COMPARISON OF UTERINE BODY CANCER INCIDENCE AMONG WOMEN LIVING IN ENVIRONMENTALLY DISADVANTAGED AREAS (2000–2019)

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Living in ecologically compromised regions can significantly increase the risk of malignant neoplasms in the female reproductive system, including uterine body cancer (UBC). This study aimed to calculate the relative risk (RR) and the frequency of primary incidence of UBC among women aged 41–60 years living in areas with different levels of exposure to radiation, chemical, and combined environmental factors. The analysis considered high-, moderate-, and low-grade forms of UBC over a 20-year period (2000–2019). Information for the study was provided by Bryanskstat (Bryansk Region Statistical Bureau), Bryansk Regional Oncological Dispensary, Rospotrebnadzor and Rostechnadzor. We found that the RR of initial occurrence of high-grade forms of UBC in women living in ecologically compromised regions was considerably higher than that in female population of ecologically safe (control) territories, reaching the mean value of 1.28 (95% CI: 1.00–1.64); $p = 0.047$). Other findings include an increased RR of occurrence of both high- and, to a greater extent, low-grade forms of UBC in areas with high radioactive and chemical contamination — 1.19 (95% CI: 0.87–1.63) and 1.36 (95% CI: 0.70–2.65), respectively; the relative risks for combined and chemical contamination areas were 1.18 (95% CI: 0.90–1.55) and 1.34 (95% CI: 0.75–2.39), respectively; no increase was observed between the territories with combined and radioactive contamination — 0.99 (95% CI: 0.67–1.46) and 0.98 (95% CI: 0.44–2.21). In all likelihood, the data from this study indicate that accident-related radiation contamination plays a more significant role in the development of high-grade — and especially low-grade — forms of UBC than does chemical contamination.

Keywords: Chernobyl accident, malignant neoplasms of the endometrium, radioactive contamination, chemical pollution, combined contamination, relative risk, Bryansk region

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Compliance with ethical standards: the study used anonymized statistical information on the incidence of UBC in the Bryansk region in 2000–2019.

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СРАВНИТЕЛЬНАЯ ОЦЕНКА ЗАБОЛЕВАЕМОСТИ ЗЛОКАЧЕСТВЕННЫМИ НОВООБРАЗОВАНИЯМИ ТЕЛА МАТКИ ЖЕНЩИН, ПРОЖИВАЮЩИХ НА ЭКОЛОГИЧЕСКИ НЕБЛАГОПОЛУЧНЫХ ТЕРРИТОРИЯХ (2000–2019 ГГ.)

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Проживание на экологически неблагополучных территориях может существенно увеличивать риск развития злокачественных новообразований женской репродуктивной системы, в том числе злокачественных новообразований тела матки (ЗНОТМ). Целью исследования было провести расчет относительного риска (ОР) и частоты первичной заболеваемости женщин 41–60 лет, проживающих на территориях с различным уровнем радиационного, химического и сочетанного воздействия окружающей среды, высоко-, умеренно и низкодифференцированными формами ЗНОТМ за двадцатилетний период (2000–2019 гг.). Информация для исследования была предоставлена Брянскстатом, Брянским областным онкологическим диспансером, Роспотребнадзором и Ростехнадзором. Выявлено существенное превышение ОР первичной заболеваемости высокодифференцированными формами ЗНОТМ у женщин, проживающих на экологически неблагополучных территориях (суммарно в зонах химического, радиоактивного и сочетанного загрязнения), по сравнению с женщинами, проживающими на экологически благополучных (контрольных) территориях. ОР составил 1,28 (95% ДИ: 1,00–1,64); $p = 0{,}047$). Выявлен повышенный ОР заболеваемости высоко- и в большей степени низкодифференцированными формами ЗНОТМ между территориями радиоактивного и химического загрязнения — ОР 1,19 (95% ДИ: 0,87–1,63); 1,36 (95% ДИ: 0,70–2,65); сочетанного и химического загрязнения — ОР 1,18 (95% ДИ: 0,90–1,55); 1,34 (95% ДИ: 0,75–2,39); при этом не установлено повышение риска между территориями сочетанного и радиоактивного загрязнения — ОР 0,99 (95% ДИ: 0,67–1,46); 0,98 (95% ДИ: 0,44–2,21). По всей вероятности, полученные данные свидетельствуют о большей роли влияния аварийного радиационного фактора на формирование высоко- и особенно низкодифференцированных форм ЗНОТМ относительно химического.

Ключевые слова: Чернобыльская катастрофа, злокачественные новообразования тела матки, радиоактивное загрязнение, химическое загрязнение, сочетанное воздействие, относительный риск, Брянская область

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Statistics based on GLOBOCAN 2022 (estimates from the International Agency for Research on Cancer) indicates that the number of new cases of malignant neoplasms (MNs) in the world has reached 20 million [1]. It is estimated that approximately one in five men or women develops MN during their lifetime, and about one in nine men and one in twelve women die from it [1]. Projections indicate that new MN cases will surpass 35 million in 2050, representing a 77% increase over 2022. Demographic transition is a key factor determining the extent of cancer spread: in 2022, the global population was about 8 billion people, and by 2050 it will reach 9.7 billion [1]. Malignant neoplasms of the endometrium (uterine corpus) are the sixth most frequently diagnosed cancer in women (4.3%) [1].

According to the Hertsen Moscow Oncology Research Institute, in 2022, endometrial cancer ranked fourth among all cancers, accounting for 7.1% of the total number of MN cases [2].

Living in ecologically compromised territories can significantly increase the risk of diseases of the female reproductive system [3–9]. According to researchers [3], chronic exposure to heavy metals can lead to breast cancer, endometriosis, hypertension, menstrual disorders, and spontaneous abortions, as well as premature birth and stillbirth. It was established that metalloestrogen cadmium induces UBC, elevated lead levels have a teratogenic effect and can cause spontaneous abortion, and mercury affects the menstrual cycle and can lead to infertility [3]. According to [4], cadmium is a potential risk factor for hormone-dependent tumors, such as UBC, because the vascular endothelium is a target of cadmium toxicity, which can affect coagulation processes and the fibrinolytic system. Patients with fibroids and especially UBC were found to have disrupted coagulation and fibrinolysis, which translate into hypercoagulation [4]. A monitoring of 62,534 women who survived the atomic bombing (1958–2009) [5] revealed a significant relationship between the radiation dose and the risk of UBC, which indicates that the uterine corpus is particularly sensitive to the carcinogenic effect of radiation.

According to [10–12], the southwestern territories of the Bryansk Region remain highly contaminated with cesium-137 (^{137}Cs) from the Chernobyl accident. The contamination levels exceed those that classify the area as radioactively contaminated, and the average annual effective doses exceed 1 mSv per year, reaching maximum values of up to 5.6 mSv/year [13, 14]. In recent years, the Bryansk region has seen an increase in the release of gaseous pollutants into the atmosphere [15, 16]. It is important to note in some areas of the region the population is exposed to both radioactive and chemical contamination factors (combined exposure) [17–19]. A study [19] found that the relative risk (RR) of UBC among women aged 18–80 years living in ecologically compromised areas was significantly higher than in control regions. In addition, continued environmental pollution accelerates the mutation process, which increases the population load [20].

This study aimed to calculate the relative risk (RR) and the frequency of primary incidence of UBC among women aged 41–60 years living in areas with different levels of exposure to radiation, chemical, and combined environmental factors. The analysis considered high-, moderate-, and low-grade forms of UBC over a 20-year period (2000–2019).

METHODS

The post-Chernobyl radioactive contamination density data (^{137}Cs and ^{90}Sr) were taken from [12], the average annual effective dose data — from [14], the data on the level of CO, NO_x, SO_2 and volatile organic compounds (VOCs) in the air — from [15]. The study covered the years 2000–2019.

Based on official data from the Bryansk Regional Oncological Dispensary [21], we calculated the RR and the frequency of primary incidence of high-, moderate-, and low-grade forms of UBC, taking into account the levels of chemical and radioactive contamination. The study covered the period from 2000 to 2019. We performed a histological analysis of UBC samples collected from 1,030 women aged 41–60 years.

For statistical analysis, we used the Shapiro–Wilk test, the Mann–Whitney *U* test, and calculated 95% confidence intervals. Levels of statistical significance were set at $p < 0.05$, $p < 0.01$, and $p < 0.001$. The absolute values of the incidence of UBC were recalculated per 100,000 female population [15]. We used MyOffice package (New Cloud Technologies; Russia) for analysis of the data collected.

RESULTS

Based on the degrees of radioactive and chemical contamination and the level of primary incidence of UBC over a twenty-year period (2000–2019), we divided the Bryansk region into four groups. The results of this effort are given in Table 1; the analysis of the data therefrom was part of an earlier work [19].

The incidence of high-, moderate-, and low-grade forms of UBC is 21.0%, 18.1% and 14.4% higher in women living in contaminated areas (combined, radioactive, and chemical contamination) compared to the female population of the control areas: 29.4 ± 4.8; 28.7 ± 5.1 and 27.8 ± 4.1 versus 24.3 ± 4.2 (Table 2). However, no significant differences between the groups were found ($p > 0.05$). The frequency of high-grade forms of UBC is higher in women living in territories with radioactive (15.6 ± 3.1) and combined (15.4 ± 3.2) contamination compared to those residing in chemically contaminated areas (13.1 ± 2.0) and control territories (10.6 ± 2.0). A similar trend was registered for low-grade forms of UBC: territories with radioactive contamination — 3.6 ± 1.5, combined contamination — 3.5 ± 1.0, chemically contaminated areas — 3.1 ± 0.6, and control territories — 2.7 ± 0.7. The incidence rate of moderately differentiated forms of UBC varies only slightly through cities and districts of the Bryansk region — from 10.5 to 11.7. The environmental conditions have no effect thereon; the peak value of 11.7 is registered in the territories with chemical pollution (Table 2). It should be noted that we did not observe significant differences between the groups, whether divided by the form of UBC or by the grade of the disease (Table 2).

Based on the data from Table 3, it can be concluded that women living in the environmentally compromised areas (including territories with chemical, radioactive, and combined contamination) have an increased incidence of high-, moderate- and low-grade forms of UBC compared with women living in environmentally safe (control) areas. The mean RR is 1.16 (95% CI: 0.98–1.36); its values are generally higher than those calculated for the control areas: in the chemically contaminated territories, the RR is 1.14 (95% CI: 0.97–1.35), in the areas of radioactive pollution — 1.18 (95% CI: 0.91–1.54), combined pollution — 1.21 (95% CI: 0.96–1.53). We did not register increased RR for primary incidence of UBC in comparison of the territories with different types of contamination: the values vary between 1.02 and 1.06.

An analysis of data from Table 4 revealed a significant ($p = 0.047$) increase of the RR of incidence of UBC. The highest RR was registered for high-grade forms of the disease in women residing in ecologically compromised areas (chemical, radioactive, and combined contamination jointly). In the control areas, the RR was 1.28 (95% CI: 1.00–1.64).

Table 1. Territories of the Bryansk region grouped by the degree of chemical, radioactive, and combined contamination and by the incidence of primary UBC among women aged 18–80 years (per 100,000 population) (2000–2019) [19]

Areas of the Bryansk region	The main gaseous pollutants of atmospheric air					The density of radioactive contamination, kBq/m^2		UBC M ± *m*
	Total	Including:				^{137}Cs	^{90}Sr	
		VOCs	NO_x	SO_2	CO			
	Gross emissions of gaseous pollutants per district area, g/m^2							
Environmentally safe areas								
Rognedinsky	13	0	6	0	7	21.7	0.8	21.5 ± 5.5
Suzemsky	28	5	9	1	13	18.6	2.5	46.6 ± 7.5
Mglinsky	31	6	6	2	17	6.6	0.6	23.3 ± 4.7
Kletnyansky	47	27	5	5	10	5.4	0.5	25.2 ± 4.4
Navlinsky	54	12	13	4	25	18.9	0.8	35.5 ± 4.2
Dubrovsky	56	13	17	0.4	26	7.2	0.4	25.0 ± 5.0
Brasovsky	64	10	19	6	29	25.2	0.4	37.1 ± 4.3
Sevsky	68	20	10	24	14	18.9	1.4	35.3 ± 4.5
Komarichsky	99	25	19	9	46	27.1	1	30.6 ± 4.5
Karachevsky	115	29	34	1	51	13.9	0.8	37.7 ± 5.0
Surazhsky	128	35	35	6	52	8.2	0.4	27.8 ± 3.9
Mean	**63.9**	**16.5**	**15.7**	**5.3**	**26.4**	**15.6**	**0.9**	**32.3 ± 3.0* –8.7%**
Chemically polluted territories								
Pogarsky	123	65	22	4	32	29.9	1.1	45.6 ± 6.4
Zhiryatinsky	156	104	16	1	35	5.4	0.8	32.6 ± 6.3
Zhukovsky	195	22	53	40	80	6.6	0.8	28.3 ± 3.1
Trubchevsky	275	88	27	2	158	23.6	0.8	38.0 ± 5.1
Pochepsky	365	223	33	3	106	5.4	0.5	31.9 ± 4.2
Unechsky	559	292	58	32	177	7.2	0.8	31.1 ± 3.0
Vygonichsky	858	749	37	2	70	9.5	0.4	12.7 ± 3.9
Bryansky	959	813	47	13	86	5.7	0.4	32.6 ± 3.8
Town of Seltso	5209	773	2405	97	1934	4.4	0.8	33.8 ± 5.6
Dyatkovsky	8045	339	3760	1139	2807	38.4	1.1	35.7 ± 3.9
City of Bryansk	32190	5217	10886	2617	13470	8.8	5.9	41.6 ± 3.1
Mean	**4448.5**	**789.5**	**1576.7**	**359.1**	**1723.2**	**13.2**	**1.2**	**38.2 ± 3.0* +8.0%**
Radioactively contaminated areas								
Krasnogorsky	15	1	5	0	9	303.4	9.3	51.3 ± 7.2
Gordeevsky	28	2	11	0.2	15	328.6	5	31.2 ± 6.6
Zlynkovsky	38	5	11	4	18	412.4	16.3	26.7 ± 4.4
Novozybkovsky	51	10	0	0	41	460.6	8.4	18.2 ± 4.5
Klimovsky	72	16	8	15	33	139.6	6.4	38.6 ± 7.4
Klintsovsky	169	17	70	2	80	194.4	4.7	18.6 ± 3.1
Mean	62.2	8.5	17.5	3.5	32.7	306.5	8.4	32.5 ± 3.8* –8.1%
Territories of combined radioactive and chemical contamination								
Starodubsky	392	316	24	9	43	45.4	1.4	26.1 ± 3.0
Town of Klintsy	7264	2059	2616	139	2450	195.6	3	39.9 ± 3.3
Town of Novozybkov	7422	1778	2159	406	3079	456.5	9.7	42.4 ± 4.7
Mean	**5026**	**1384.3**	**1599.7**	**184.7**	**1857.3**	**232.5**	**4.7**	**36.9 ± 2.7* +4.3%**

Note: * — the difference (in %) from the all-Russian indicator of primary incidence (2000–2019).

Compared to environmentally safe areas, the RR growth rates were 1.47 (95% CI: 1.01–2.13) for territories of radioactive contamination, 1.45 (95% CI: 1.04–2.03) in the combined contamination areas, and 1.23 (95% CI: 0.96–1.59) in the chemically contaminated territories. The form-wise comparison to the overall UBC incidence rate revealed an increased RR between the territories of radioactive and chemical contamination — 1.19 (95% CI: 0.87–1.63), combined and chemical contamination — 1.18 (95% CI: 0.90–1.55). However, there was no RR increase between the territories of combined and radioactive contamination — 0.99 (95% CI: 0.67–1.46). In all likelihood, these data suggest that accident-related radiation plays a greater role in the formation of highly differentiated forms of UBC than chemical pollution.

There was no increase in the primary incidence of moderate-grade (Table 5) and low-grade (Table 6) forms of UBC in women living in ecologically compromised areas compared with environmentally safe areas: the RR for moderately differentiated

Table 2. Comparative assessment of the primary incidence rates of high-, moderate-, and low-grade forms of UBC among women aged 41–60 living in areas of the Bryansk region with varying environmental conditions, 2000–2019 (per 100,000 population)

Territories under study / Forms of UBC	Environmentally safe areas (control)	Chemically polluted territories	Radioactively contaminated areas	Territories of combined radioactive and chemical contamination
	I (*N* = 169)	II (*N* = 662)	III (*N* = 81)	IV (*N* = 118)
All forms	24.3 ± 4.2	27.8 ± 4.1	28.7 ± 5.1	29.4 ± 4.8
Including:				
High-grade	10.6 ± 2.0	13.1 ± 2.0	15.6 ± 3.1	15.4 ± 3.2
Moderate-grade	10.9 ± 2.1	11.7 ± 1.9	10.6 ± 2.7	10.5 ± 2.5
Low-grade	2.7 ± 0.7	3.1 ± 0.6	3.6 ± 1.5	3.5 ± 1.0

Note: the differences between the groups by the areas are insignificant at $p > 0.05$.

forms was 1.06 (95% CI: 0.82–1.34), low-grade forms — 1.03 (95% CI: 0.63–1.69). In addition, we registered no growth of RR for moderate-grade UBC between control territories and territories of chemical radioactive and combined contamination — the values range from 0.97 to 1.07 (Table 5). The rates of primary incidence of moderately differentiated forms of UBC between the areas of chemical, radioactive and combined contamination vary between 0.64 and 0.98, and there are significant differences (p = 0.019) between the chemically and radioactively contaminated areas:

Table 3. Relative risk of the primary incidence of high-, moderate-, and low-grade forms of UBC among women aged 41–60 living in areas of the Bryansk region with varying environmental conditions, 2000–2019 (per 100,000 population)

Type of area	Population size	Got sick, abs.	Did not get sick, abs.	RR (95% CI)
The total rate of high-, moderate-, and low-grade forms of UBC				
Chemical, radioactive and combined contamination (total)	153394	861	152364	1.16 (0.98–1.36)
Environmentally safe areas	34823	169	34654	
Chemically contaminated areas	119153	662	118491	1.14 (0.97–1.35)
Environmentally safe areas	34823	169	34654	
Radioactively contaminated areas	14127	81	14046	1.18 (0.91–1.54)
Environmentally safe areas	34823	169	34654	
Areas of combined contamination	20114	118	19996	1.21 (0.96–1.53)
Environmentally safe areas	34823	169	34654	
adioactively contaminated areas	14127	81	14046	1.03 (0.82–1.30)
Chemically contaminated areas	119153	662	118491	
Areas of combined contamination	20114	118	19996	1.06 (0.87–1.28)
Chemically contaminated areas	119153	662	118491	
Areas of combined contamination	20114	118	19996	1.02 (0.77–1.36)
Radioactively contaminated areas	14127	81	14046	

Table 4. Relative risk of primary incidence rates of high-grade forms of UBC among women aged 41–60 living in areas of the Bryansk region with varying environmental conditions, 2000–2019

Type of area	Population size	Got sick, abs.	Did not get sick, abs.	RR (95% CI)
Chemical, radioactive and combined contamination (total)	153394	418	152902	1.28 (1.00–1.64)
Environmentally safe areas	34823	74	34749	
Chemically contaminated areas	119153	312	118841	1.23 (0.96–1.59)
Environmentally safe areas	34823	74	34749	
Radioactively contaminated areas	14127	44	14083	1.47 (1.01–2.13)
Environmentally safe areas	34823	74	34749	
Areas of combined contamination	20114	62	20052	1.45 (1.04–2.03)
Environmentally safe areas	34823	74	34749	
Radioactively contaminated areas	14127	44	14083	1.19 (0.87–1.63)
Chemically contaminated areas	119153	312	118841	
Areas of combined contamination	20114	62	20052	1.18 (0.90–1.55)
Chemically contaminated areas	119153	312	118841	
Areas of combined contamination	20114	62	20052	0.99 (0.67–1.46)
Radioactively contaminated areas	14127	44	14083	

Table 5. Relative risk of primary incidence of moderately differentiated forms of UBC among women aged 41–60 living in areas of the Bryansk region with varying environmental conditions, 2000–2019

Type of area	Population size	Got sick, abs.	Did not get sick, abs.	RR (95% CI)
Chemical, radioactive and combined contamination (total)	153394	350	152968	1.06 (0.82–1.34)
Environmentally safe areas	34823	76	34747	
Chemically contaminated areas	119153	278	118875	1.07 (0.83–1.38)
Environmentally safe areas	34823	76	34747	
Radioactively contaminated areas	14127	30	14097	0.97 (0.64–1.48)
Environmentally safe areas	34823	76	34747	
Areas of combined contamination	20114	42	20072	0.96 (0.66–1.39)
Environmentally safe areas	34823	76	34747	
Radioactively contaminated areas	14127	30	14097	0.64 (0.44–0.93)
Chemically contaminated areas	119153	278	118875	
Areas of combined contamination	20114	42	20072	0.89 (0.65–1.24)
Chemically contaminated areas	119153	278	118875	
Areas of combined contamination	20114	42	20072	0.98 (0.62–1.57)
Radioactively contaminated areas	14127	30	14097	

RR 0.64 (95% CI: 0.44–0.93). These data indicate a higher incidence of moderately differentiated forms of UBC in women living in areas of chemical contamination relative to areas of radioactive contamination. In contrast to the primary incidence of moderate-grade forms of UBC, we found an increased relative risk of low-grade forms thereof between control territories, territories of radioactive contamination (RR 1.30 (95% CI: 0.60–2.79)) and territories of combined exposure (RR 1.28 (95% CI: 0.64–2.54)) (Table 6). However, between chemically contaminated areas and control territories the RR was not increased: 0.95 (95% CI: 0.57–1.59) (Table 6).

As Table 6 shows, there is an increased RR of low-grade forms of UBC between territories of radioactive and chemical contamination — 1.36 (95% CI: 0.70–2.65), and areas of combined and chemical contamination — 1.34 (95% CI: 0.75-2.39). There was no such increase registered between territories of combined and radioactive contamination — RR 0.98 (95% CI: 0.44–2.21). The data for low-grade forms of UBC (Table 6) are similar to the results for highly differentiated forms of UBC (Table 5); they suggest that, in all likelihood, accident-related radiation plays a greater role in the formation of low-grade forms of UBC than chemical pollution.

DISCUSSION

There are many risk factors affecting the occurrence of UBC, and it is virtually impossible to make provisions for them [22, 23].

A study [24] that investigated the dependence of the UBC incidence rate on anthropogenic impact found that before the age of 45, its role in the development of endometrial cancer is less significant than after 45.

In [25], it was found that the combined effects of radiation and chemical contamination increase the incidence of low-grade ovarian malignancies compared with areas affected by only one pollution factor. Consequently, the authors of that study concluded that radiation and chemical factors act synergistically. In this study, no such pattern was observed, but we established an increased RR of incidence of high- and, to a greater extent, low-grade forms of UBC between territories of radioactive and chemical contamination, combined and chemical

Table 6. Relative risk of primary incidence rates of low-grade forms of UBC among women aged 41–60 living in areas of the Bryansk region with varying environmental conditions, 2000–2019

Type of area	Population size	Got sick, abs.	Did not get sick, abs.	RR (95% CI)
Chemical, radioactive and combined contamination (total)	153394	86	153289	1.03 (0.63–1.69)
Environmentally safe areas	34823	19	34804	
Chemically contaminated areas	119153	62	119091	0.95 (0.57–1.59)
Environmentally safe areas	34823	19	34804	
Radioactively contaminated areas	14127	10	14117	1.30 (0.60–2.79)
Environmentally safe areas	34823	19	34804	
Areas of combined contamination	20114	14	20100	1.28 (0.64–2.54)
Environmentally safe areas	34823	19	34804	
Radioactively contaminated areas	14127	10	14117	1.36 (0.70–2.65)
Chemically contaminated areas	119153	62	119091	
Areas of combined contamination	20114	14	20100	1.34 (0.75–2.39)
Chemically contaminated areas	119153	62	119091	
Areas of combined contamination	20114	14	20100	0.98 (0.44–2.21)
Radioactively contaminated areas	14127	10	14117	

contamination, although no increased RR was found between territories of combined and radioactive contamination.

A limitation of this study was that it did not take into account the stage of the disease or its immunohistochemical profile.

CONCLUSIONS

1. The incidence of high-, moderate-, and low-grade forms of UBC is 21%, 18%, and 14% higher among women living in areas of combined, radioactive, and chemical contamination compared with control areas; however, there are no significant differences between the groups.

2. The relative risk (RR) of developing a high-grade form of UBC is higher among women residing in ecologically compromised territories (chemically, radioactively contaminated areas and areas with combined pollution factors) compared with those living in environmentally safe (control) territories: RR 1.28 (95% CI: 1.00–1.64); $p = 0.047$).

3. The RR of primary incidence of moderate- and low-grade forms of UBC among women living in ecologically compromised areas is comparable to that of women in control territories, with values ranging from 1.03 to 1.06.

4. Other findings include an increased relative risk (RR) of occurrence of both high- and, to a greater extent, low-grade forms of UBC in areas with high radioactive and chemical contamination — 1.19 (95% CI: 0.87–1.63) and 1.36 (95% CI: 0.70–2.65), respectively; the relative risks for combined and chemical contamination areas were 1.18 (95% CI: 0.90–1.55) and 1.34 (95% CI: 0.75–2.39), respectively; no increase was observed between the territories with combined and radioactive contamination — 0.99 (95% CI: 0.67–1.46) and 0.98 (95% CI: 0.44–2.21).

5. In all likelihood, the data from this study indicate that accident-related radiation contamination plays a more significant role in the development of high-grade — and especially low-grade — forms of UBC than does chemical contamination.

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