Conference Paper

The Psychological Consequences of the Chernobyl Accident in Remote Period

A. V. Khavylo

National Research Nuclear University MEPhI (Moscow Engineering Physics Institute), Kashirskoe shosse 31, Moscow, 115409, Russia

Abstract

Results of empirical research of social and psychological problems of activity of the population from contaminated areas of Russia after accident on the Chernobyl nuclear power plant (CNPP) in the remote period (2004–2014) by results of monitoring are presented in the article. Empirical material is based on the sample including results of inspection of 5988 people of the age of 16–89 years. 4003 surveyed live on is radioactive the polluted areas, 1985 surveyed – on is radioactive uncontaminated areas. Monitoring was conducted with Method research of social and psychological problems of population. It is proved that in the remote period (2004–2014) after accident on the CNPP, the level of expressiveness of social and psychological problems of activity of the population from contaminated areas of Russia considerably decreased. Level of expressiveness and structure of social and psychological problems at the population from contaminated areas have features in comparison with the population from uncontaminated areas.

Keywords: emergency situation, social and psychological problems of activity, Chernobyl accident, radiation factor

Corresponding Author:
A. V. Khavylo
khavylo@strider.ru

Received: 22 July 2018
Accepted: 9 September 2018
Published: 8 October 2018

Publishing services provided by Knowledge E

Selection and Peer-review under the responsibility of the Breakthrough Directions of Scientific Research at MEPhI Conference Committee.

1. Introduction

The accident at the Chernobyl nuclear power plant (CNPP) in 1986 had a very serious impact on the health of thousands of people who were exposed immediately after the accident and who received high doses of radiation. In general, however, the environmental consequences of the Chernobyl accident currently does not have a significant impact on the health of the population in the surrounding areas, except for a few restricted areas [3, 12].

Studies on the medical and psychological consequences of the Chernobyl accident show that the population of radioactively contaminated areas (RCA) is characterized by linking many adverse situations with radiation factor [4].

This often leads to the development of false psychological attitudes among people for diseases caused by radiation. Also, researchers note the risk of creating a focus on moral and material assistance from the surrounding and the State [6].

In the remote period following the accident, the RCA population is emerging social apathy and the incidence of neurological disorders, in particular neurotic type reactions [8, 9].

In addition to the health and environmental consequences, the Chernobyl disaster has led to many negative social and psychological processes associated with the massive displacement of people and changes in their way of life (living conditions, work, nutrition, changes in the economic activities of the regions) [5, 11].

In his 2010 report, 'Optimizing international efforts to study, mitigate and minimize the consequences of the Chernobyl disaster', the Secretary General of the UN Assembly noted that the population of RCA still needed State assistance, because socio-psychological, economic and environmental consequences of the Chernobyl accident so far had a negative impact on contaminated.

2. Materials and Methods

The study was conducted from 2004 to 2014 in the context of monitoring the psychosocial condition of the population exposed to radiation. Monitoring was part of a program of Joint Activities to Overcome the Consequences of the Chernobyl Disaster within the Union State for the years 2006–2010, as well as the federal targeted program, 'Overcoming the Consequences of Radiation Accidents in the Period up to 2015' in radioactively contaminated and uncontaminated territories of Russia [2, 7].

The collection of baseline data was carried out jointly with the specialists of the regional information and analysis centers (Bryansk, Tula, Kaluga, Bolkhov) and socio-psychological rehabilitation centers (Nicole Slobodan, Bryansk reg.; Bolkhov, Orel reg., Uzlovaya, Tula reg).

We studied the social and psychological problems of the population of the RCA Russia after the Chernobyl accident in the remote period. 5988 persons aged 16–89 years were surveyed: 4003 were residing in RCA, 1985 surveyed on radioactively non-contaminated territory (RNA).

We applied MRSPP (Method research of social and psychological problems of population; V. N. Abramova, T. A. Marchenko, T. B. Melnitskaya, A. V. Khavylo, E. V. Antonova, 1989–2004) [1].

Statistical methods: Mann–Whitney test, Pearson's agreement criterion (Pearson chi-square), Kruskal–Wallis test.

3. Results

We studied socio-psychological problems of vital activity from 2004 by year 2014. As the control group sample was used population RNA similar in socio-demographic characteristics. The quota method of sampling (multi-stage quota sampling) was used.

The quotas were calculated on the basis of statistical information on age and gender characteristics of the population living in the territories studied according to the census of 2002 and 2010. The sample of the study was divided into three parts according to the chronological principle. Data collected in related years were combined: 2004–2005, 2008–2009 and 2013–2014.

The average values of indicators of the socio-psychological problems of the population of RCA and RNA as a result of multi-year monitoring are presented in Figure 1.

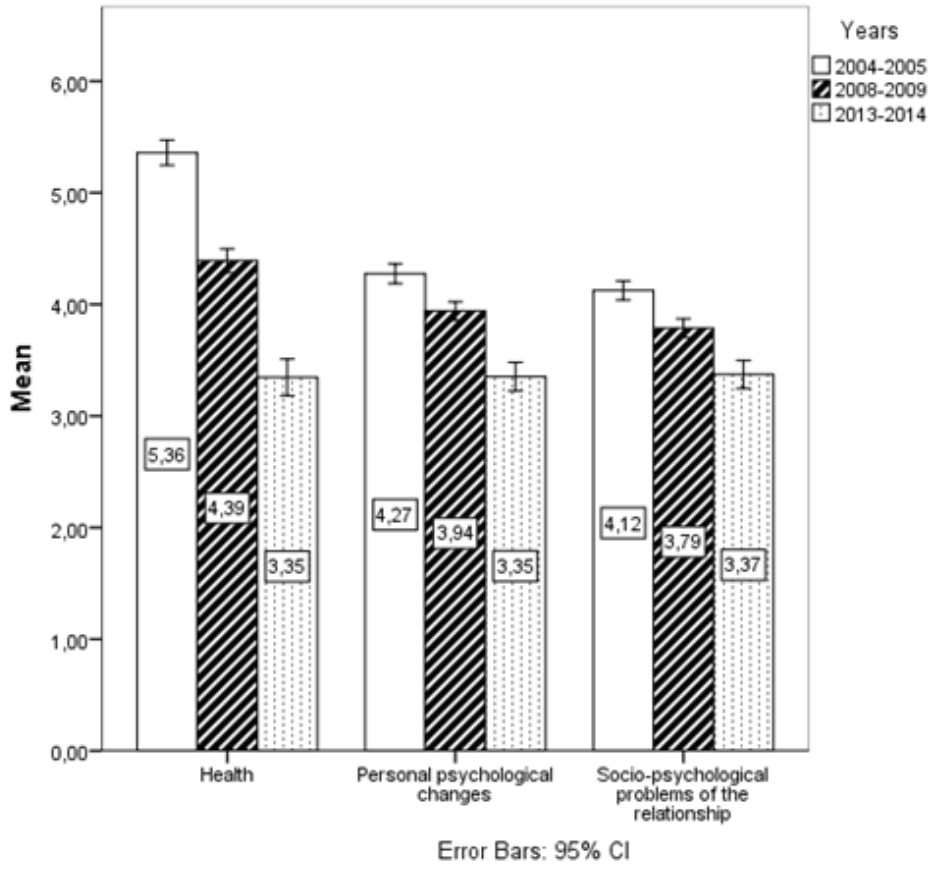

Figure 1: Social and psychological problems of the population of RCA.

An assessment of the statistical significance of the differences was carried out using the non-parametric Kruskal-Wallis test. For the three factors studied, there are statistically significant differences between the measurements made in different years: $p < 0.001$. We can talk about reducing the general level of public concern about RCA health problems and socio-psychological problems over the past 10 years.

To assess the dynamics of changes in the internal structure of the investigated factors of social and psychological tension and social disadaptation, we analyzed the primary scales of the MRSPP methodology.

Table 1 summarizes the concerns of the population RCA health problems according to the results of monitoring. Here and beyond, the results are sorted in descending order of magnitude for the 2013–2014 period. To assess the significance of the differences, Pearson's agreement criterion (Pearson chi-square) was used.

According to the results of statistical analysis, it was found that there were statistically significant changes in all signs of the 'Health' factor from 2004 to 2014. There is a steady downward trend in the concern of the population of the RCA with health problems.

Table 1: Structure of indicators of the 'Health' factor in the population of RCA.

Indicators of the Factor 'Health'	Years of the survey, (P ± Sp) %			Statistical Significance	
	2004–2005	2008–2009	2013–2014	Chi-square (χ^2)	Significance level ($p <$)
Asthenia, weakness	82.6 ± 1.0	72.0 ± 1.1	55.8 ± 1.7	192.7	0.001
Neuroses of radiation phobia	76.9 ± 1.1	65.6 ± 1.2	51.0 ± 1.7	164.1	0.001
Psychosomatic disorders	59.8 ± 1.3	54.7 ± 1.2	44.7 ± 1.7	48.9	0.001
Memory loss	68.8 ± 1.2	60.9 ± 1.2	44.5 ± 1.7	131.5	0.001
Pain syndromes	64.2 ± 1.2	56.3 ± 1.2	39.6 ± 1.7	131.4	0.001
Fears related to radiation	54.3 ± 1.3	47.4 ± 1.2	36.5 ± 1.7	67.4	0.001
Loss of sensitivity	54.7 ± 1.3	48.2 ± 1.2	35.6 ± 1.7	78.1	0.001
Neglect to health	32.0 ± 1.2	36.3 ± 1.2	30.1 ± 1.6	11.7	0.010
Hypochondria	41.8 ± 1.3	32.6 ± 1.1	24.6 ± 1.5	73.4	0.001
Apathy, indifference	36.2 ± 1.2	31.3 ± 1.1	22.6 ± 1.5	45.8	0.001
Note: P – percentage; Sp – percentage error.					

The hierarchy of current health problems remained virtually unchanged throughout the observation period. The most common causes of complaints of the RCA population were asthenia, fatigue, weakness, decreased efficiency: 55.8% in 2013–2014. A large

proportion of respondents associate their health problems with an increased level of radiation: 51.0% in 2013–2014.

In our opinion, this is due to the special nature of the perception of radiation. Information on the level of radiation and potential harm to health we receive not directly, but through other people or other sources of information, such as through the media. It was impossible to knowingly control the effects of radiation on the organism. This leads to the fact that some people begin to see the cause of these or other health problems in living on RCA and an increased radiation background.

Tarabrina [10] notes that in the long term this attitude to the radiation factor may lead to the formation of hypochondria human reactions. Based on the results of our study it can also be noted that a relatively large proportion of respondents expressed concern about psychosomatic disorders and memory deterioration: 44.7% and 44.5% in 2013–2014, respectively.

Dynamics of population concerns RCA personal problems are shown in Table 2. The significance of the observed differences was assessed using Pearson's agreement criterion.

Table 2: Structure of indicators of the 'Personal psychological changes' factor in the population of RCA.

Signs of the factor 'Personal psychological changes'	Years of the survey, (P ± Sp) %			Statistical Significance	
	2004–2005	2008–2009	2004–2005	2008–2009	2004–2005
Over-responsibility	81.9 ± 1.0	76.8 ± 1.0	75.4 ± 1.5	18.1	0.010
Emotional instability	68.6 ± 1.2	57.6 ± 1.2	47.5 ± 1.7	104.0	0.001
General deterioration of character	48.9 ± 1.3	45.9 ± 1.2	38.0 ± 1.7	25.9	0.001
Self-incrimination	43.8 ± 1.3	44.4 ± 1.2	37.3 ± 1.7	12.7	0.010
Internal conflicts	50.7 ± 1.3	52.3 ± 1.2	36.5 ± 1.7	60.0	0.001
Auto aggression	38.9 ± 1.3	41.6 ± 1.2	33.3 ± 1.6	15.8	0.001
Decreased self-esteem	41.2 ± 1.3	36.3 ± 1.2	28.3 ± 1.6	38.2	0.001
Indifference	22.0 ± 1.1	23.6 ± 1.0	21.1 ± 1.4	2.4	–
Shyness, stiffness	25.0 ± 1.1	25.7 ± 1.1	19.8 ± 1.4	11.5	0.010
Coldness	18.6 ± 1.0	19.9 ± 1.0	18.3 ± 1.4	1.4	–
Note: P – percentage; Sp – percentage error.					

In general, almost all signs show a positive trend toward decreasing the relevance of the problems presented in this factor. The hierarchy of the most important personal

problems of the RCA population remains unchanged throughout the observation period from 2004 to 2014.

Most often in the interview, the surveyed noted signs of over-responsibility: 75.4% in 2013–2014, emotional instability: 47.5% in 2013–2014. In analyzing the data, we consider that responsibility in today's society is socially acceptable and desirable, so perhaps some of the interviews surveyed slightly exaggerated the manifestations of these Signs.

For eight of the ten signs, statistically significant differences were found between measurements made at different time periods. This suggests that the revealed dynamics are characteristic for the entire structure of this factor.

In this context, we are not talking about a personality change, which is a fairly stable and mental entity. We consider the signs of this factor as a manifestation of individual personal reactions, which are a psychic response to the stressful effects caused by living in the RCA.

The dynamics of the factor 'Socio-psychological problems of the relationship' is presented in Table 3.

As before, the statistical significance of the differences was estimated using Pearson's agreement criterion. Eight of the signs out of ten revealed statistically significant differences between the measurements taken at different time periods. By all indications, where significant differences were revealed, it is possible to observe a negative dynamics: the frequency of complaints of the population of RCA on problems in communication is decreasing.

Most often in the interview, the surveyed noted a high irritability: 63.6% in 2013–2014; disappointment in people: 56.2% in 2013–2014; incomprehensibility by others: 53.8% in 2013–2014. In this case, the structure of the signs of this factor during the 10 years of observation has practically not changed.

To assess the dynamics of the overall level of socio-psychological tension in the RCA, we conducted a comparative analysis. Figure 2 shows the average values of the integral indicator of the level of socio-psychological tension in three measurements. The results of the RCA population survey serve as a benchmark.

We note a decrease in the level of social and psychological tension during 10 years of monitoring both at RCA and RNA. The severity of the level of socio-psychological tension in the compared time periods is significantly higher among the population of the RCA in comparison with the population of RNA.

Table 3: Structure of indicators of the 'Socio-psychological problems of the relationship' factor in the population of RCA.

Signs of the factor 'Socio-psychological problems of the relationship'	Years of the survey, (P ± Sp) %			Statistical Significance	
	2004–2005	2008–2009	2004–2005	2008–2009	2004–2005
High irritability	74.4 ± 1.1	67.0 ± 1.2	63.6 ± 1.7	34.9	0.001
Disappointment in people	62.7 ± 1.3	60.3 ± 1.2	56.2 ± 1.7	9.4	0.010
Incomprehensibility by others	51.3 ± 1.3	54.6 ± 1.2	55.3 ± 2.4	7.4	–
Loss of friends, relatives	52.7 ± 1.3	45.2 ± 1.2	41.9 ± 1.7	30.2	0.001
Rejection of the norms and rules of society	54.3 ± 1.3	47.1 ± 1.2	38.7 ± 1.7	52.9	0.001
Loss of communication needs	40.8 ± 1.3	38.6 ± 1.2	36.5 ± 2.4	11.8	0.050
Feeling of hostility environment	35.4 ± 1.2	37.9 ± 1.2	34.1 ± 1.7	4.1	–
Unwillingness to live in a family	20.8 ± 1.1	21.0 ± 1.0	16.3 ± 1.3	8.8	0.010
Unwillingness to have a family	12.7 ± 0.9	15.8 ± 0.9	11.0 ± 1.1	12.4	0.010
Rejection of culture	9.1 ± 0.7	11.9 ± 0.8	6.6 ± 0.9	18.9	0.001
Note: P – percentage; Sp – percentage error.					

A comparative analysis using the nonparametric Mann–Whitney test allows us to conclude that during the whole period of monitoring, statistically significant differences in the level of socio-psychological tension among residents of RCA and RNA are observed. According to the data of 2004–2005, $p < 0.050$, according to 2008–2009 and 2013–2014, $p < 0.001$.

4. Discussion

As a result of the study, we can talk about reducing the general level of concern about the psychosocial problems of the RCA population during monitoring. It has been found that a large proportion of those surveyed link their health problems to elevated radiation levels.

Describing the changes in personal identity, the RCA residents often noted signs of over-responsibility, expressed concern about emotional instability, insomnia, lack of power, heightened anxiety. The problems of relations among the population of RCA

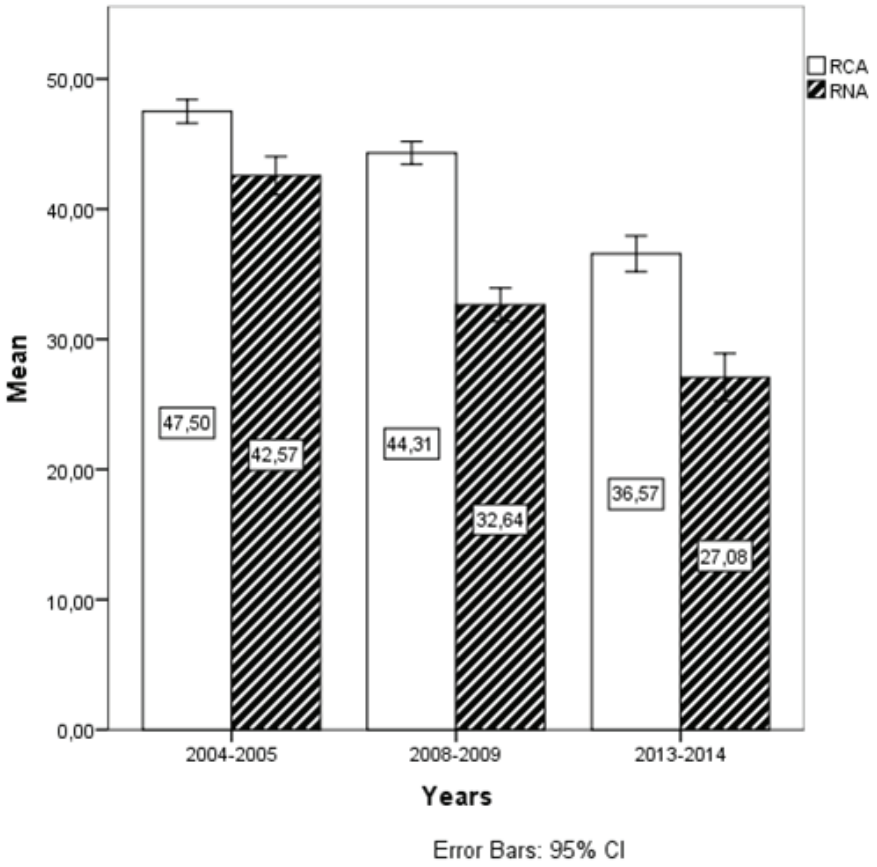

Figure 2: Dynamics of the level of socio-psychological tensions RCA and RNA of Russia on the results of monitoring.

are expressed in heightened irritability, frustration in people and denial of generally accepted norms and rules. Noted that the hierarchy of signs within each factor has not undergone significant changes during the monitoring period.

The comparative analysis found that the integral indicators for the three socio-psychological disadaptation factors of the inhabitants of RCA are more important: they are more concerned with health problems and are more worried by negative personal changes and problems in relationships with others.

On the basis of the aforementioned, the following conclusions can be drawn:

1. In the remote period (2004–2014), the level of socio-psychological problems of life in the population of RCA Russia has considerably declined since the Chernobyl accident. The level of expression and the structure of the socio-psychological problems of the population of the RCA have special characteristics in comparison with the population of RNA.

2. The severity of factors of socio-psychological maladjustment is significantly higher among RCA residents in comparison with the population of RNA: they are

more concerned with health problems, they are more concerned with negative personal changes and problems of relationships with others.

3. The composition and nature of the social and psychological adaptation and rehabilitation package should include the population of the entire RCA in the post-accidental period.

References

[1] Abramova, V. N., Antonova, Ye. V., Marchenko, T. A., et al. (2004). *Instruction on Monitoring the Socio-psychological State of the Population of Radioactively Contaminated Territories of Russia and Belarus: A Practical Guide to Improving Information Technology for Working with the Population of Radioactively Contaminated Areas*, pp. 38–53. Obninsk: Prognoz (in Russian).

[2] Abramova, V. N., Gerasimov, D. V., Melnitskaya, T. B., et al. Analysis of the socio-psychological state of the population of the Kaluga region, including the actual needs of the population for information on the consequences Chernobyl accident. Chernobyl legacy 20 years later, pp. 94–98. Kaluga (in Russian).

[3] Bennet, B., Repacholi, M., and Carr, J. (2006). Medical consequences of the Chernobyl accident and social health programs: Report of the expert group "Health" of the UN Chornobyl Forum. Geneva, 190 c. (in Russian).

[4] Zykova, I. A. and Arkhangelskaya, G. V. (2007). *Radioactivity of the Population of Contaminated Territories and Measures to Reduce it: A Manual for Specialists of Rospotrebnadzor Services*, 24 c. St. Petersburg (in Russian).

[5] Lieberman, A. N. (2002). *Radiation and Stress: Socio-psychological Consequences of the Chernobyl Accident*, 138 c. SPb (in Russian).

[6] Melnitskaya, T. B. (2009). Information and psychological safety of the population in the context of the risk of radiation exposure: concept, model, technology: Doctor of Psychology thesis: 05.26.02, 19.00.04 [Protection Area: Russian. Center of Emergency. and Radi. medicine. A.M. Nikiforov EMERCOM of Russia]. Obninsk. 429 c. (in Russian).

[7] Melnitskaya, T. B., Rybnikov, V. Yu., and Khavylo, A. V. (2015). *Socio-psychological Problems of Vital Activity and Stressful Reactions of the Population in the Long-term Period After the Chernobyl Nuclear Power Plant Accident*, 148 c. SPb.: Politechnica-Service (in Russian).

[8] Rumyantseva, G. M., Chinkina, O. V., and Bezhina, L. N. (2009). *Radiation Incidents and Mental Health of the Population*, 288 c. M: FGU "GNTsSSP" (in Russian).

[9] Tarabrina, N. V. (2008). Psychology of post-traumatic stress: An integrative approach: Doctor of Psychology thesis, 362 c: 19.00.04. St. Petersburg (in Russian).

[10] Tarabrina, N. V., Lazebnaya, E. O., Zelenova, M. E., et al. (1996). *Psychological Consequences of Experiencing "Invisible" Stress. Social and Psychological Rehabilitation of Victims of the Chernobyl Disaster: Experience and Perspectives*, pp. 213–220. M (in Russian).

[11] Khavylo, A. V. (2014). Socio-psychological problems of life activity and stressful reactions of the population living in radioactively contaminated territories of Russia after the Chernobyl accident. *Bulletin of Psychotherapy*, vol. 52, no. 57, pp. 80–92 (in Russian).

[12] Tsyb, A. F., Abramova, V. N., Krikunova, L. I., et al. (2006). Psychological consequences of radiation risk exposure in women living in the Bryansk region, contaminated with radionuclides. *Medical Radiology and Radiation Safety*, vol. 51, no. 2, pp. 36–44 (in Russian).