

The psychological effects of radiological terrorism - a challenge to the family physician

Vili Slavchev Zahariev, Nikolai Milenov Hristov

*Medical University-Sofia, Faculty of Public Health,
Department of Social Medicine University Hospital "Tsaritsa Ioanna", Bulgaria*

*corresponding e-mail: vilislavchev@abv.bg
postal address: (MUS), 8, Bialo more Str., 1527 Sofia, Bulgaria*

Our objective was to assess the ability of family physicians from a capital city to overcome the psychological adverse effects of radiological terrorism and provide psychological support to the victims. We performed a single cross-sectional study in order to collect data and analyse the preparedness of general practitioners. The study was performed in September 2011. The relative share of the studied group of 400 GPs is 45% (out of a total of 890) with a standard error of 2.5% and 95% CI - (40.1%÷49.9%). The knowledge and skills of family physicians are fragmented and superficial. Family physicians are also lacking any practical experience in the medical provision of victims, and in particular in the provision of psychological support. Many problems arise from missing knowledge on ionizing radiation and its influence on humans. Adequate education and practical training of family physicians could be the main factors in overcoming the psychological consequences of radiation accidents.

Keywords: Psychological effects, radiological terrorism, radiation accidents, family physicians

Introduction

The main goals of terrorism are to spread panics and fear among the population, and to destabilize and paralyze the functioning of governmental institutions. The acute and painful perception of the radiation effects and the pronounced "radiophobia" among the population potentiate the effects of terrorism (Dodgen, Norwood, Becker, Perez, and Hansen, 2011; ICRP, 2006; NCRP, 2010). The medical consequences of radiation terrorism are directly and indirectly linked to radiation effects. The direct effects are deterministic and stochastic (ICRP, 1991). They are not dependent on the individual's knowledge on radiation effects, as well as his subjective perception of the health danger resulting from exposure. Direct effects can be avoided or mitigated through protective measures reducing exposure. The indirect effects are caused by both the accident and the related intervention. They can surpass the direct effects and can be foreseen. Besides they can influence hundreds of thousands of people and can persist with years. Indirect effects are related rather to the subjective perception of risk, than the actual exposure. Unlike direct effects, with indirect effects full-scale protective measures can have a stress-generating and aggravating effect (Becker, 2001; Collins and de Carvalho, 1993; Havenaar, 1996).

The overcoming of psychological effects is much more challenging than with radiological effects due to the larger contingent of people affected (Dodgen et al., 2011, IAEA 2005; Tubiana and Aurengo, 2005). Experience from previous radiation accidents shows that in the population from affected regions negative effects on mental health by far surpass the immediate health effects (Becker, 2001;

Havenaar, 1996, IAEA, 1988, 1998; Nénot, 2009). Psychological effects are manifested by: stress, psychological suffering, and changes in the ability for adequate judgment of risk, changes in the individual and social behavior. Psychological suffering may vary from the feeling of psychological discomfort to a degree of manifestation with clinical signs and symptoms. Changes in the attitude of the affected person towards his health may occur as well. Even the smallest symptoms in such cases are perceived as manifestations of radiation impairment. Many people are affected with Multiple Idiopathic Physical Symptoms “MIPS” (Engel, Locke, Reissman, DeMartino, Kutz, McDonald, and Barsky, 2007; REAC/TS, 2011). Consequently, unnecessarily complete medical examinations are performed accompanied by unwarranted anxiety in the interpretation of results or the anticipation of ensuing results.

Psychological complications are characterized by a diversity of psycho-pathological symptoms and syndromes. In the acute phase one can observe effective shock reactions with polymorph symptomatic - stupor, sub-stupor, disturbances in the sensory synthesis, depressive episodes, fugues, aphasia, abasia, pseudo-paralysis, schizophrenic experiences. These symptoms belong to the so-called reactions to heavy stress and disturbances in adaptation, which include: acute stress reaction and post-traumatic stress disorder. As reactions to acute stress disorder (ASD) one can also observe: dynamic polymorph symptomatic, bewilderment, narrowed field of clear consciousness, impairment of the perception-notion sphere, disorientation, anxiety, hyper-activity, withdrawal, escape, depression, anger, despair, vegetative symptoms, albeit none of the symptoms persists (American Psychiatric Association, 1994). Actual post-traumatic stress disorders (PTSD) can occur with a latency period no longer than 6 months. They are characterized by repeated experience, re-living the event in memories, dreams or nightmares multiple times (flashbacks), alienation, indifference, insensitivity, равнодушие, avoidance of actions and situations reminding of the psycho-trauma. Adaptation disturbances, psycho-active drugs abuse, disorders with generalized anxiety and depression, may also be observed. Often a pathological axis “physical impairment, psychological stress, psycho-somatic disorder” forms (American Psychiatric Association, 1994; Royal College of Psychiatrists, 2012; Yehuda, 2002).

Apart from these fundamental reactions, there exist other important psychological issues emerging long after the accident - the so-called “syndrome of the marked by radiation” or the phenomenon “social stigma”. FOLLOWING THE ACCIDENT IN GOIANIA A YOUNG WOMAN WHOSE BROTHER HAS DIED WITH ACUTE RADIATION SYNDROME (ARS), REPORTED: “They started treating us like we were leprous”. Local graveyards refused to bury the deceased, hotels did not accommodate residents of Goiania, Brazilian airlines refused to book passengers from this region, etc. (Collins and de Carvalho, 1993; IAEA, 1988, 1998).

In these cases the role of family physicians is extremely important. Reduction in psychological consequences is a major functional requirement to be met in disasters. Family physicians should have information about: the type of exposure - external (whole-body or local), internal or combined, and the received dose. Thus they can define the necessary approach to victims - psychiatric or psychological treatment, medical consultation, specific treatment, etc. periodic visits to the family physician tend to calm the population. Apart from this family physicians should monitor groups at risk (kids, pregnant, aged, and chronically ill) for a longer period of time. Long-term health care is necessary for several reasons: to provide information on the gravity of health issues, to identify radiation-induced health effects at an early stage, to forecast the need for medical and psychological care provision, and to answer the unfounded fear or anxiety of people (IAEA 2005; REAC/TS, 2011).

Objective

Improvement of the population medical provision in case of radiation terrorism and analysis of the ability of family physicians from the capital city of Sofia in Bulgaria to overcome psychological adverse effects and provide psychological support to the victims according to the recommendations of leading international organizations.

Methods

We performed a single cross-sectional study in order to collect data and analyse the preparedness of general practitioners. The study was performed in September 2011. We used direct individual survey “face to face” using a questionnaire developed by us on the basis of document analysis. The type of study we performed is considered a sociological study in Bulgaria and not one in need of approval from an ethical review board. All participants were fully informed about the study. They were aware that the results obtained are intended for publication. Each participant was given the option to decline the interview. We made a simple random sample using a generator of random numbers and based on the register general practitioners in Sofia. The relative share of the studied group of 400 GPs is 45% (out of a total of 890) with a standard error of 2,5% and 95% CI - (40,1%÷49,9%). The dropout percentage in the course of the study is 10%. We processed data using SPSS ver. 19.0. The adopted level of significance in the testing of H_0 was $\alpha=0.05$ in guaranteed probability 95%. In order to validate results from the performed analyses we used the following statistical methods: descriptive analysis; tests for interdependence between descriptive data - χ^2 Pearson test, Exact test, coefficient of contingency of Cramer (V) - for orientation estimation of the degree of manifestation of the dependence found by the χ^2 - method; tests for comparing relative shares - Z test.

Analysis of results and discussion

Some social and demographic features of the 400 GPs participating in the study are: 319 are female with a relative share of 79.7%. Males are 81 - 20.3%. Distribution by age demonstrates a highest share of physicians aged between 41 and 50 - 168 with a relative share of 42%, followed by those aged between 31 and 40 - 115 - 28.7%. Under the age of 30 are only 14 - 3.5%. By specialty the largest share occupy physicians with specialty general medicine - 40.8%, followed by internal diseases - 29.3% and paediatrics - 11.5%. 12 physicians have other specialties.

At the stage of introductory questions studying the respondents' attitudes towards the relevance and significance of the problem, 36.5% determine the relevance as “very high” and “high”, 17.9% as “low” and “very low”, and 22.8% - “neither high, nor low”.

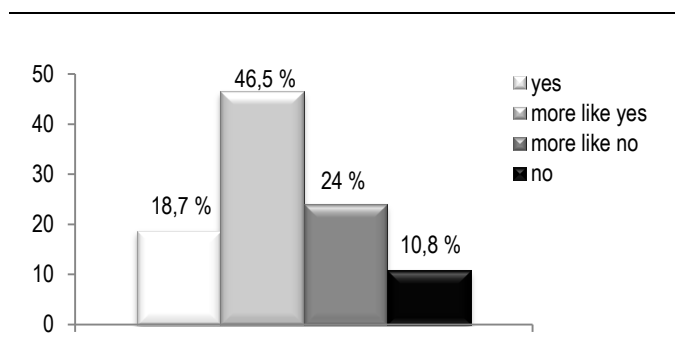
A larger share of physicians determine the significance as “very high” and “high” - 50%, as “low” and “very low” - 13.3%, and 15.5% as “neither high, nor low”. According to 19% of the respondents the danger of radiological terrorism in Bulgaria is “very high” and “high”, while 33.9% define it as “low” and “very low”.

We believe that of utmost importance is the following question we asked family physicians: “Do you think that medical care for persons with external exposure carries risk for the others?” The persons answering “no” represented barely 31.8% of all respondents. The relative share of “yes” responses was 42.7%, which confirms the alternative hypothesis (H_1) for significant difference in the compared relative shares - $Z=4.40$, $p<0.0001$.

To the question: “Do you know how to provide psychological support to victims of radiological terrorism?” the “yes” answers amounted to 18.7% (CI=14.99%÷22.87%). Only 10.8% (CI=7.93%÷14.26%) answered with “no”. The largest share went to the answers “more like yes” - 46.5% (CI=41.53%÷51.52%) of all respondents. This share was significantly different from the share of answers “more like no” - 24% (CI=19.9%÷28.49%) - $Z=10.54$, $p<0.0001$. Results are presented on fig. 1.

Keeping in mind the pronounced “radiophobia” among the population, family physicians should be able to answer their patients whether a certain condition is due to radiation exposure. For example a member of a family may be interested whether his cancer may be due to contacts with another member of the family with a history of radiation exposure. Every physician, regardless of his specialty, should be able to provide grounded answers to similar questions. To this end it is necessary that family physicians are aware of some basic data on radiation-induced cancer risk assessment. Furthermore, the physician should be able to determine the probability with which a certain type of cancer might have been caused by ionizing radiation exposure. Family physicians should be aware that contrary to widespread belief ionizing radiation is a relatively weak carcinogen. Hereditary impairments have not been identified. A number of international organizations confirm that for radiation induced cancer dose thresholds do exist - 200 mSv for bone marrow, 100 mSv for child thyroid, and 500 mSv for all other tissues and body parts (ICRP, 2005; United Nations Scientific Committee on the Effects of Atomic Radiation, 2010).

FIGURE 1. “DO YOU KNOW HOW TO PROVIDE PSYCHOLOGICAL CARE TO VICTIMS OF RADIOLOGICAL TERRORISM?”



To the open question on the nature of radiation impairment the majority of the studied physicians - 51.1% (CI=45.98%÷56.19%), pointed out “cancer” and 2.3% (CI=1.05%÷4.34%) “malignant bone tumor”. These answers speak of associative link between ionizing radiation and the carcinogenesis process and are an evidence of pronounced radiophobia.

In case of radiological terrorism the majority of survivors will receive relatively small doses. The main effect would be on the psychic of the population (ICRP, 2006; NCRP, 2010). A mounting experimental and epidemiological data categorically reject the negative effect of small doses of ionizing radiation (Scott, 2008; Scott, Sanders, Mitchel, and Boreham, 2008; Tubiana and Aurengo; 2005, Ware, 2008). H. Rossi has formulated this expressly: “No one and nowhere have proven the carcinogenic effect of small doses” (Rossi and Kellerer, 1972). Simultaneously growing in popularity is the view that the living organism and human in particular reacts in exactly the opposite manner to small and large doses.

Prof. T. D. Luckey introduced the term - “radiation hormesis”, meaning that low-level radiation (LLR) is beneficial - doses below 0,2 Gy and intensity of the dose below 0,1 Gy.h⁻¹ (Luckey T. 1980, 1991, and 2011). Despite the many controversies regarding the linear no-threshold model (LNT) in the field of LLR, it remains generally accepted and at the basis of rationing of radiation exposure on the individual and the human populations. The leading argument in favor of this model is that it is the most conservative and therefore, the most humane (BEIR VII, 2005; ICRP, 2005). Other authors categorically deny the radiation hormesis, calling it “an unbelievable lie” (Brenner and Hall, 2006; Brenner and Sachs, 2006; Grossman, 2011). In spite of the heated discussions mounting evidence points that in doses less than 100 mSv the causative relation between exposure and carcinogenesis is entirely speculative (Higson, Boreham, Brooks, and Luan 2007; United Nations Scientific Committee on the Effects of Atomic Radiation 2010; Tubiana, 2005; Ware, 2008). In view of their role in dealing with psychological effects it is extremely important for family physicians to be aware of the affects of LLR. To the question: “Do you know what radiation hormesis is?” we received the following answers: the “yes” answers reach barely 16% (CI=12.55%÷19.97%) of the respondents, compared to “no” answers for the majority of respondents - 84% (CI=80.03%÷87.45%). The alternative hypothesis (H₁) for significant difference in the compared relative shares was thus categorically accepted: Z=37.09, p<0.0001. the distribution of answers to this question is represented on Figure 2.

We believe that of certain interest is the crossing of the question: “Do you know how to provide psychological support to victims of radiological terrorism?” with the question: “Do you know what radiation hormesis is?” - Table 1.

FIGURE 2. “DO YOU KNOW WHAT RADIATION HORMESIS IS?”

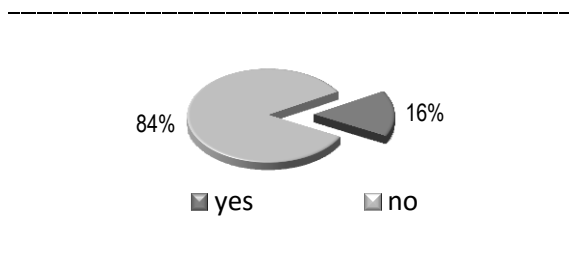


TABLE 1. CORRELATION BETWEEN THE AWARENESS OF RADIATION HORMESIS AND THE PROVISION OF PSYCHOLOGICAL CARE

		Do you know what radiation hormesis is?		Total
		yes	no	
Do you know how to provide psychological care to victims of radiological terrorism?	Yes	24	51	75
	More like yes	32	154	186
	More like no	7	89	96
	No	1	42	43
Total		64	336	400

$\chi^2(3)=25.9, p < 0.0001$
 $V=0.25$

Using the χ^2 test of Pearson we accepted the alternative hypothesis (H_1) for statistically significant correlation between them - $\chi^2=25.9$, $p < 0.0001$, which is weakly expressed - $V=0.25$. Out of the 261 physicians, who believed they know how to provide psychological support, a significant share - 78.5% have no notion of radiation hormesis.

The terrorist act cannot be predicted but the psychological reaction to it can be mitigated applying specific methods before, during and after it. Typically, the first level for seeking help is the family physicians. Competent, well organized and effective medical care would dissolve to a large extent the accumulated social tension. Relevant measures before the incident would be: informing of the population in advance on the aims and structure of emergency response; health risks from ionizing radiation and protection means; systemic education and practical training of family physicians. During the incident uninterrupted information should be submitted, providing the population with clear, brief and understandable guidance for behavior, which are to be repeated and based on internationally approved guidelines for action. Following the incident: a system for ensuing monitoring and long-term health support, qualified psychological care and social support for survivors.

Conclusion

Experience from previous radiation accidents tells us that among the population from affected regions, the negative effects on psychic health by far exceed the immediate health effects.

Collected and analyzed data justify our claim that the knowledge and skills of family physicians are fragmented and superficial. Family physicians are also lacking any practical experience in the medical provision of victims, and in particular in the provision of psychological support.

Most problems here arise from missing knowledge on ionizing radiation and its influence on humans. Adequate education and practical training of family physicians could be the main factors in overcoming the psychological consequences of radiation accidents.

Our research supports the notion that family physicians are left outside the system for civic protection following major disasters and would need additional education during their students' years and/or additional training while practicing.

Further research could elucidate on the professional preparedness of family physicians from other locations in Bulgaria and from other Eastern European countries to offer support to patients seeking care, but the results are unlikely to be significantly different, as in the context of Bulgarian healthcare physicians practicing in Sofia are considered most competent professionally.

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