

Thank you to our hosts for this opportunity to speak; and Thank You World Family, so many of you gathering here; thank you for listening.

Nuclear, is war of human consequences.

The Cold War promised “mutual destruction.” Cities were made into targets. Vaporizing large numbers of people was the strategy.

Now we know, even regional use of nuclear weapons would cause global damage.

It is my job to give a summary of the medical consequences of using these weapons.

My slides will be published on line with citation and references.

Resources:

International Physicians for the Prevention of Nuclear War:

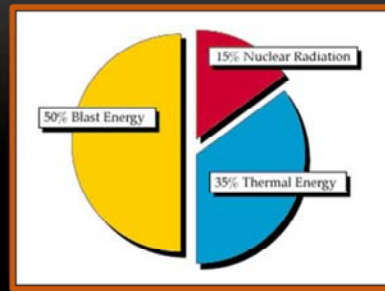
<http://www.ippnw.org/pdf/1998ForrowJAMA.pdf>

“From Hiroshima to **Mutual Assured Destruction** to Abolition 2000.” Lachlan Forrow, MD; Victor W. Sidel, MD; reprinted from the Journal of the American Medical Association, August 5, 1998; Vol 280, No 5, pages 456—461.

European Leadership Network: 2014. Ambassador A. Kmentt.

http://www.europeanleadershipnetwork.org/avoiding-the-worst-re-framing-the-debate-on-nuclear-disarmament_1558.html

The energy profile of a nuclear explosion:



A nuclear explosion is composed of three types of energy:
Blast, Heat, and Radiation.

All of these have both immediate and long-term medical consequences.

Broad Resources:

The Bulletin of Atomic Scientists; <http://thebulletin.org/search/topics/nuclear-weapons>

Union of Concerned Scientists:

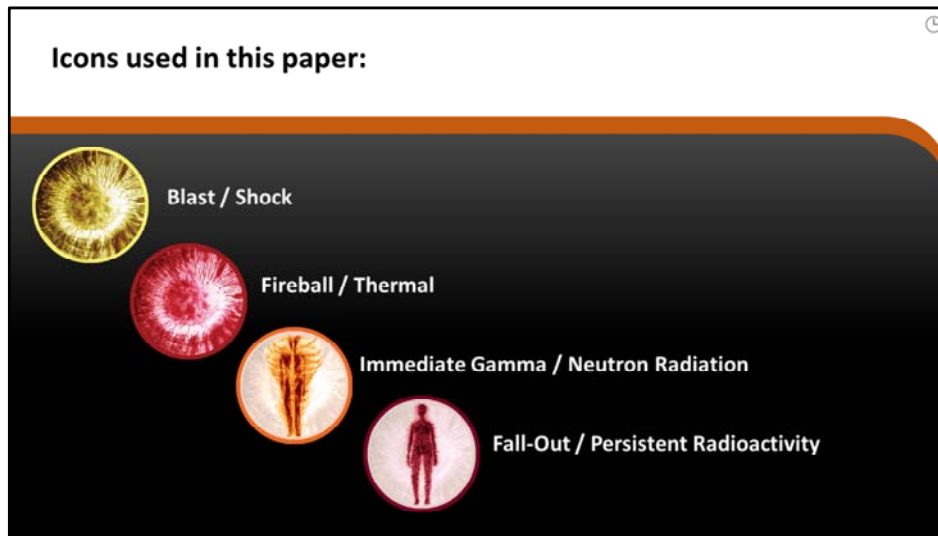
<http://www.ucsusa.org/our-work/nuclear-weapons#.VHpzhDHF8xl>

International Atomic Energy Agency – Tools for Nuclear Inspection (factsheet):

<http://www.iaea.org/sites/default/files/inspectors.pdf>

Reaching Critical Will: <http://www.reachingcriticalwill.org>

The disarmament arm of Women's International League for Peace and Freedom.



I am using four ICONS to track how each type of energy from these weapons impact human health:

- Yellow is Blast.
- Red is Thermal.
- Orange is Immediate Gamma / Neutron Radiation.
- Purple is longer lasting radioactivity from the atomic fission products.

Today Nuclear Weapons are very much larger than in 1945, but the forces are the same.

Art Credit:

Original Figures and Emblem by Loren Olson.

Icon formatting, Saro Lynch-Thomason, Fullsteam Labs.



More than 2000 nuclear explosions that have already occurred.

Every nuclear explosion results in harm to human health and our environment. Our planet is already contaminated, even without waging a full-scale nuclear war.

I am asked to talk about the consequences of using nuclear weapons so I will focus on Hiroshima and Nagasaki, Japan. In August 1945 the United States bombed Hiroshima and Nagasaki, Japan. More than 150,000 people were killed then, and more over time. We heard today as many as 250,000.

I need to acknowledge the personal side of this:

My government chose to use the first nuclear weapons on cities full of people. Five years later, the US initiated a long-term study of the atomic bomb survivors.

Researchers assumed that humanitarian aid might "skew the results" of their study and so medical treatment was not offered to the victims.

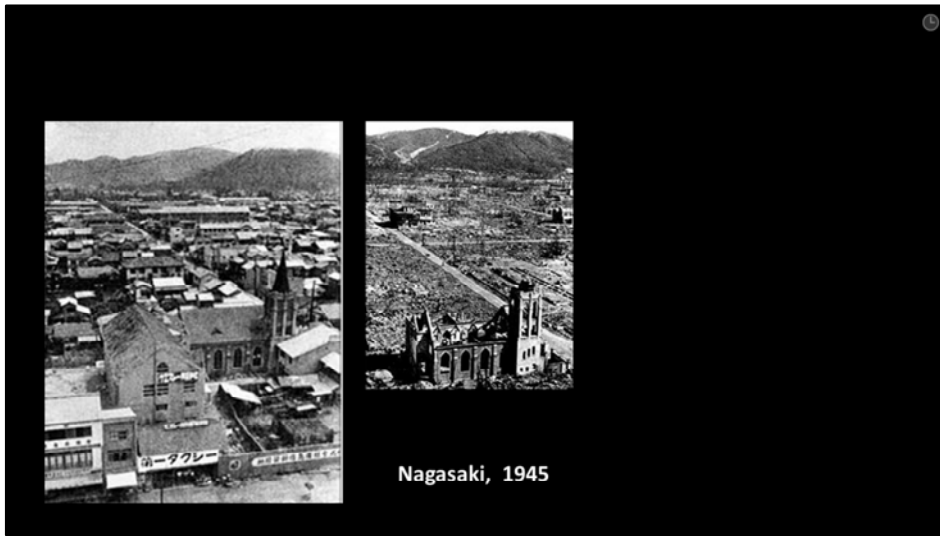
Today, the data from that study is used widely, including by me, here, today. Most published studies do not acknowledge this. Speaking only as one woman, I need to say I am sorry. I regret this history.

Art Credit:

This image, used with permission from Mr. Hashimoto is a screen capture from a short film by Isao Hashimoto, entitled "1945-1998." posted here:

<http://www.ctbto.org/specials/1945-1998-by-isao-hashimoto/>

The DVD which shows the progression of nuclear explosions between 1945 and 1998, more than 2000 in all, is also available from the artist.



Nagasaki. 1945.

The church is in both frames...

Today this size of bomb would be considered a "tactical" or small weapon.

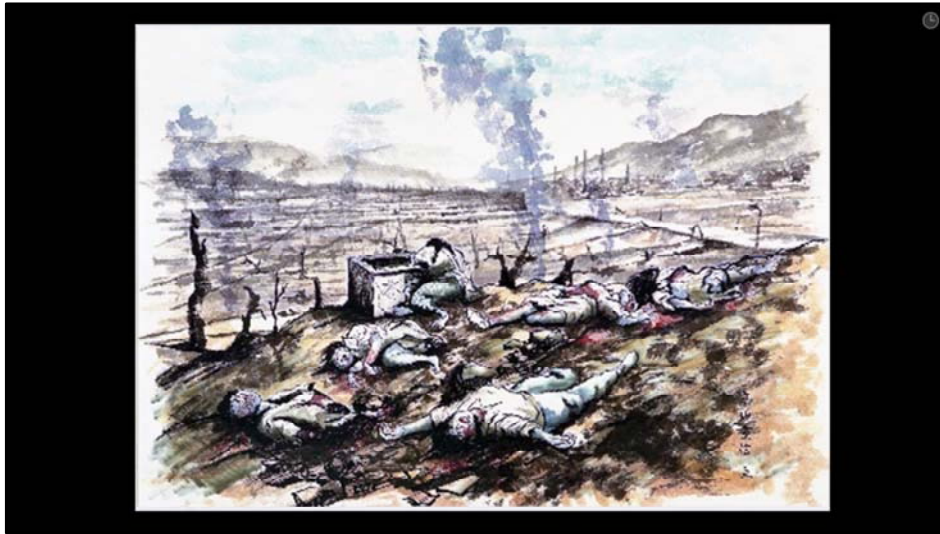


First is the shockwave.
Pressure waves form in living tissue;
The body's lungs and other membranes rupture.

Internal bleeding and embolisms cause immediate death.

Reference:

Dr. Helen Caldicott, 2004, "The New Nuclear Danger," The New Press, NY, NY.



A Hibakusha from Nagasaki who witnessed this destruction, made this painting from memory.

Art Credit:

Painting by a Hibakusha from Nagasaki, recording events witnessed. Made available by Hibakusha Stories Project; <http://www.hibakushastories.org/>



Thermal: Immediate medical consequences

At Ground Zero temperatures are as hot as the surface of the sun
(7000° F / 3800° C)

Resulting winds of 160 -- 500 mph / 250 -- 800 kph leveling
people, homes and vegetation;

Immediate updraft of mushroom cloud carries particulate to
atmosphere.

Temperatures are as hot as the surface of the sun resulting in:

- Immolation
- Asphyxiation
- Burns

The heat creates winds up to 800 kilometer per hour, leveling everything in the way.

Sources:

The Atomic Bombings of Hiroshima and Nagasaki :

Chapter 18 - Characteristics of the Injuries to Persons

("This report has been compiled by the Manhattan Engineer District of the United States Army under the direction of Major General Leslie R. Groves.") circa 1945 – no date given

http://avalon.law.yale.edu/20th_century/mp18.asp

Hiroshima by John Hersey

<https://archive.org/details/hiroshima035082mbp>

An account of a visit to the remains of Hiroshima, published in The New Yorker in August, 1946.







Immediate Air Radiation levels:
Lethal if not shielded

Hiroshima:

Gamma rays: 10,300 rads / 103 Gy;

Estimated neutrons: 14,100 rads / 141 Gy

Nagasaki:

Gamma rays: 25,100 rads / 251 Gy

Estimated neutrons: 3,900 rads / 39 Gy

Lethal level ~ 4.5 Gy

A dose of ionizing radiation of 4.5 Grays is considered lethal.

These levels far exceed that.

If not shielded, flesh is literally cooked.

Source of information:

http://atomicbombmuseum.org/3_health.shtml

Resources on Ionizing Radiation:

Nuclear Information and Resource Service:

<http://www.nirs.org/radiation/radiationhome.htm>

Institute for Energy and Environmental Research:

<http://ieer.org/resource/classroom/measuring-radiation-terminology/>

Dr. Ian Fairlie is an independent researcher in radiological impacts; his collection of articles of interest is here:

<http://www.ianfairlie.org/scientific-references/>



Acute High-Dose Ionizing Radiation: Immediate Medical Consequences

In the human body systemic failure is in three forms:

1. (> 30 Gy whole body) **Cerebrovascular syndrome**
2. (6 to 30 Gy whole body) **Gastro-Intestinal syndrome**
3. (1 to 6 Gy whole body) **Hematopoietic syndrome**

The systemic failure of the human body comes in three forms:

Number 1: **Cerebrovascular syndrome:**

cerebral edema; is immediate and always fatal within hours to 1 or 2 days;

Number 2: **Gastro-Intestinal syndrome:**

Intestinal lining cells die; Nausea, vomiting, and diarrhea, leading to severe dehydration;

Plasma volume falls, veins collapse;

Necrosis of intestine; Death is common.

Number 3: **Hematopoietic syndrome:**

Bone marrow IS Depleted;

Circulating blood is not replenished;

Increased of infections and hemorrhaging

Survivors have an increased incidence of radiation-induced cancer, including leukemia.

Citations:

J. Radiol, 1984. May; 57(677):355-69.

The LD50 for uniform low LET irradiation of man.

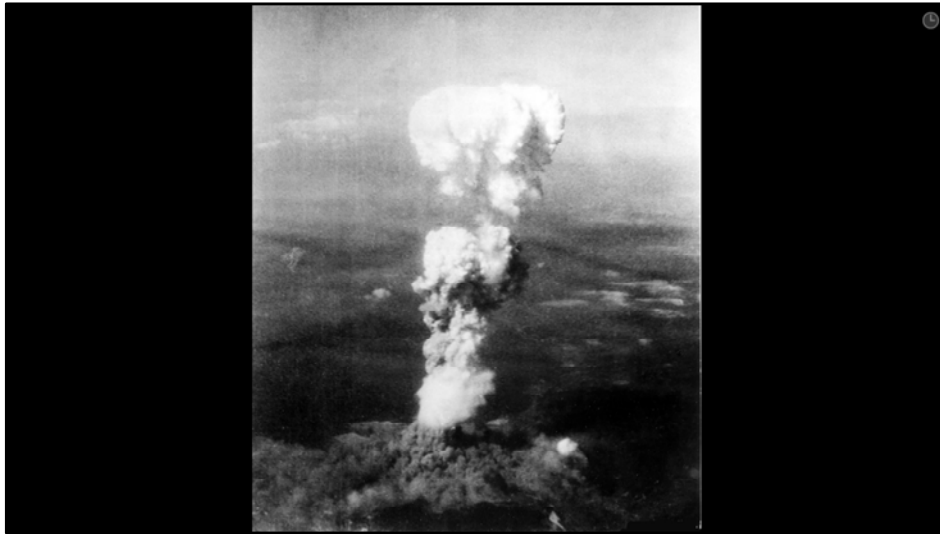
<http://www.ncbi.nlm.nih.gov/pubmed/6372928>

Characterization of systemic failures;

http://www.merckmanuals.com/professional/injuries_poisoning/radiation_exposure_and_contamination/radiation_exposure_and_contamination.html

More details:

http://atomicbombmuseum.org/3_health.shtml



This photo was taken from the plane that dropped the bomb on Hiroshima.

It is a mistake to say that this photo is of the bomb.

This cloud is what was, moments before:

buildings,

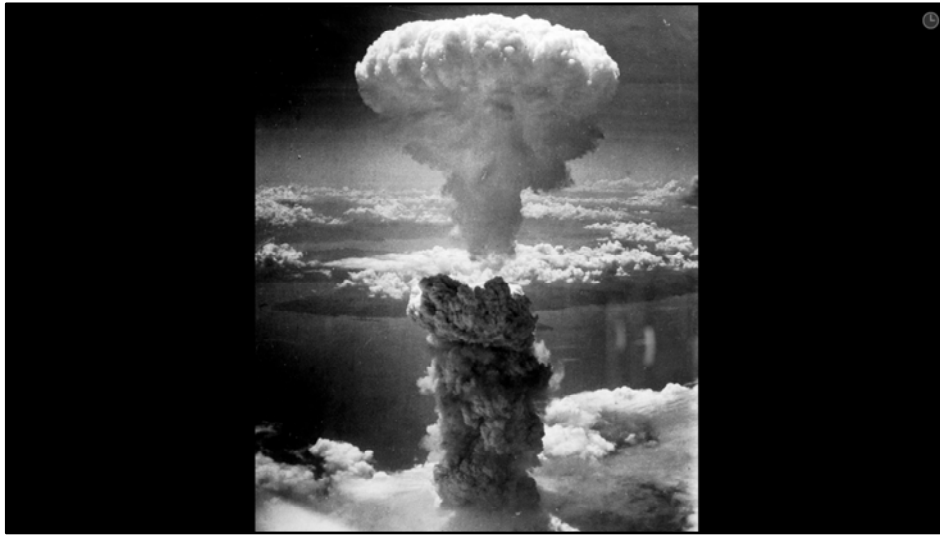
trees,

homes,

girls,

boys,

women and men.



And this was the City of Nagasaki.

Nuclear weapons are inherently indiscriminate.



Immediate Fatalities

City	Estimated Population at the time of the bombing	Estimated number of acute deaths (with 2 – 4 months)
Hiroshima	340,000 – 350,000	90,000 – 166,000
Nagasaki	250,000 – 270,000	60,000 – 80,000

Source: Radiation Effects Research Foundation

At least 150,000 men, women and children died in 1945 from these two nuclear weapons; and over time, many more.

Source for data reported in the table:
Radiation Effects Research Foundation.
http://www.rerf.jp/general/ga_e/ga1.html



Now we turn our attention to those who survived those first months.

Photo Credit: Nagasaki Atomic Bomb Museum, via Hibakusha Stories Project.



Community Infrastructure Gone

At Hiroshima, 270 of 300 Doctors perished
and also 1654 of 1780 nurses

Source: ICRC Resource Center

Families and homes gone.

Social infrastructure gone.

There was little help for those suffering injury or burns.

Most of the medical community perished in the initial blast.

Today's weapons very much larger.

Source for loss of medical personnel:

International Red Cross Resource Center

The Hiroshima disaster – a doctor's account

12-09-2005

Extracts from the journal written by the ICRC's Dr. Marcel Junod, the first foreign doctor to reach Hiroshima after the atom bomb attack on 6 August 1945, and to treat some of the victims.

<https://www.icrc.org/eng/resources/documents/misc/hiroshima-junod-120905.htm>

The Cities of Hiroshima and Nagasaki have created educational museums. These links are to the websites created by these organizations:

http://www.pcf.city.hiroshima.jp/index_e2.html

<http://www.city.nagasaki.lg.jp/peace/english/abm/>



Climate and Public Health Impacts

- Firestorms from 100 Hiroshima-size bombs used against modern cities would inject 5 teragrams of smoke and soot into the atmosphere, blocking sunlight from reaching the Earth.

International Physicians for the Prevention of Nuclear War Action Kit on Humanitarian Impacts of Nuclear Weapons: <http://hinwcampaignkit.org/>

The blast pulverizes the city. The heat burns that and then the updraft sucks particles high up into the atmosphere, creating a shroud.

Resources:

International Physicians for the Prevention of Nuclear War, Campaign Kit, Banning Nuclear Weapons: the Humanitarian Facts, posted Nov 2014

<http://hinwcampaignkit.org/table-of-contents/>

Ira Helfand, IPPNW, “Nuclear Famine: 2 Billion People at Risk” second edition; 2013.

<http://www.ippnw.org/pdf/nuclear-famine-two-billion-at-risk-2013.pdf>



Without direct sunlight, green plants cannot grow well.

Agricultural crops and natural ecosystems fail.

In the event of a full-scale nuclear war, these climate impacts would be global and are named “Nuclear Winter.”

Resources:

In 1983 Carl Sagan published a pamphlet entitled “Nuclear Winter.” Now out of print, the document outlined a remarkable finding: even if only Super Power side fired its nuclear arsenal, it would still result in global destruction of the climate due to a shroud of particulate material in the atmosphere. Without direct sunlight for years, green plants and all those who eat them would die.

2007, Robock, Oman and Stenchikov published: “Nuclear Winter Revisited with a Modern Current Climate Model and Current Nuclear Arsenals: Still catastrophic Consequences.” Printed in the Journal of Geophysical Research, Vol. 112, D13107 (14 pages) and posed: <http://climate.envsci.rutgers.edu/pdf/RobockNW2006JD008235.pdf>




International Physicians for the Prevention of Nuclear War have published a number of papers on the climate impacts of even a limited nuclear war. The most recent study projects a staggering 2 billion deaths from what is now called Nuclear Famine.

Resources:

Ira Helfand, IPPNW, "Nuclear Famine: 2 Billion People at Risk: Global Impacts of Limited Nuclear War on agriculture, food supplies and Human Nutrition," second edition, 2013. Posted here: <http://www.ippnw.org/pdf/nuclear-famine-two-billion-at-risk-2013.pdf>

Steven Starr, Senior Research Scientist for Physicians for Social Responsibility has compiled many references on "Nuclear Darkness" posted here:

<http://www.wagingpeace.org/references-on-high-alert-and-nuclear-famine-dangers/>



Ionizing Radiation: No Safe Dose

- All regulatory agencies acknowledge that every exposure to ionizing radiation carries risk of harm:

**There is no “safe” dose of ionizing radiation:
It is not safe for adult males.
Recent findings:
Ionizing radiation is even less safe for children and for females.**

THIS SLIDE SKIPPED IN PRESENTATION due to time limitations – included here for reference.

Citation and Resources:

Nuclear Information and Resource Service: Factsheet, “The Myth of the Millirem” posted:
<http://www.nirs.org/factsheets/mythmiliremftsht.htm>

Dr. Rosalie Bertell, 2000; “No Immediate Danger? Prognosis for a Radioactive Earth.”
Summertown Books.

Dr. Helen Caldicott, 1994. “Nuclear Madness.” WW Norton Co.

Dr. John Gofman, 1990. “Radiation Induced Cancer from Low-Dose Exposure: an
Independent Analysis.”

Much of the book is posted here (no fee):

<http://www.ratical.org/radiation/CNR/RIC/contents.html>

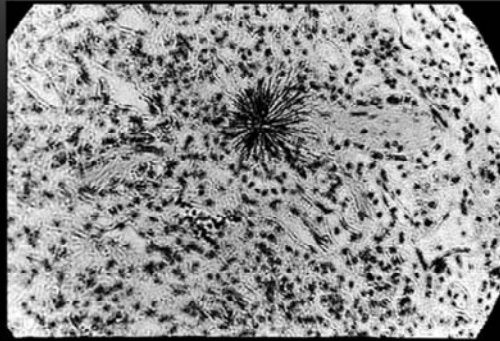
Møller AP and Mousseau TA(2012) The effects of natural variation in background
radioactivity on humans, animals and other organisms. Biological Reviews
DOI: 10.1111/j.1469-185X.2012.00249.x

Ian Fairlie, 2013. “Recent Evidence on the risks of very low doses of radiation” posted:

<http://www.ianfairlie.org/news/recent-evidence-on-the-risks-of-very-low-level-radiation/>



Visible damage from Plutonium emitting alpha radiation in lung tissue



THIS SLIDE SKIPPED IN PRESENTATION due to time limitations – included here for reference.

This is a photograph of the damage to lung tissue from alpha particles coming from some plutonium, located in the center of the black starburst.

Alpha particle emissions inside the body may damage cells and cell structures 1000 times more than an external gamma or X-ray

An internal dose of radioactivity may be so local in impact that there is “no” dose to the whole body; nonetheless, cancer may result.

Photo Credit:

Robert Del Tredici (used by permission).

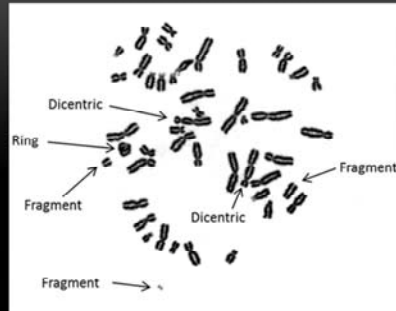
Resources with discussions of internal v external radiation exposure.

<http://www.euradcom.org/>

<http://www.euradcom.org/2011/2009confproc.htm>



Radiation Induced Chromosomal Aberrations, as seen with microscope

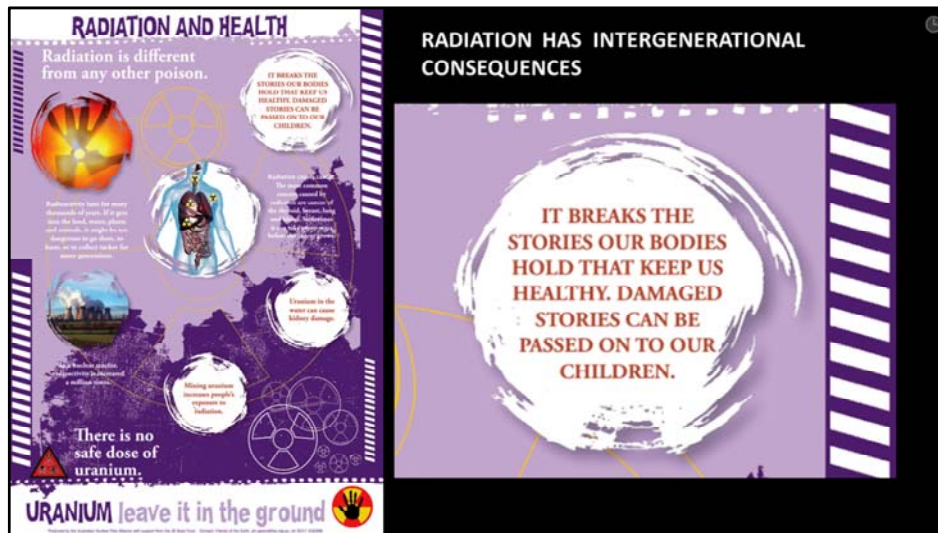


Radiation is invisible but we can see the damage it has done to these chromosomes.

Resources:

Dicentric and other chromosomal aberrations are common in people who have suffered acute radiation exposure. The damaged chromosomes are found in white blood cells and can be assessed as a biological dosimeter. More information here:

http://www.rerf.jp/radefx/late_e/chromoab.html



Some traditional communities in Australia say the same thing this way:

“Radiation: Breaks the stories our bodies hold that keep us healthy. Damaged Stories can be passed on to our children.”



Ionizing Radiation: Non-Cancer Medical Impacts



Radiation impacts our cells.
When the reproductive cells are harmed, deformations are one outcome.
This happens to all babies: plants, animals, humans.

We also suffer:
Loss of fertility;
Spontaneous abortion and miscarriage;
Possible heritable mutations;
Avoidance of reproduction due to uncertainty.

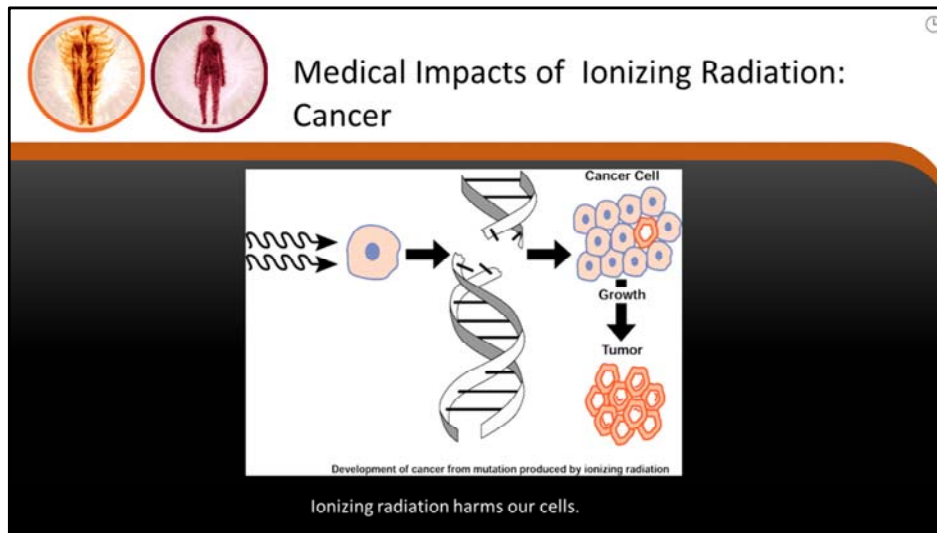
Resources:

Impact on radiation exposure on reproduction has been very difficult to study in human beings. The work of Moller and Mousseau on species with a shorter life span (birds, bugs, plants) shows that ionizing radiation does reduce population size, results in mutations that are heritable and that some of the mutations are expanding in populations outside the initial study areas near Chernobyl and Fukushima. See:

http://www.academia.edu/1376987/Abundance_of_birds_in_Fukushima_as_judged_from_Chernobyl and:

<http://cricket.biol.sc.edu/chernobyl/papers/moller-et-al-Ecol-Ind-2013.pdf>

Radiation exposure can also lower our overall immune function, leading to many symptoms like increases in other illness, chemical intolerance and in the extreme and AIDS-like syndrome.



Cancer is the most studied long-term consequence of non-lethal radiation exposure.

WHEN genetic material inside a living cell is damaged, sometimes our bodies can repair that damage. Otherwise the abnormal cell may sit quietly in the body for years or even decades before it makes us sick.

There is no way to predict which exposure will result in cancer. In general, more radiation equals more cancer risk. However, even an exposure too small to measure could, sometimes, result in cancer death.

Resources

Previous pages have listed some of the classic authors on radiation of the 20th century. The National Institute of Environmental Health in the United States published this broader piece “Cancer and the Environment: What You Need to Know.” posted:

http://www.niehs.nih.gov/health/materials/cancer_and_the_environment_508.pdf

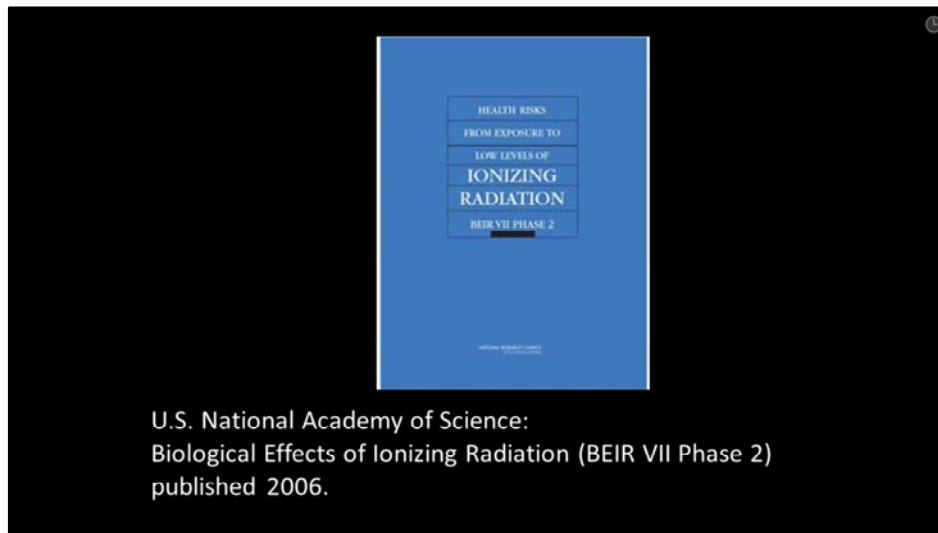


Children's bodies are small; so the same amount of radiation delivers a larger dose.

Since children are growing, the cells in their bodies are dividing more rapidly. The DNA in cells is more likely to be damaged when in cell division.

Art Credit:

Saro Lynch-Thomason, Fullsteam Labs

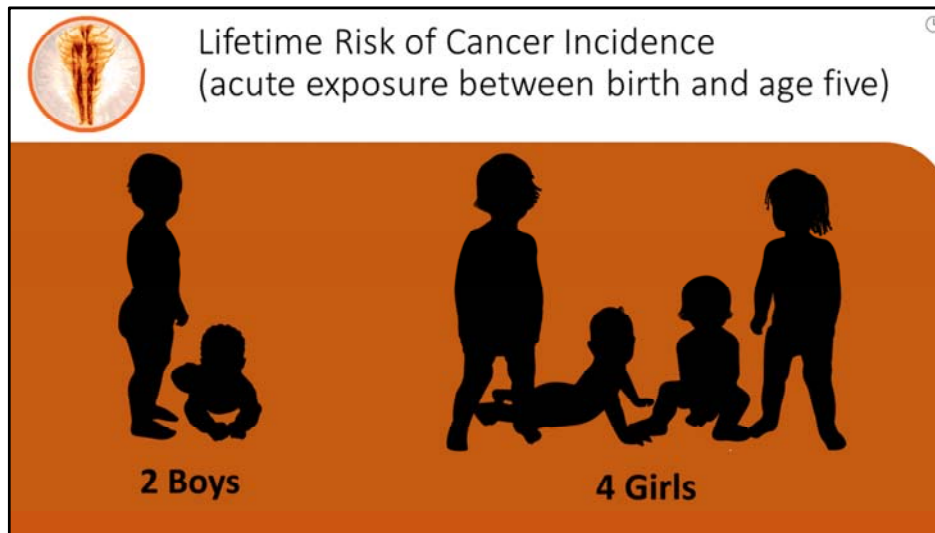


This 2006 report, the Biological Effects of Ionizing Radiation, #7, also called BEIR VII is the source of the data for the findings I am about to present. The data in the report is primarily from the survivors of the Hiroshima and Nagasaki.

Citation:

The Biological Effects of Ionizing Radiation, VII; Phase 2 is available at no charge for a PDF file here: <http://www.nap.edu/openbook.php?isbn=030909156X>

Important note: BEIR VII assumes that the victim's radiation exposure was an acute external exposure (the moment of the bomb explosion); internalized radioactivity is not considered.



The survivors of Hiroshima and Nagasaki were grouped by the age they were at the time of the bombing. These groups were tracked over their lifetimes. Cancers and cancer deaths were counted.

There are many problems with this data, but we can broadly say that those who were five years or younger in August, 1945 had the most cancer at some point in their lives.

Girls in this group were twice as likely to get cancer at some point than were boys.

For every male in the 0-5 cohort that suffered cancer at some point in their lives, two females got cancer.

The BEIR VII report is where these numbers are found; the report itself does not discuss gender as a risk factor. I published my findings in 2011. In 2006, independent from my work, Dr. Arjun Makhijani published the same findings.

Source:

Olson, 2011. NIRS Briefing Paper: "Atomic Radiation is more harmful to women." posted: <http://www.nirs.org/radiation/radhealth/radhealthhome.htm>

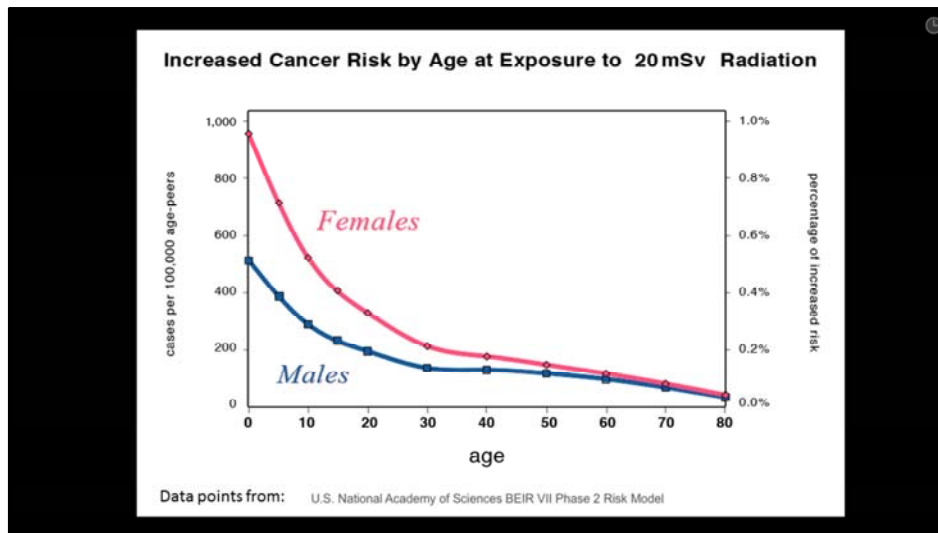
Makhijani, 2005 started the Healthy from the Start Campaign to address disproportionate impact of ionizing radiation on young females.

<http://ieer.org/projects/healthy-from-the-start/>

And <http://ieer.org/resource/health-and-safety/open-letter-to-president-bush-on-protecting-the-most-vulnerable/>

Art Credit:

Saro Lynch-Thomason, Fullsteam Labs



Here is the same information in graphic form.

The pink line is girls, the blue line is boys.

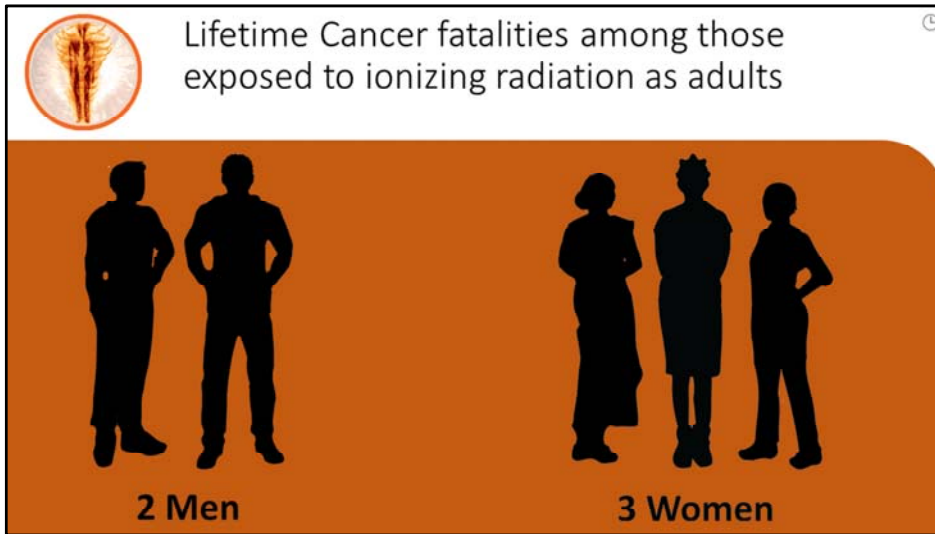
We can easily see the gender difference and that it is greatest in the youngest children.

The entire graph is a snapshot of our species cancer-response to acute radiation exposure. It is likely a picture of any radiation—exposed population including those living in all the testing areas like The Marshall Islands, Semipalitinsk, St. George, Utah and in places like Fukushima.

Graph provided to NIRS by Ian Goddard.



It is extremely important to understand that little girls are not a “sub-population.” We are an inextricable part of the human lifecycle.



Gender was also a factor for those who were adults at the time of the bombings.

Over their lifetime women exposed as adults suffered 50% more cancer death than did men in the same age group.

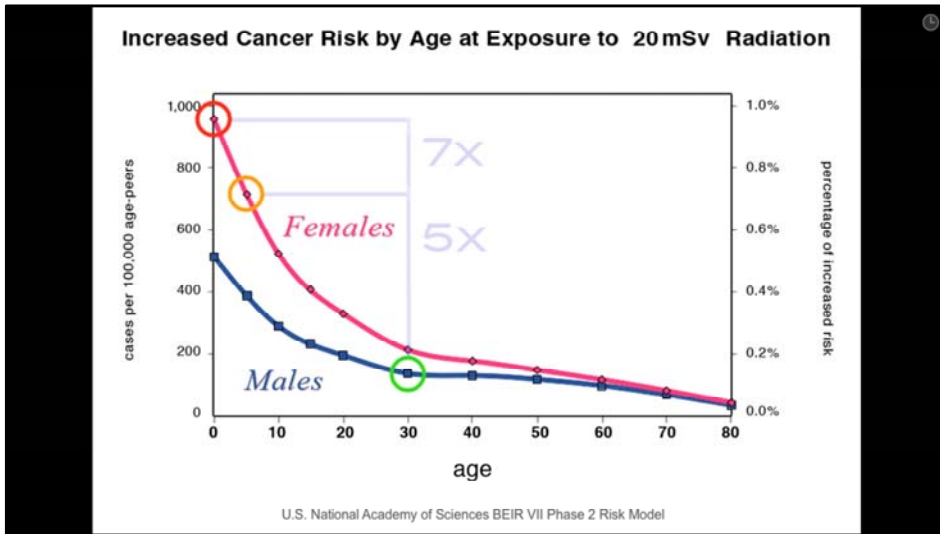
For every 2 men in these cohorts who died of cancer, three women died of cancer.

Source:

(see above) Olson, Makhijani, numbers in tables of BEIR VII.

Art Credit:

Saro Lynch-Thomason, Fullsteam Labs



THIS SLIDE WAS SKIPPED DUE TO TIME LIMITATIONS – included for reference

This is the same graph. The green circle marks the Reference Man, for generations used by regulators to set standards to legalize public exposures.

Now that most of the lifetime data is in from the A-Bomb survivors from Hiroshima and Nagasaki, it is easy to see that our regulations do not protect the most vulnerable: little girls.



Possible Factors in Gender Difference

Females have 50% more
high-risk tissue
compared to males



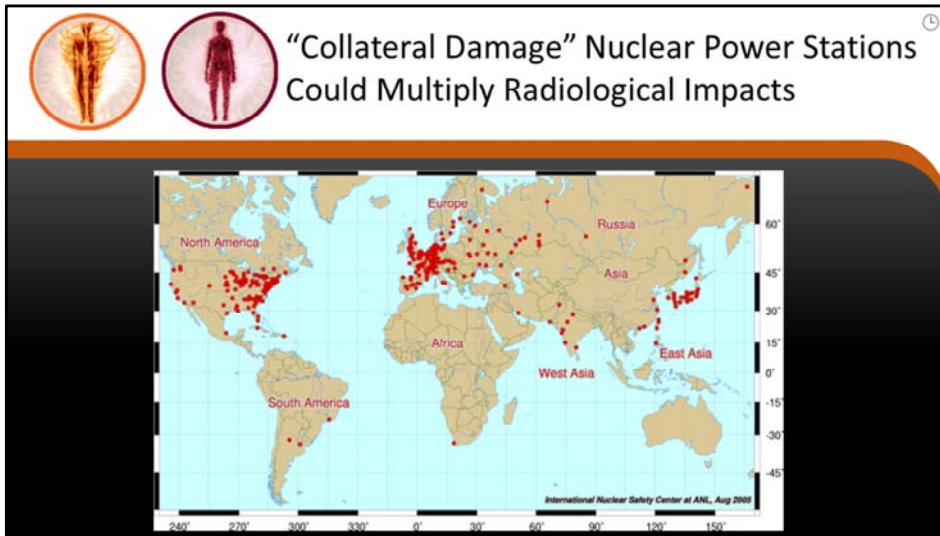
THIS SLIDE WAS SKIPPED DUE TO TIME LIMITATIONS – included for reference

Proportion of sensitive reproductive tissue
Proportion of fatty tissue
Metabolic differences

Animal studies also show gender differences
Olga Kovalchuk, et al (add cites)

Art Credit:

Dave Shannon



THIS SLIDE WAS SKIPPED DUE TO TIME LIMITATIONS – included for reference

Each red dot is a nuclear power reactor. Nuclear weapon detonation in some areas of the world would result in the destruction, or at the least the disruption of a reactor. This would greatly increase the radiological exposures and the duration of contamination.



This is a picture of health:
These women have recently stopped a nuclear waste dump from being put on their People's Traditional lands.

Radiation prevention is more than avoiding harm. It is a source of health and empowerment.

See: <http://www.foe.org.au/muckaty-winnerz>



We know these words. Today, here in Vienna, I want to say them in a new way:

PREVENTION IS THE CURE.



The future is in our hands.

I want to thank this community for moving this discussion forward. Thank you.