craniorachischisis</b>	10:	<b>16</b>	(0.63)
<b>Anencephaly</b>	16:	<b>23</b>	(0.70)
<b>Encephalocele</b>	5:	<b>11</b>	(0.45)
<b>Spina bifida</b>	<b>62:</b>	50	(1.24)
<b>Microcephaly</b>	6:	<b>15</b>	(0.40)
<b>Microphthalmos</b>	<b>7:</b>	6	n/c
<b>Teratoma</b>	1:	<b>6</b>	n/c
<b>Conjoined twins</b>	<b>1:</b>	<b>4</b>	n/c

**Table 3a. Rivne Infants with Microcephaly (MIC) and/or Microphthalmia (mOPH)<sup>(a)</sup>**

Category <sup>(b)</sup>	Polissia		Non-Polissia		Rivne Oblast		M:F
	N (F) <sup>(c)</sup>	Rate <sup>(d)</sup>	N (F)	Rate	N (F)	Rate	
Live Births (Females)	72379 (34791)		73058 (35326)		145437 (70117)		1.07
<b>ISOLATED</b>	19 (11)	2.63	12 (8)	1.64	31 (19)	2.13	0.63
<b>Microcephaly</b>	11 (8)	1.52	8 (5)	1.10	19 (13)	1.31	0.46
<b>Microphthalmia</b>	8 (3)	1.11	4 (3)	n/c	12 (6)	0.83	1.00
<b>NOT ISOLATED<sup>(e)</sup></b>	43 (23)	5.94	18 (6)	2.46	61 (29)	4.19	1.10
MIC and Ocular Anomalies							
Microphthalmia	3 (3)	n/c	-	-	3 (3)	n/c	n/c
Cataracts	1 (1)	n/c	-	-	1 (1)	n/c	n/c
<b>Syndromes</b>							
<b>Fetal Alcohol</b>	9 (2)	1.24	11 <sup>(f)</sup> (4)	1.51	20 (6)	1.38	2.33
Cytogenetic	2 (1)	n/c	3 (1)	n/c	5 (2)	0.34	n/c
Other	4 (2)	n/c	-	-	4 (2)	n/c	n/c
Microcephaly and no microphthalmia							
<b>Multiple Anomalies</b>	13 (6)	1.80	2 (1)	n/c	15 (7)	1.03	1.14
Microphthalmia, not Microcephaly							
Syndromes							
Cytogenetic	2 (1)	n/c	1 (0)	n/c	3 (1)	n/c	n/c
Goldenhar	1 (1)	n/c	-	-	1 (1)	n/c	n/c
<b>Multiple Anomalies</b>	8 (6)	1.11	1 (0)	n/c	9 (6)	0.62	n/c
<b>All non-syndromic</b>	44 (27)	6.08	15 (9)	2.05	59 (36)	4.06	0.64
<b>All syndromic</b>	18 (7)	2.49	15 (5)	2.05	33 (12)	2.27	1.75
<b>TOTAL</b>	62 (34)	8.57	30 (14)	4.11	92 (48)	6.33	0.92

**Table 3c. Alcohol Consumption by Pregnant Women**

Area of Residence <sup>(1)</sup>	Women	AE ( <sup>3</sup> ), % (N)	P	OR	CL
POLISSIA <sup>(2)</sup>	852	1.53 (13)			
NON-POLISSIA <sup>(2)</sup>	1417	4.73 (67)	<0.0001	0.31	0.16, 0.58
Rivne City	566	6.36 (36)	<0.0001	0.23	0.11, 0.45
Khmelnysky City	1062	4.43 (47)	0.0003	0.33	0.17, 0.63

# PEDIATRICS®

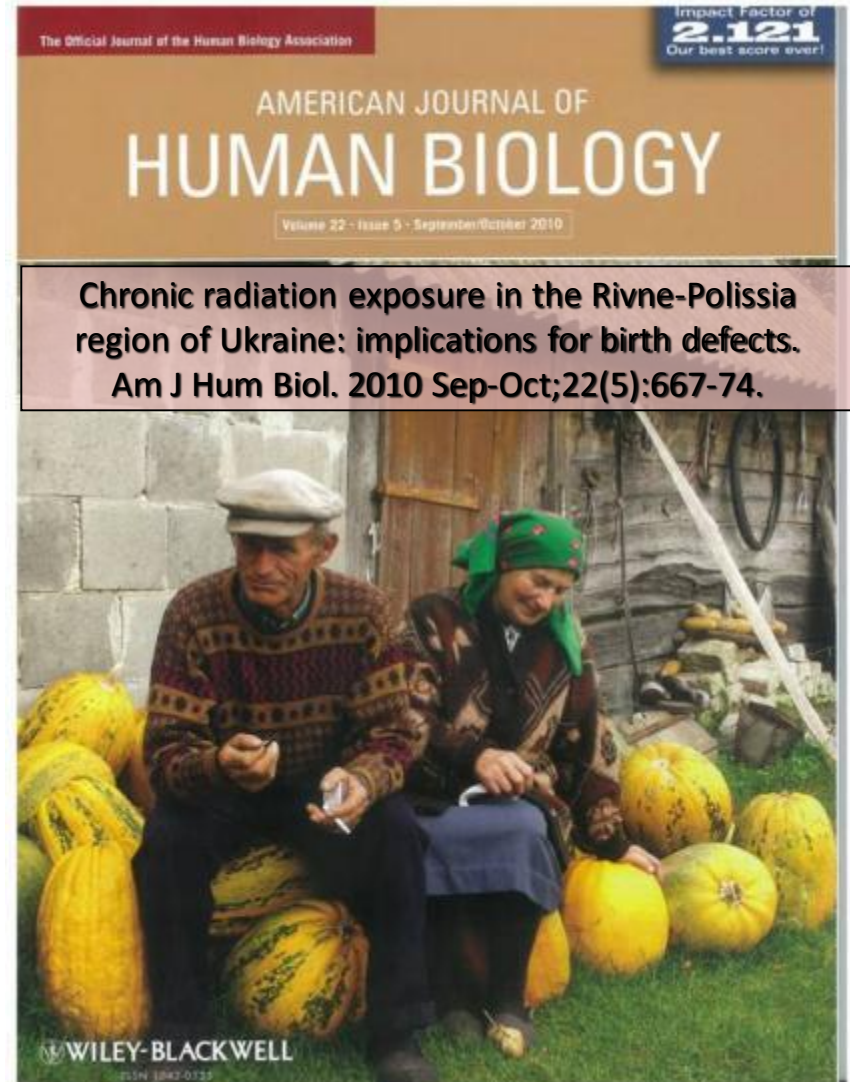
OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS

## Malformations in a Chernobyl-Impacted Region

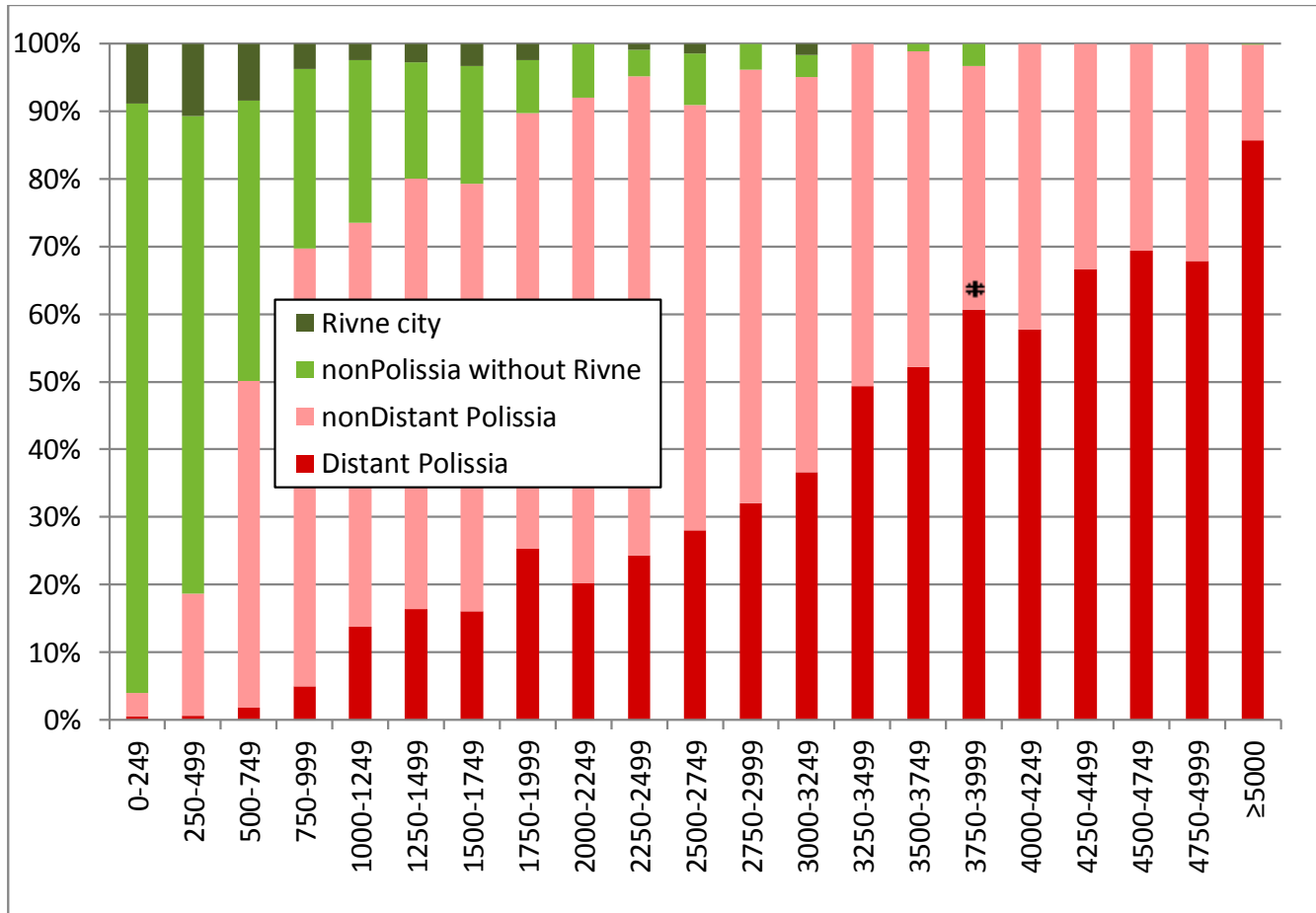
Wladimir Wertelecki

*Pediatrics* 2010;125:e836-e843; originally published online Mar 22, 2010;  
DOI: 10.1542/peds.2009-2219

The online version of this article, along with updated information and services, is  
located on the World Wide Web at:  
<http://www.pediatrics.org/cgi/content/full/125/4/e836>







**Figure 2.** Whole Body Counts (WBC) in Bq as <sup>137</sup>Cs recorded in 6026 pregnant women residing in Rivne Province (2008-2011). The (\*) indicates the official upper norm for children under the age of 15 years (3700 Bq as <sup>137</sup>Cs) and for adults, 14800 Bq as <sup>137</sup>Cs)

**Whole Body Counts of Incorporated Ionizing Radiation ( $^{137}\text{Cs}$ )  
Detected in Rivne Ambulatory Patients**


	Distant Polissia <sup>(a)</sup>	Non-Distant Polissia <sup>(b)</sup>	Non-Polissia without Rivne City <sup>(c)</sup>	Rivne City
Pregnant Women <sup>(d)</sup>	1157	2533	2048	288
Above Bq norm <sup>(e)</sup> (%)	558 (48.2)	154 (6.1)	3 (0.1)	-
Children <sup>(f)</sup>	1338	3671	1245	452
Above Bq norm (%)	162 (12.1)	50 (1.4)	-	1 (0.3)
Adult Males <sup>(f)</sup>	2117	5885	3176	1149
Above Bq norm (%)	136 (6.4)	22 (0.4)	-	-


Regions

-  Polissia soils
-  Designated as **Chornobyl impacted zone**

 nonPolissia

 Nuclear power plants (NPP)

 30 km radius zones

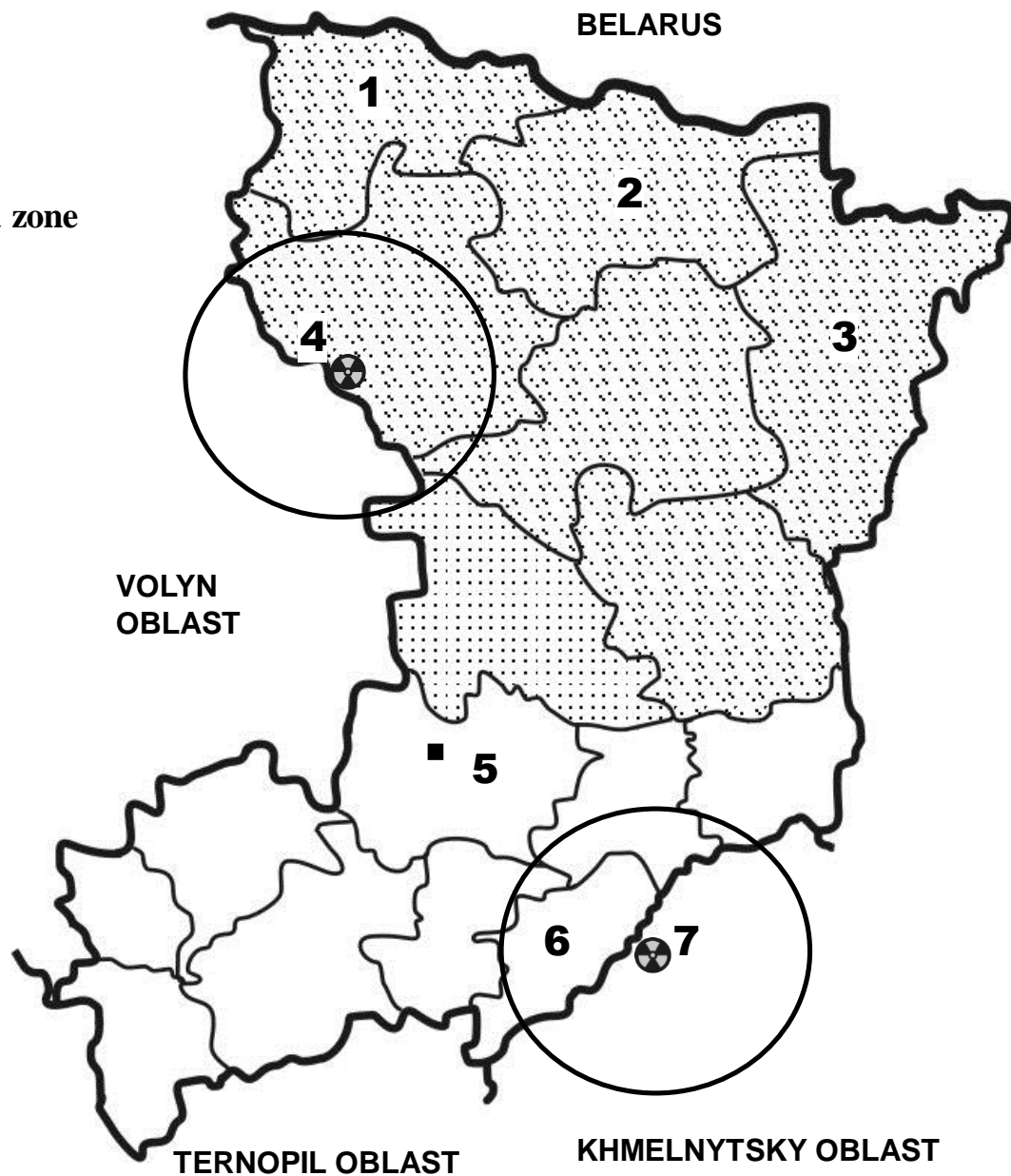
 Rivne city (capital)

**Distant Polissia**

- 1 – Zarichne County
- 2 – Dubrovytsia County
- 3 – Rokytno County

**Other sites**

- 4 – Kuznetsovsk NPP
- 5 – Rivne County
- 6 – Ostroh County
- 7 – Khmelnytsky NPP



**Table 4b. Rates<sup>(1)</sup> of Neural Tube Defects (NTD) and Microcephaly/  
a-Microphthalmia (M/M) in the Vicinities of two Nuclear Power Plants  
(2000-2009)**

Area	Live Births	NTD <sup>(1)</sup>	M/M <sup>(1)</sup>
Volodymyrets County in Polissia <sup>(2)</sup>	15956	26.3 (42)	11.9 (19)
Polissia excluding Volodymyrets County <sup>(3)</sup>	56423	26.1 (147)	7.4 (42)
Ostroh County in non-Polissia <sup>(4)</sup>	4109	34.1 (14)	12.2 (5)
Non-Polissia excluding Ostroh County <sup>(5)</sup>	68949	15.4 (106)	3.6 (25)

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## Density estimation for data with rounding errors<sup>☆</sup>

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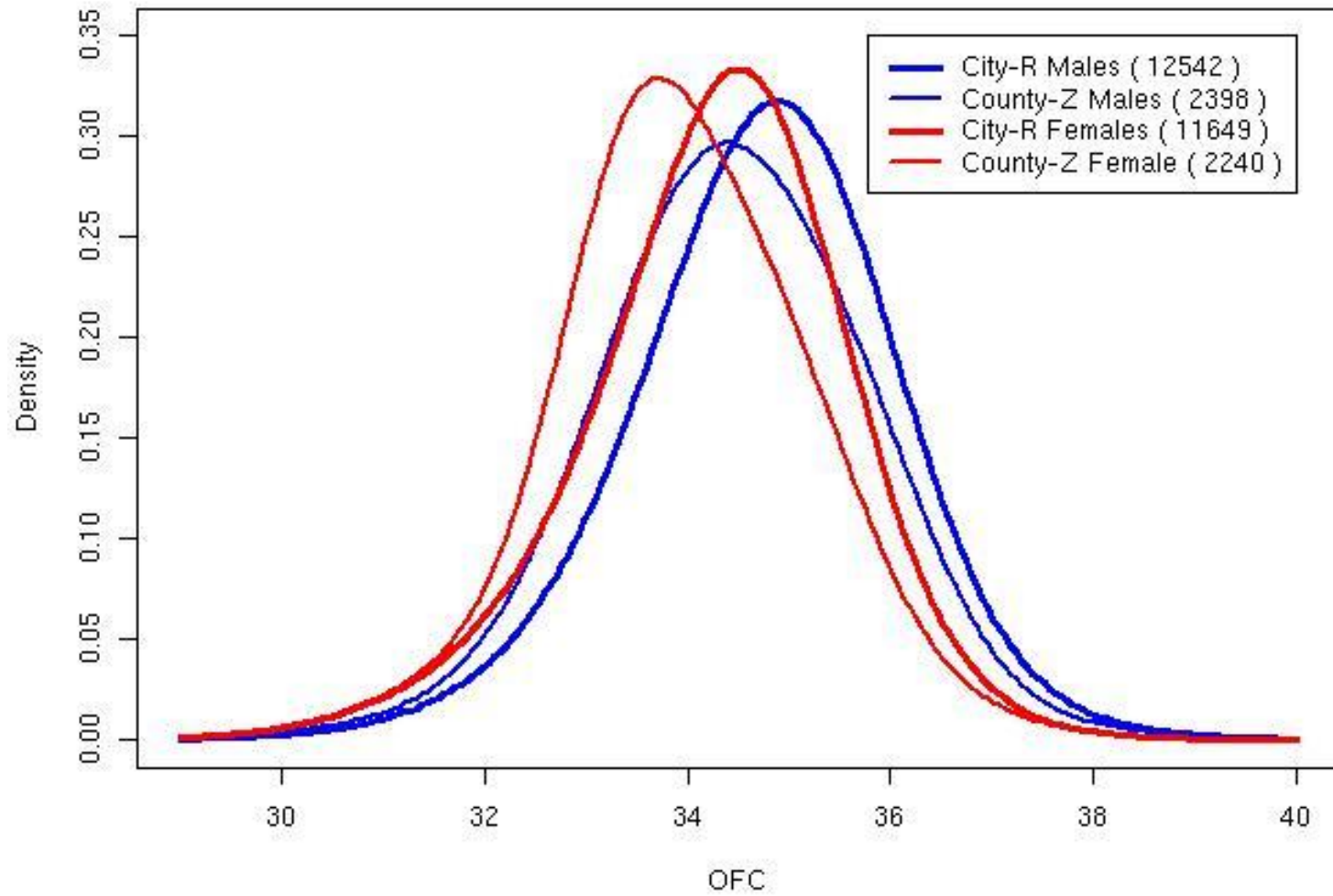
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### ABSTRACT

Rounding of data is common in practice. The problem of estimating the underlying density function based on data with rounding errors is addressed. A parametric maximum likelihood estimator and a nonparametric bootstrap kernel density estimator are proposed. Simulations indicate that the maximum likelihood approach performs well when prior



Distributional differences permutation test - differences p-value <0.0001

### Neural Tube Defects Highest Rates and Other Anomalies in Europe (Eurocat) vs. Polissia/nonPolissia

Categories <sup>(a)</sup>	Births	NTD	MIC	ANOPH/ MICROPH	FAS	BLEX	OMPH	GSTR	CTW
<i>Polissia (2000-2009)</i>	72800	25.96	5.77	3.43	5.08	1.37	3.43	2.34	0.41
<i>nonPolissia (2000-2009)</i>	73488	16.33	3.27	1.22	5.72	0.68	4.22	3.13	0.68
EUROCAT Rates 2005-2009									
Northern England (UK)	164501	14.41 (1)	1.40	0.91	0.18	1.09 (4)	2.74	6.02 (2)	0.43 (1)
Wales (UK)	172085	13.60 (2)	4.88 (2)	1.57 (1)	0.76 (2)	0.64	4.24 (4)	6.22 (1)	0.35 (3)
Paris (France)	133880	12.85 (3)	1.05	1.12 (5)	0.15	1.57 (1)	6.05 (1)	1.27	0.15
East Midlands & South Yorkshire (UK)	358590	11.57 (4)	0.73	0.39	0.20	0.81	3.96	5.21 (3)	0.31 (4)
Wessex (UK)	143432	11.36 (5)	1.19	0.77	0.21	0.70	3.21	4.74 (4)	0.35 (3)
Barcelona (Spain)	44406	11.26	1.80	0.90	0.00	1.35 (2)	3.38	2.03	0.00
South West England (UK)	240454	10.98	4.62 (3)	1.21 (4)	0.33 (5)	0.75	3.45	3.99	0.25
Thames Valley (UK)	146831	10.96	0.68	0.82	0.07	0.89	5.52 (2)	3.27	0.27 (5)
Basque Country (Spain)	103040	10.77	3.69 (4)	1.07	0.10	0.58	4.66 (3)	1.65	0.19
Norway	238163	9.78	0.29	0.80	0.04	0.38	2.65	3.57	0.08
Antwerp (Belgium)	100207	9.78	2.10	1.10	0.00	0.70	1.50	1.10	0.00
Hainaut (Belgium)	63349	9.47	1.89	0.16	0.32	0.63	2.21	1.89	0.00
Saxony-Anhalt (Germany)	86662	9.00	19.27*	0.81	0.81 (1)	0.69	3.00	3.81	0.35 (3)
Valencia Region (Spain)	55055	8.36	2.91	1.27 (3)	0.00	0.18	0.54	1.45	0.36 (2)
N Netherlands (NL)	90450	8.18	2.87	1.11	0.00	1.33 (3)	2.21	1.44	0.00
Wielkopolska (Poland)	192533	8.15	1.30	0.99	0.05	0.36	1.87	1.61	0.26
Styria (Austria)	51525	7.76	5.05 (1)	0.58	0.39 (4)	0.00	4.08 (5)	4.08 (5)	0.00
Hungary	493001	6.02	1.76	1.03	0.00	0.45	1.46	0.89	0.14
Dublin (Ireland)	126232	5.86	3.41 (5)	1.51 (2)	0.55 (3)	0.95 (5)	2.38	2.61	0.00
Emilia Romagna (Italy)	203283	5.66	0.98	0.98	0.00	0.69	1.87	0.89	0.00
Tuscany (Italy)	152147	5.46	0.59	0.72	0.07	0.46	2.23	0.92	0.07



UKRAINE

**RIVNE OBLAST ADMINISTRATION  
PUBLIC HEALTH ADMINISTRATION**

38, 16 Lypnia Str., Rivne, Ukraine, 33028

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To: International co-investigators, programs and agencies.

From: Research Centre for Radiation Medicine of the Ukrainian Academy Medical Sciences (RCRM UAMS), Public Health Administrations of the Provinces of Khmelnytsky, Rivne and Volyn and OMNI-Net/Ukraine Population Monitoring of Congenital Malformations Program.

**Re: Invitation to participate in framing complementary initiatives regarding long-term health impacts of Chernobyl with an emphasis on child development and congenital malformations.**

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