

BEIR VII: Update on the risks of “low-level” radiation

Overview of the main findings
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Overview

- Radiation risks somewhat higher than prior estimate
- Cancer incidence and mortality risks
- Risks by age and gender
- Some non-cancer risks, including heart disease and stroke at higher levels of exposure
- Various risk hypotheses studied
- Detailed look at latest radiation risk literature
- Synergisms with chemicals not examined

Linear No-Threshold (LNT)

- BEIR VII re-affirms LNT hypothesis
- Hiroshima-Nagasaki and 10 rem
- Cellular level evidence for LNT
- Risk for low doses and low dose rates estimated to be somewhat lower than single dose risk
- Hormesis and thresholds considered but not endorsed as representing best scientific view of low-dose risk
- Genetic variation in population combines with environmental factors

BEIR VII Overview

	Males	Females	Ratio	Average
Incidence, all	900	1370	1.52	1135
Mortality, all	480	660	1.38	570
Incidence, solid	800	1300	1.63	1050
Mortality, solid	410	610	1.49	510

BEIR V and BEIR VII cancer fatalities

All cancers	Males	Females	Ratio	Average
BEIR V	770	810	1.05	790
BEIR V, w/DREF=2	385	405		395
BEIR VII, DREF = 1.5	480	660	1.38	570
Ratio, BEIR VII/adj. BEIR V	1.25	1.63		1.44

Risk Factors currently in use

- Generally used reference risk for workers: 0.04 fatal cancers per Sv (BEIR V with DREF = 2; note no DREF actually recommended in BEIR V)
- Generally used reference risk for general public: 0.05 fatal cancers per Sv
- Risk factor in EPA Fed. Guidance Report 13 (FGR 13): 0.0575 fatal cancers per Sv
- BEIR VII (average for men and women): 0.057 fatal cancers per Sv
- Incidence, FGR 13: 0.0846 cancers per Sv
- Incidence BEIR VII: 0.1 cancers per Sv
- BEIR VII risks incorporate DREF = 1.5

Male female cancer details incidence per million rem

Incidence			
Age	0 (infant)	5	30
Colon, male	336	285	125
Colon Female	220	187	82
Lung, male	314	261	105
Lung female	733	608	242
Breast, female	1171	914	253
Thyroid male	115	76	9
Thyroid female	634	419	41
Other solid male	1123	672	198
Other solid female	1339	719	207
leukemia, male	237	149	84
leukemia, female	185	112	63
All solid, male	2326	1667	602
All solid, female	4592	3265	1002
All, male	2563	1816	686
All, female	4777	3377	1065

Ratios female/male cancer risk

Ratio	Ratio infant	Ratio 30 yr	Incidence	
infant/30 yr	female/male	female/male	Age	
2.69	0.65	0.66	Colon, male	
2.68			Colon Female	
2.99	2.33	2.30	Lung, male	
3.03			Lung female	
4.63			Breast, female	
12.78	5.51	4.56	Thyroid male	
15.39			Thyroid female	
5.67	1.19	1.05	Other solid male	
6.47			Other solid female	
2.82	0.78	0.75	leukemia, male	
2.94			leukemia, female	
3.86	1.97	1.66	All solid, male	
4.58			All solid, female	
3.74	1.86	1.55	All, male	
4.49			All, female	

Heritable effects (BEIR VII, p. 20)

- “Adverse health effects in children of exposed parents...have not been found”
- “there are extensive data on radiation-induced transmissible mutations in mice and other organisms”
- “There is therefore no reason to believe that humans would be immune to this sort of harm.”