Long Term Effects of Low Dose Radiation in Healthcare Professionals

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Safety in Imaging and Radiation Treatment

Purpose

To explore the relationship between dosimetry-based occupational exposure to ionizing radiation and...

- ✓Cancer
- ✓Non-cancer pathology
- ✓Reproductive health

} in health professionels

Has radiation risk been studied?

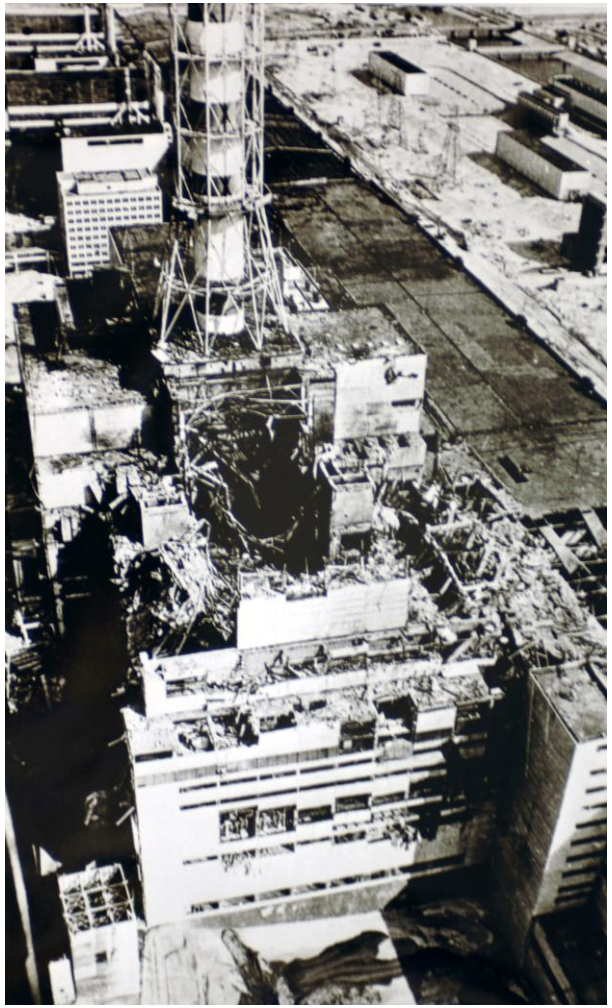
Large doses Short time ≠ Small doses Long time

We can only use large exposures to a limited extent.

Studies on healthcare professionals?

Challenges: Estimated radiation doses, small groups, self-reporting and lack of control groups

Findings: Increased occurrence of cancer, cataracts, and cardiovascular diseases.



Chernobyl, 4 months after the accident (1986)

Danish registers

CPR Register: Unique ID system (since 1968) links data across healthcare, social services, and more, enabling longitudinal studies.

National Health Registers

1. **Patient Register**: Tracks hospital visits and diagnoses (since 1977).
2. **Prescription Registry**: Records all pharmacy-dispensed prescriptions (since 1995).
3. **Cancer Registry**: Data on cancer incidence (since 1943).
4. **Causes of Death Register**: Comprehensive mortality data.
5. **Fertility Register:** (established in 1994 but contains retrospective data dating back to 1980).
6. **Legally Induced abortions Register**: Established in 1973 and records all legally induced abortions performed in DK.

Socioeconomic Registers: Data on education, employment, and income, allowing for studies on social determinants of health.

Strengths

1. Nationwide coverage and comprehensive data.
2. Data linkage via CPR numbers.
3. Decades of longitudinal data, enabling robust research.

Global Impact: Denmark's registers are considered gold-standard in population-based research.

The Danish National Institute of Radiation Protection Register

Data Availability: Electronic dosimeter data is available from the 1990s onwards. Earlier data exists in paper format stored in the basement, but only for dosimeter readings above 0.5 mSv.

Dosimeter Technology: Film-based dosimeters were used until around 10 years ago, after which TLD (thermoluminescent dosimeter) tablets were adopted due to the decreasing availability of analog films. There should be no significant difference in data quality between these methods.

Dosimeter Types and Measurements:

- Dosimeter readings are divided into **skin dose** and **whole-body dose**. The difference between the two is based on the filtering applied within the dosimeter:
  - **Skin Dose:** Measures radiation penetrating approximately 0.07 mm into the skin.
  - **Whole-Body Dose:** Measures radiation penetrating around 10 mm into tissue.

The Danish National Institute of Radiation Protection Register

Measurements began in 1965, covering a total of approximately 60,000 people.

16,000-36,000 SRP doses in the paper archive (1965-1990) (is now being digitalised - SIRT)

År	Totaldosis	Estimeret antal doser >= 0,5 mSv
1965	4.886	1713
1966	6.157	2159
1967	6.718	2356
1968	6.814	2389
1969	6.816	2390
1970	5.572	1954
1971	5.100	1788
1972	5.465	1916
1973	4.362	1530
1974	4.469	1567
1975	4.453	1561
1976	3.993	1400
1977	4.029	1413
1978	4.777	1675
1979	4.005	1404
1980	3.514	1232
1981	3.013	1056
1982	3.113	1092
1983	2.974	1043
1984	2.645	927
1985	2.547	893
1986	2.479	869
1987	2.102	737
1988	1.826	640
1989	1.791	628
1990	1.868	655
I alt	(1965 - 1989)	36334

The digital archive:

	April 2023	ultimo 2021		April 2023 - Mænd	April 2023 - Kvinder
Personer med SRP-doser (eff. Dosis) og CPR	62.852	60.783		22.316	40.521
- heraf m. SRP-doser > 0 mSv	28.370	27.004		10.125	18.241
- heraf m. SRP-doser > 0 mSv modtaget for mere end 10 år siden	18.836	15.669		7.322	11.511

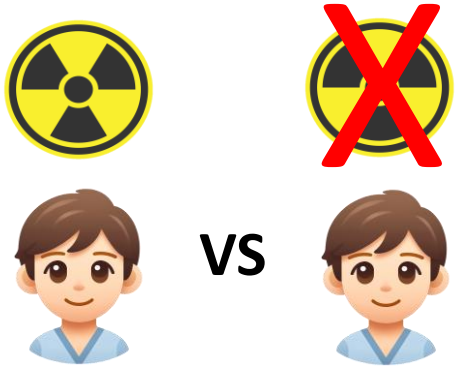
Heard from students and radiographers

"I would never want to work in nuclear medicine due to the radiation."

"My colleague worked in intervention for many years and got cancer. I wonder if they are related."

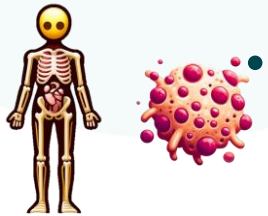
"I have trouble getting pregnant. My mom says it's my own fault for working in this field."

Ongoing and future research



Cases: Using the Danish National Institute of IR Protection registry and linking the data to the CPR register.

Data Handling: Secured and encrypted server hosted by Statistics Denmark.



- *Cancer: overall risk of cancer, as well as specific cancer types, examining incidence, prevalence, and cancer-related mortality.*

- *Non-cancer pathology: specific pathologies expected to be associated with exposure include, but are not limited to, cataract, cardiovascular diseases, neurological diseases,and dementia.*

- *Reproductive health: risk of reproductive problems, infertility, abortions due to abnormalities/intrauterine fetal death and need for IVF treatment.*

Ongoing related research

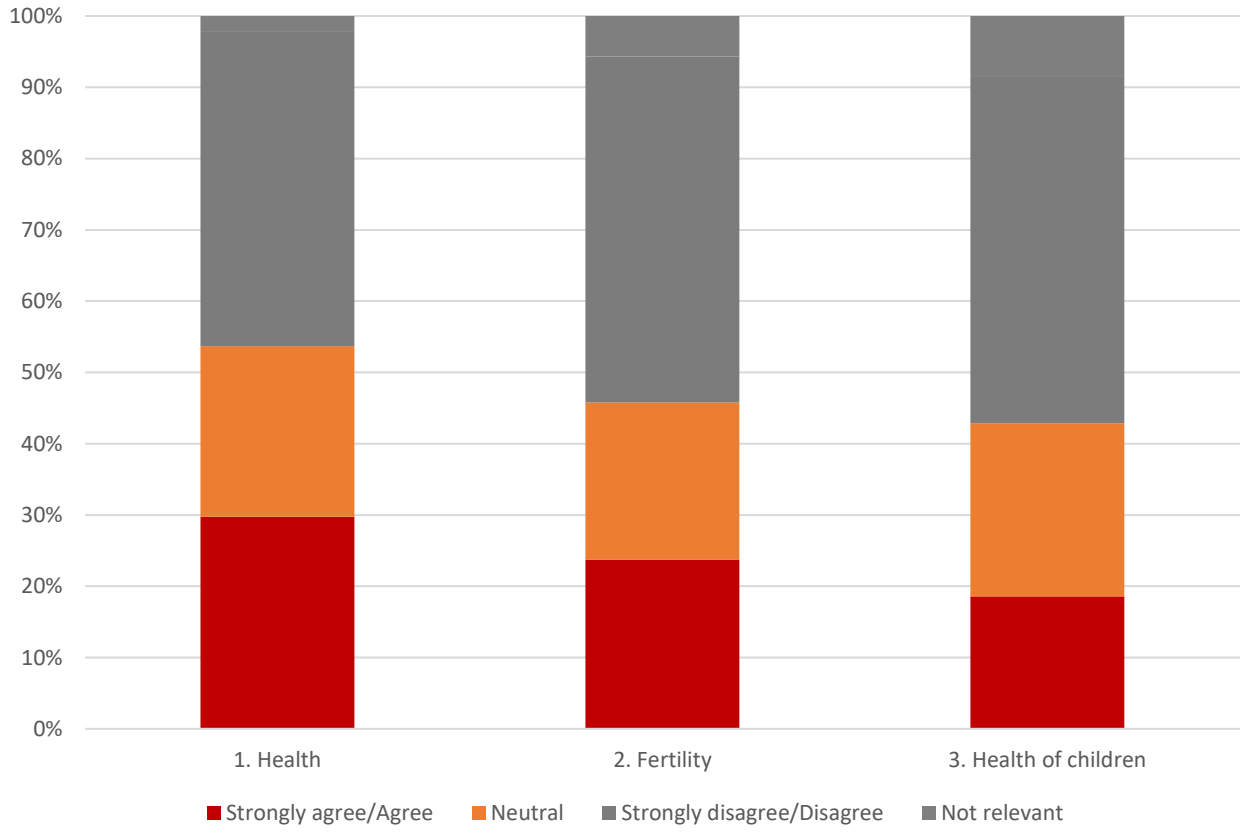
Scoping review - Ionising Radiation Induced Non-Cancerous Pathology Amongst Healthcare Personnel

Questionnaire for European Radiographers Published.

Questionnaire for nurses working with radiation.

Questionnaire for medical doctors working with radiation.

Results - Health and Safety Concerns



1. I think that **my** occupational exposure to radiation **may have** a negative impact on my **health** (not considering fertility).

2. I think that **my** occupational exposure to radiation **may have** a negative impact on my fertility (including miscarriages).

3. I think that **my** occupational exposure to radiation **may have** a negative impact on the health of my children due to radiation exposure of the featus, eggs or sperm.

No significant differences between sex.

Research Team & Funding







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Thank you

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