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# STUDYING THE POPULATION HEALTH EFFECTS DUE TO NUCLEAR TESTS: THE ROLE OF THE SEMEY STATE MEDICAL UNIVERSITY

At the Semipalatinsk nuclear test site (SNTS) more than 450 nuclear weapons tests, including 118 air and ground explosions were conducted in the period from 1949 to 1989. Territory of East Kazakhstan and Pavlodar regions of Kazakhstan were contaminated by radioactive fallout. Local population was exposed to multiply acute and chronic irradiation. July 29, 2000 the last tunnel of the Semipalatinsk nuclear test site was detonated. December 18, 1992 in Kazakhstan it was adopted the Law "Social protection of citizens affected by nuclear tests at the Semipalatinsk nuclear test site" which determined the ranking of territories of Kazakhstan contaminated with radioactive fallout, in accordance with radiation doses, registration the citizens exposed to radiation, and the procedure for the provision of medical care to the population. Decisions of 52th and 53th session of the UN General Assembly "Assistance to the Semipalatinsk region of Kazakhstan", "Nuclear-weapon-free zone in Central Asia", and "Nuclear disarmament with a view to the ultimate elimination of nuclear weapons" demonstrated the interest of the world society to the problem of nuclear tests consequences in Kazakhstan.

Semey State Medical University was founded in 1953 based on the Resolution of the USSR Ministers Council and Decree of the Ministry of Health. According the Strategic Program of University development the main directions of our activity include improving the training of highly qualified medical staff of new generation for public health care in the East Kazakhstan Area and the Republic of Kazakhstan, development of medical science and research staff, and improving the population health status. For sixty years the specialists trained in our University have been provided medical assistance to the residents of regions adjacent to the Semipalatinsk nuclear test site.

After closing the SNTS the Government of the Republic of Kazakhstan and medical organizations have to solve the complex problems of evaluation of medical, demographic and social consequences for the population, as well as the development of state programs to minimize the harmful effects of radiation exposure. The main tasks were: reconstruction and calculation of individual and collective doses for the population of the territories adjacent to the NTS; determination of the radiation risk groups, including persons exposed to direct radiation, and their descendants in three generations; assessment of the health damage and demographic consequences; definition of the relationship between diseases and radiation exposure; prevention and treatment of diseases induced by radiation, and rehabilitation of the affected people.

The key problem in assessing the consequences of nuclear explosions is the reconstruction of radiation dose for the exposed people. From 1995 the stuff of our University in collaboration with scientists of Hiroshima University have been evaluated the content in the environmental objects the long-lived products of nuclear fallout with reconstruction of effective radiation doses for the population. It was used the calculation method, ESR of tooth enamel, and physical dosimetry. Cytogenetic studies of chromosomal aberrations in peripheral blood lymphocytes to find some biological radiation markers were carried out. These data have contributed to the problem of determining the radiation doses for the population directly exposed to radiation.

Retrospective assessment of radiation exposure of the population of areas adjacent to the SNTS, currently shows excess of absorbed doses in the people exposed to direct radiation

For 20 years, the staff of the University is involved in collaborative research with leading research institutes and laboratories of Kazakhstan, Russia, Japan, Germany, United States, Israel and other countries to study the radiation effects (figure 1).

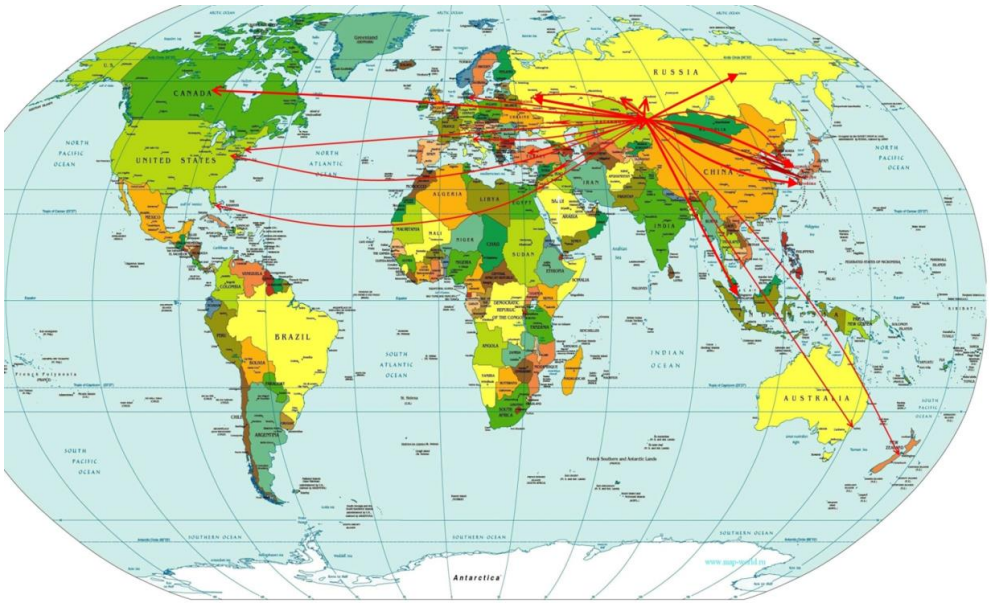


**Figure 1. International collaboration on the problems of radiation medicine and ecology.**

Kazakh President Nursultan Nazarbayev in 2009 proposed the creation in Semey a cluster of radiological medicine. Currently, based on the Semey regional oncologic dispensary, it is planned to create a nuclear medicine department with the use of positron emission tomography and production of radiopharmaceuticals. The cluster includes Semey State Medical University as the lead institution, Research Institute for Radiation Medicine and Ecology, Semey, and the Regional Oncology Dispensary. Cluster will form an effective system for the interaction between medical and research institutes aimed to improving the health status of the population of East Kazakhstan region, promote the development of regional and national innovation potential for early diagnosis, treatment and rehabilitation of the patients with cancer (60-70 %) and somatic (40-30 %) diseases (figure 2, 3).

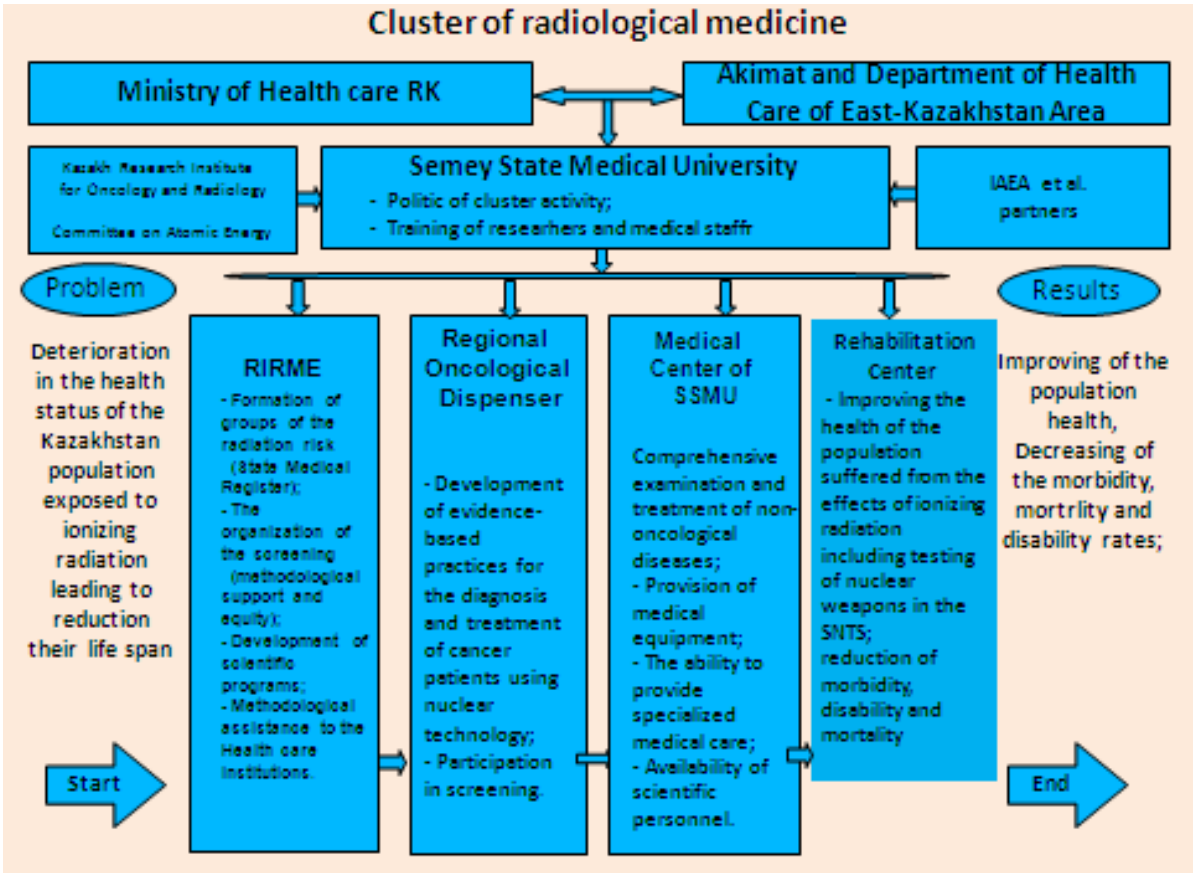


**Figure 2. Cluster of radiological medicine.**

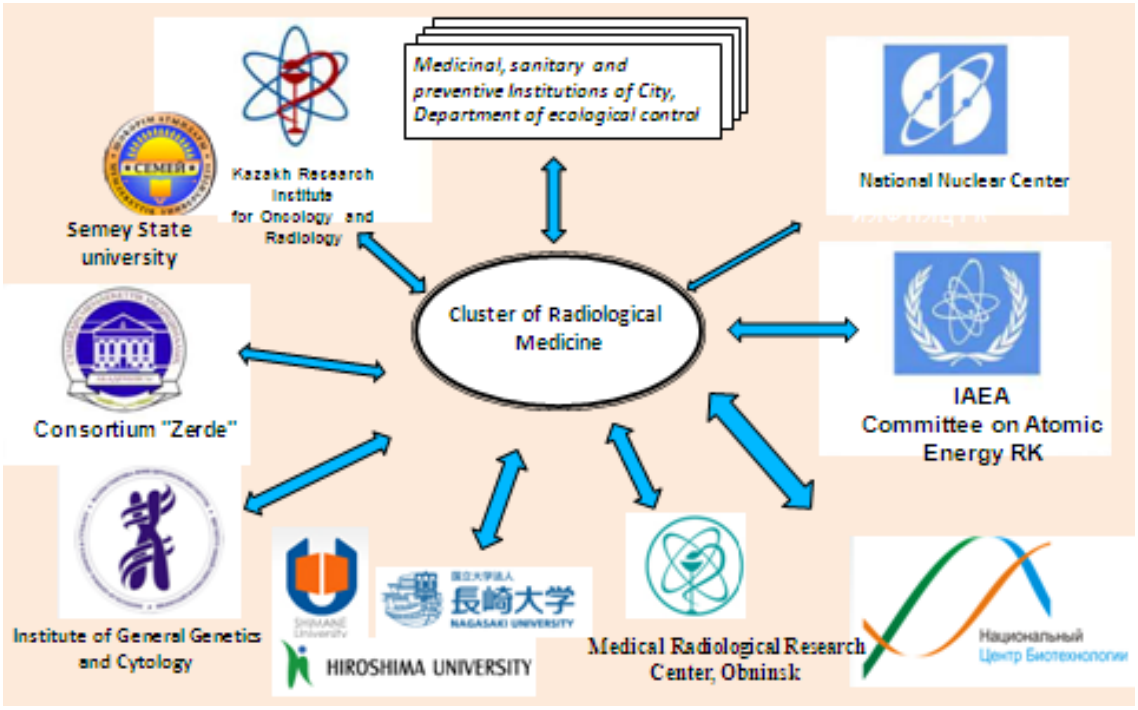


**Figure 3. Integration of the cluster with partners.**

From 2007 to 2009, it was implemented a joint project with the International Atomic Energy Agency (IAEA) KAZ/6/008 "Improvement of radiological services in East Kazakhstan." It was trained 19 specialists of Oncological Center.

Research Program «Scientific basis for rehabilitation of the population living in the region of former Semipalatinsk Nuclear Test Site» was carried out in the University in the period from 2006 to 2009. In the frame of the project it was conducted epidemiological and clinical studies that have allowed us to determine the basic medical and demographic consequences of radiation exposure at direct irradiation: calculate the risk of somatic diseases and cancer; find the markers of radiation damage in the body systems; establish the cytogenetic effects of exposure and correlations between doses, radiation-induced diseases, and effects of premature aging.

From 2012 our University in cooperation with the Research Institute for Radiation Medicine and Ecology have been carry out research program "Development of science based technologies to minimize ecological risk of adverse effects to human health". The Program Director is Professor TK Rahypbekov. Within the project it was conducted screening examination of more than 5 thousand inhabitants of East Kazakhstan and Pavlodar regions. Primarily our focus is on the health status of offspring of exposed parents. It was performed comprehensive clinical studies of such socially important classes of diseases as cancer, cardiovascular, endocrine, rheumatologic diseases, formed Register of cardiovascular diseases of persons with different doses of irradiation, performed cytogenetic studies and the study of polymorphisms of candidate genes predisposing to the CVD and cancer (figure 4).

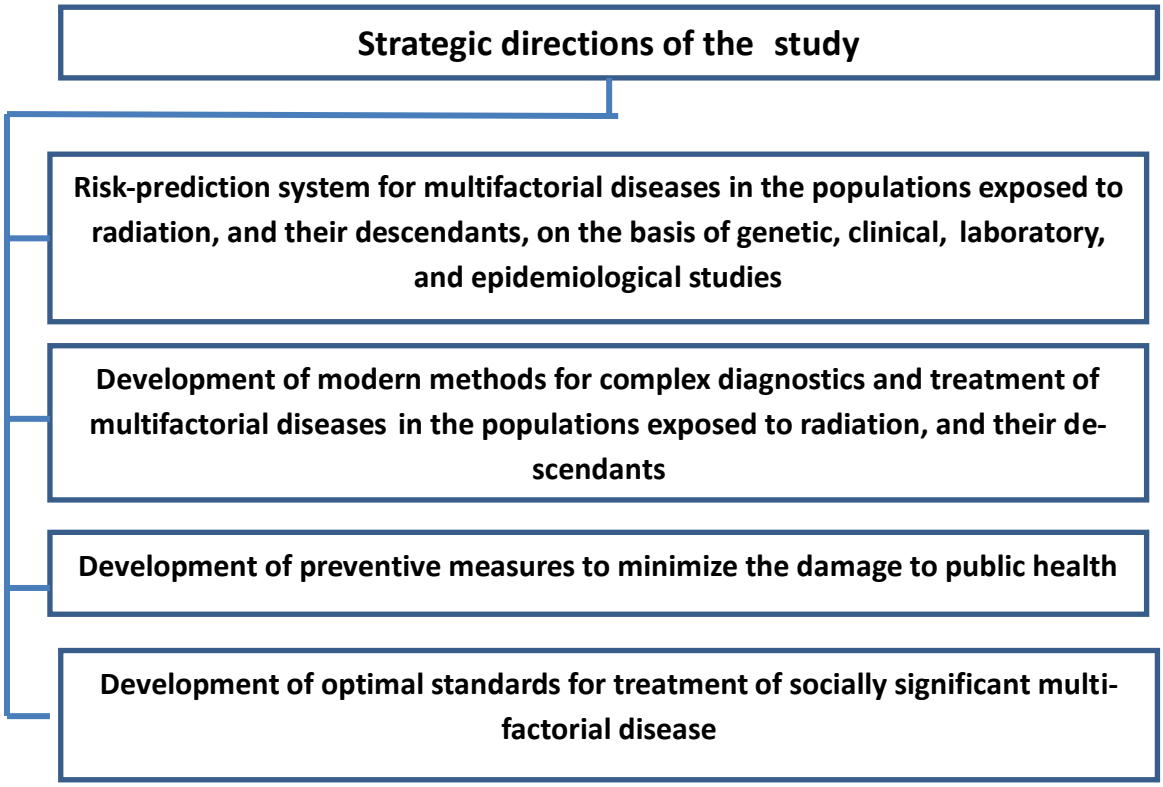


**Figure 4. The main strategic direction of the study.**

Currently, the staff of the University, together with colleagues from the University of Hiroshima, Shimane Medical University (Japan), Institute of Biophysics, Moscow (Russia) carried out the implementation of the international project, which aims is to study of the biological effects resulting from exposure to gamma radiation and reactor neutron irradiation (model equal to the flow of radioactive particles in the epicenter of the bombing of Hiroshima) on animals; assessment of biological effects in animals and their offspring using immunological, histochemical, cytogenetic and morphological studies; investigation of accumulated radiation doses using a high-tech method of dosimetry - electron paramagnetic resonance (EPR) in the enamel of the animal.

Semey State Medical University every year for over 20 years have been conducting International Scientific Conference "Ecology. Radiation. Health" dedicated to the study of the problems of radiation medicine, ecology and epidemiology. The conference is traditionally attended by scientists from Japan, Russia, United States, Kyrgyzstan, Slovakia, Sweden, Belarus. At the conference it is conducted the seminars, workshops for training of university staff and doctors to modern methods of diagnosis, treatment and rehabilitation of basic social diseases, the organization of health care. Our most successful students are awarded annually by our partner from Japan (Nagasaki University).

During 25 years after the closure of the Semipalatinsk nuclear test site, with the assistance of the international scientific community a lot of researches to assess and eliminate the consequences of its activity have been performed. At the same time, not all problems are solved until now. We invite all interested scientific and public organizations to effective cooperation.