Cohort study of residents near the Semipalatinsk nuclear test site in Kazakhstan – feasibility assessment

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Overall goal

Assess feasibility of establishing a long-term, prospective cohort study of the health effects of low and moderate radiation exposures resulting from nuclear weapons testing at the Semipalatinsk Nuclear Test Site (SNTS).

SNTS Background

- 18,500 km^2 in the Northeast of Kazakhstan near the city of Semey (formerly Semipalatinsk).
- 1949-1989: the Soviet Union conducted 456 nuclear tests at SNTS, releasing radioactive material into the soil and air.

Previous Studies

- Two cohort studies of residents surrounding the SNTS (Table).
- Overlap of participants in studies likely but currently unknown.

Objectives

The project will produce a detailed report summarizing the feasibility of an integrated cohort study.

Epidemiology

- Test the possibilities of record linkage of study participants between the two cohorts.
- Identify and review possible follow-up mechanisms for ascertainment of vital status and outcomes of interest (e.g., cause of death, cancer incidence, cardiovascular disease).
- Establish procedures for standardizing diagnostic criteria and evaluation of completeness of case ascertainment in the two cohorts.

Doses and Exposures

- Review existing reports on methods used to calculate dose in both cohorts.
- Identify the most important sources of information for estimating dose.
- Calculate individual doses using the two approaches developed in the two cohorts for a sample of individuals and compare results from the two approaches.

Project Partners

International Agency for Research on Cancer, France – Coordinator.
Norwegian Radiation Protection Authority, Norway.
Federal Office for Radiation Protection, Germany.
National Nuclear Centre, Kazakhstan.
Research Institute for Radiation Medicine Ecology, Kazakhstan.
National Institute of Radiological Sciences, Japan.

Table. Historical and New cohorts

Historical cohort

Characteristics

- Collaboration between Kazakh, German, and USA partners.
- *Prospective* study of 9,850 residents from 10 'exposed' and 9,604 residents from 6 'unexposed' settlements.
- All participants were born before 1 June 1961.
- Follow-up ended in 1999.

Dosimetry

- Methods developed by the US National Cancer Institute.
  - Thyroid dose range: 0 to 0.65 Gy for external dose and 0 to 9.6 Gy internal dose [1].

Study Results

- Weak evidence of radiation related risks of cardiovascular disease with increasing time since exposure [2].

Cross-sectional study

- Found increased risk of thyroid nodules [1].

New cohort

Characteristics

- Collaboration between Kazakh and Japanese partners.
- *Retrospective* study of 18,204 residents from 14 'exposed' and 6 'unexposed' settlements.
- Participants sampled more recently, including individuals born after 1961.
- Follow up ended in 2009.

Dosimetry

- Methods developed by National Institute of Radiological Sciences (Japan).
  - Whole body dose range: <0.6 Sv to 2 Sv.

Study Results [3]

- Increased risk of ischemic heart and circulatory system disease.
- Increased risk of cerebro-vascular disease.
- Increased risk of malignant neoplasms.

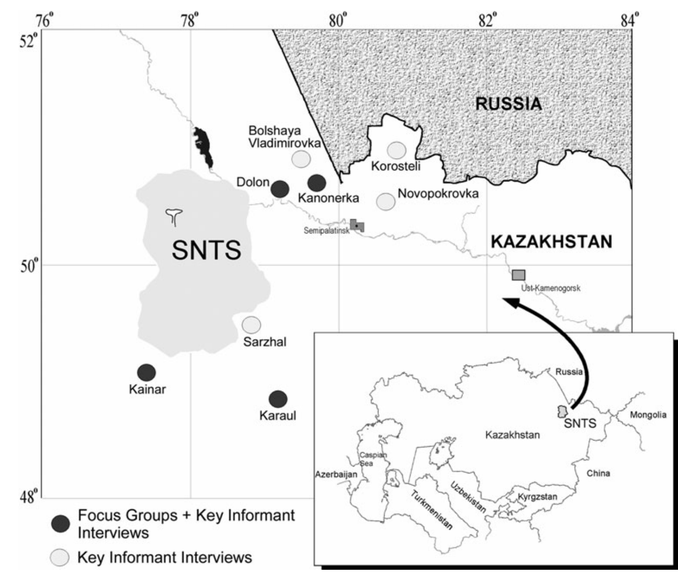
Chagan lake, also called "atomic lake," is still highly radioactive (*courtesy of Kyrmyzy Minkenova*)

Current status

- Study collaborators have successfully assessed the possibility of linking the two existing registry records which are the basis for the "new" and "historical" cohorts.
- Sources and mechanisms for obtaining mortality data have been evaluated; it was proven that vital statistics registries collect information of sufficient quality on all causes of mortality in the region.
- Evaluation of cancer incidence data from regional cancer registries is underway.
- Possible follow-up mechanisms for cardiovascular and cerebrovascular diseases have also been assessed.
- Blood samples have been collected for families across three generations, which may allow research into heritable effects of radiation exposure.
- Dosimetrists are assessing and comparing the dose reconstruction methods used in the two cohorts and investigating opportunities for additional data collection. These efforts will contribute to a final, feasibility report.
- If feasibility is demonstrated, this report will provide the foundation for a study protocol of a long term follow-up study of the health effects among residents exposed to fallout from the testing at the SNTS.

Registries

- Two registries of residents near the SNTS have been established. These registries contain all the participants in the historical and new cohorts.
- Both registries use official records, such as tax books, to determine residential history, and will be the basis for combining the two cohorts for future research.



Map of settlements around the SNTS (*Taken from Drozdovitch et al. 2011*)

This monument is in recognition of the Semipalatinsk bomb site (*courtesy of G. Hamra*)

References

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International Agency for Research on Cancer

World Health Organization

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