

Mortality study: updated results from the historical cohort study and further research perspectives

Bernd Grosche

Federal Office for Radiation Protection, Germany

bgrosche@bfs.de

Special thanks to Linda Walsh

Background

- “historical cohort”, set up by NIIRME
 - Exposed population: Cheremushka, Dolon, Kainar, Kanonerka, Kaskabulak, Karaul, Kundyzdy, Mostik, Sarzhal and Znamenka
 - Inclusion criteria
 - Born before January 1, 1961
 - confirmed permanent residence until the end of 1962

Background

- “historical cohort”, set up by NIIRME
 - comparison villages located several hundreds of kilometers east/southeast of the Semipalatinsk test site: Bol’shaia Bukon, Ivanovka, Karandykol, Kokpekty, Preobrazhenka or Ulguli-Malshi.
 - Inclusion criteria:
 - born before January 1, 1961
 - permanent residence

Background

- A further inclusion criterion for both sub-cohorts: “good general health” at start of follow-up
- This led to the exclusion of persons diagnosed with severe disease (for example, cancer or infectious disease such as tuberculosis or brucellosis)

Background

- complete vital status follow-up including emigration information
- For deceased cohort members, copies of death registration acts were stored in the archives of the “Dispanser No. 4.”

Background

- Causes of death were coded according to ICD-9.
- Follow-up procedures and ascertainment of causes of death were independent of exposure status.
- Quality control of coding procedures, searches for duplicates, and plausibility checks have been performed within the cohort database.

Size of the cohort

- Follow-up 01 Jan. 1960 – 31 Dec. 1999
- Entry: 1 Jan. 1960
- Exit
 - Date of death
 - Date of emigration
 - End of follow-up
- PersonYears 522,240

Dosimetry

- Using a US/Russian dosimetry approach
- As applied for the NCI thyroid study (Land et al., 2008)
- Available for six out of 10 settlements (7,699 out of 9,850 persons – 78.2%)
- External dose only
 - Mean 0.09 Gy; range 0 - .63 Gy

The historical cohort

TABLE 2
Historical Cohort by Ethnicity and Vital Status

			Vital status			Total
			Deceased	Alive	Emigrated	Ethnicity (%)
Ethnicity	Kazakh	Count	5249	7252	1727	14228
		Percentage of vital status	36.9%	51.0%	12.1%	73.1%
	Russian	Count	2261	1325	1640	5226
		Percentage of vital status	43.3%	25.4%	31.4%	26.9%
Total	Count	7510	8577	3367	19454	
	Percentage of vital status	38.6%	44.1%	17.3%	100.0%	

Vital status as of Dec. 31, 1999

	Deceased # (%)	Alive # (%)	Emigrated # (%)	# of cohort members
Exposed group	4,272 (43.4)	3,404 (34.6)	2,174 (22.1)	9,850 (100)
Settlement				
Cheremushki	248 (46.1)	160 (29.7)	130 (24.2)	538
Dolon/Budene	376 (40.0)	225 (23.9)	340 (36.1)	941
Kainar/Abraly	351 (46.4)	312 (41.2)	94 (12.2)	757
Kanonerka	529 (42.7)	466 (37.6)	244 (19.7)	1,239
Karaul	1,225 (43.2)	1,053 (37.1)	558 (19.7)	2,836
Kaskabulak	201 (39.0)	215 (41.8)	99 (19.2)	515
Kundyzdy	256 (41.8)	168 (27.4)	189 (30.6)	613
Mostik	218 (45.0)	136 (28.0)	131 (27.0)	485
Sarzhai/Sarapan	496 (49.0)	370 (36.5)	147 (14.5)	1,013
Znamenka	372 (40.7)	299 (32.6)	242 (26.5)	913
Comparison group	3,238 (33.7)	5,173 (53.9)	1,193 (12.4)	9,604 (100)

Study area and available NCI doses

TABLE 1
Exposure Characteristics of the Cohort by Settlement

Settlement	Persons	Date of test	Dose (Gy)			
			Mean	Minimum	Maximum	SD
Control area	9,604	n.a. ^a	0	0	0	0
Cheremushka	538	29 Aug 1949	n.a.	n.a.	n.a.	n.a.
Dolon	941	29 Aug 1949	0.39	0.0001	0.63	0.250
Kainar	757	24 Sep 1951	0.06	0	0.11	0.042
Kanonerka	1,239	29 Aug 1949	0.09	0.0002	0.15	0.059
Karaul	2,836	12 Aug 1953	0.05	0	0.08	0.026
Kaskabulak	515	12 Aug 1953	n.a.	n.a.	n.a.	n.a.
Kundyzdy	613	12 Aug 1953	n.a.	n.a.	n.a.	n.a.
Mostik	485	29 Aug 1949	n.a.	n.a.	n.a.	n.a.
Sarzhai	1,013	12 Aug 1953	0.06	0	0.09	0.033
Znamenka	913	24 Aug 1956	0.02	0.0006	0.03	0.008
Exposed and available estimate	7,699		0.09	0	0.63	0.145

^a Not available, not applicable

Relative Risks „exposed“ vs. „control“ population

Causes of death	Relative Risk	95% CI	Reference
All cardio-vascular diseases	2.27	[2.10;2.45]	Grosche et al., 2011
All solid cancers	2.42	[2.10;2.80]	Bauer et al., 2005
All causes of death	1.83	[1.74;1.91]	Bauer et al., 2005

Risk analysis

Adjusted for	levels
Gender	male, female
Attained age	10 years categories
Ethnicity	Kazakh, Russian
Calendar period	1960-69, 1970-79, 1980-89, 1990-99
Region	„exposed area“, „control area“
Time lag	10 years for cardiovascular diseases 5 years for solid cancers

Risk analysis for all cardiovascular diseases and for IHD

	Dose categories [Gy]						
	0	>0 – 0.05	>0.05-0.1	>0.1-0.3	>0.3-0.6	0.6+	ERR/Gy
PYRs	207,781	70,775	49,965	20,465	7,651	7,759	364,396
CVD	1.00	1.06	1.08	0.97	1.07	1.04	0.02
Cases	1,444	604	436	175	80	70	2,809
IHD	1.00	1.03	1.01	0.96	0.99	1.05	0.03
Lag=10yrs	804	321	226	96	40	39	1,526
IHD	1.00	1.03	0.96	0.94	1.11	1.04	0.14
Lag=20yrs	641	253	173	73	35	31	1,206

(mod. Grosche et al., Rad Res, 2011)

Strengths and limitations

- Strengths
 - Prospective character of the study's data collection
 - Excellent completeness of follow-up
- Limitations
 - High percentage of emigrants
 - More work on dosimetry is needed
 - Further follow-up needed, but not yet tested

Research perspectives

- Increasing the cohort
 - Dosimetry for further settlements
 - Expanding the catchment area
 - Extending the follow-up period
- Integrating biological and epidemiological studies
- Setting up the 3-generation study

3-generation study

- 23,960 families in the registry
- 13,692 families with information on 2nd generation
- 10,268 families with information on 3rd generation
- *Process for data abstraction has started, but incomplete*

Thank you very much for your attention



Part of this work, namely the follow-up of the cohort, was funded by the European Commission under contract IC15-CT98-0218.

Participation of C. E. Land and S. L. Simon was made possible by an Intra-Agency Agreement between the U.S. National Institute of Allergy and Infectious Diseases and the U.S. National Cancer Institute, NIAID agreement no. Y2-A1-5077 and NCI agreement no. Y3-CO-5117.

Data abstraction was funded within DoReMi (Grant Agreement 249689)

B. Grosche, SEMI-NUC, Munich, Nov. 2015

| Verantwortung für Mensch und Umwelt | ■ ■ ■ ■ ■ ■ ■

SEMI-NUC