The Health and Socioeconomic Consequences of Nuclear Weapons Testing in the Pacific: Past, Present and Future

64th Association of Pacific Island Legislators

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Neal A. Palafox MD MPH
Wilfred Alik MD

Pacific Nuclear Weapons Testing
Framework to Understand, Address, and Heal

- **Framework not limited to the RMI-- relevant to entire Pacific - throughout Blue Continent**

- **Not timebound**
  - **Past**
  - **Present**
  - **Future**

- **Working with real-time changes environment (physical and policy) and understanding**
  - **Science and medicine rapidly changing**
  - **Human Genome , Epigenetics and Illness**

- **Multiple Dimensions of Healthcare**
  - **Individuals, villages, civil society**
  - **Environment**
  - **Culture and Indigenous Ways of Living**
  - **Infrastructure and Technology**
  - **Past, present, and future generations**

- **Socio-economic development and country stewardship of development**
  - **Finding solutions, addressing changes, shared responsibility for stability**
    - **Redefining the issues**

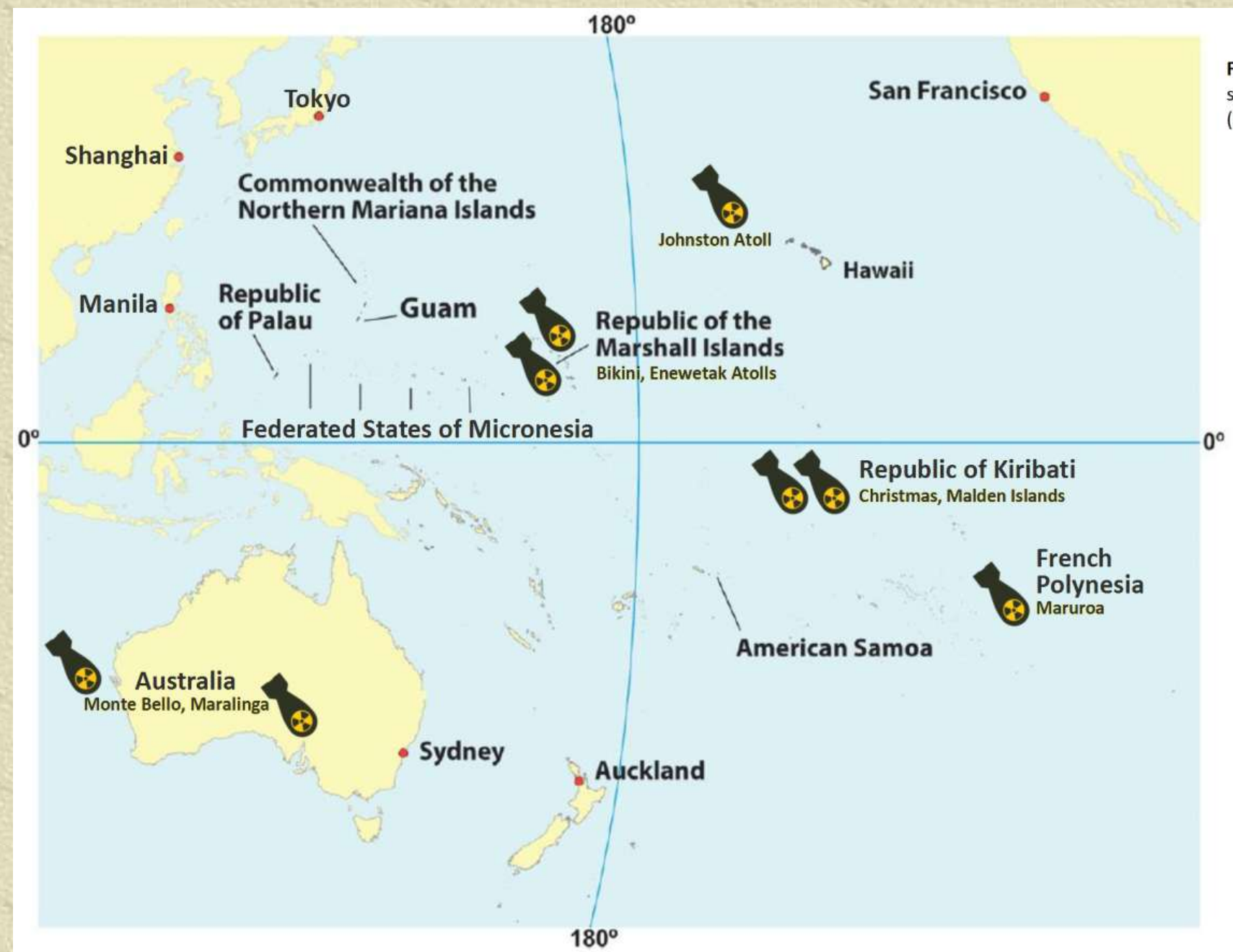


Figure 1: Nuclear weapons testing sites in the Pacific Islands and atolls (Simon et al., 2006, p. 50)

Country Conducting the Nuclear Test	Test Site	Country of Test Site	# of Tests	Equivalent Megatons of TNT
China	Lop Nor	China	22	21
France	Reganne	Algeria	4	0.1
	Maruroa	French Polynesia	41	10
United Kingdom (UK)	Monte Bello	Australia	3	0.1
	Maralinga	Australia	7	0.1
	Malden Island	Republic of Kiribati	3	1
	Christmas Island	Republic of Kiribati	6	7
United States of America (USA)	Nevada	USA	86	1
	Johnston Atoll	uninhabited unincorporated US territory	12	21
	Christmas Island	Republic of Kiribati	24	23
	Bikini Atoll Enewetak Atoll	Republic of the Marshall Islands	65	109
Union of Soviet Socialist Republics (USSR)	Kapustin Yar	Russia	10	1
	Semipalatinsk	Russia	116	7
	Novaya Zemlya	Russia	91	239

Table 2: Highlighted in yellow are nuclear weapons testing sites with ties to indigenous populations in the Pacific Islands, in comparison to other non-Pacific Island nuclear test sites around the globe. Table indicates the number of tests and the total yield in the equivalent of megatons of TNT at the test sites. Data from NCI 1997. (Simon et al., 2006, p. 50)

Past – Historical Events

- Historical events
- Force of Explosion and Ionizing Radiation
  - Health , Radiation Burns and Cancer
    - Immediate , Short term, Long term
- Process
  - Involuntary Movement & Resettlement of people
- Consequences
  - Cultural Harm – Cultural Trauma
  - Environmental Destruction and Contamination
  - Solutions not work - not understanding the problem
  - Uncertainty and Trust – Healing the injury

Cancer Type	Preliminary Study - DCEG 2004		Land et al. 2010		
	Baseline number of cancers	Excess number of cancer	Baseline number of cancers	Projected excess number of cancers 1948-2008	Projected excess number of cancers from 2009 onwards
Leukemia	123	5	140	6.0	1.4
Thyroid	127	262	190	35	15
Stomach	326	15	570	3.1	3.6
Colon	470	157	930	7.2	9.3
All other solid cancers	4,550	93	8,800	54	36
Rounded total number of cancers	5,600	530	10,600	105	65

Table 3: Projected number of lifetime baseline and excess cancers for the entire population of the Republic of the Marshall Islands by cancer type and in comparison with the NCI preliminary study (DCEG 204). (Simon et al., 2010, p. 121)

Present

- Unresolved Problems and Unmet Needs
  - Health Programs – 177 and DOE
    - Did it accomplish what it was supposed to do?
    - Changing view of the coverage, Financial Cost and Sustainability
  - Environmental Contamination (diet)
  - Who was affected and how much were they affected
    - Defined populations
  - Cultural - Indigeneity
    - Lineage , Tradition, Land Tenure and Ownership
  - Evolving Science and Understanding
  - Mechanisms for resolution and healing

Who was affected – how much?

- Four Northern Atolls – Bikini, Enewetak, Rongelap, Utrik
  - Midrange Atolls
  - All Atolls
    - Resettled when still contaminated
      - Rongelap from 1957-1985
      - Bikinians from 1972-1978
- Clean up Crews – RMI, FSM, Hawai'i
- US Veterans and Weathermen
  - Telomere
- Lucky Dragon

Pacific

- Guam
  - Terlaje Guam
- FSM
- Kiribati , French Polynesia, Australia

Future

- Transgenerational Health (will my children and children's children be affected)

- Healing and Shared Responsibility for Consequences
  - What and how– and by whom
    - World Court
    - Compact
    - Changed Circumstances

Runit Dome – Enewetak (1977 – 377 ft wide)

https://www.abc.net.au/pacific/programs/pacificbeat/us-agency-ordered-to-clean-up-handling-of-runit-nuclear-waste/13484882

Radioactive Isotopes

Isotope	Decay	Physical Half-Life
Plutonium 239	alpha	24,000 years
Cesium 137	beta - gamma	30 years
Strontium 90	beta	28 years
Iodine 131	beta	8 days

Evolving Science

- Science of the health risk from radiation exposure and societal trauma has evolved
- “We don’t even know what we don’t know”

  - Modelling and dosimetry (developed 1990- 2000’s)
    - 4 Atolls – North , to all the RMI nearly 860 km s= 550 miles south; ….Guam 2250 km = 1400 miles
    - How many cancers
  - Genetic Damage caused by ionizing radiation
  - Epigenetic Illness (2000’s to present)

Genetic Changes – Transgenerational Health

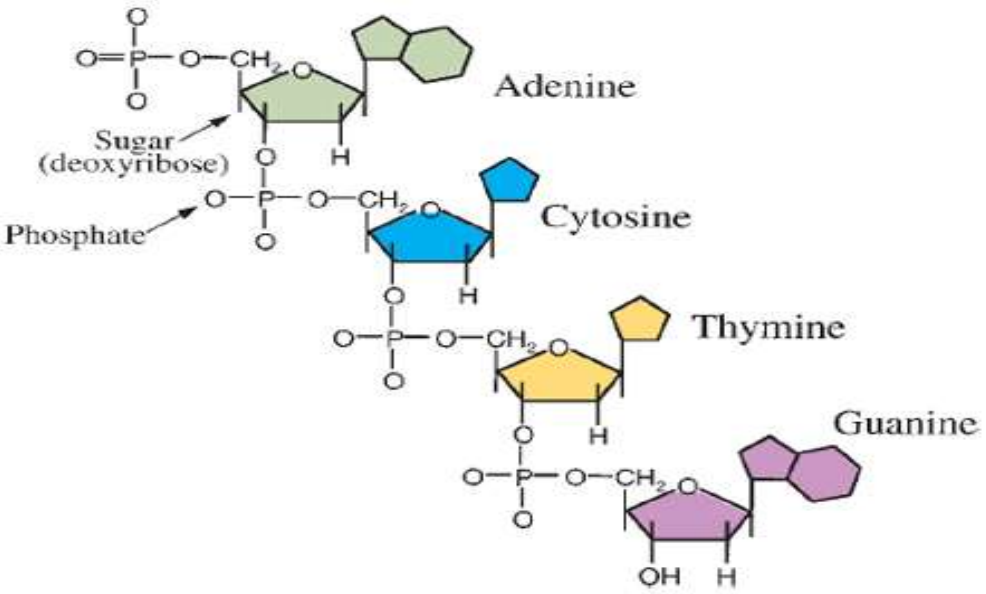
- Genetic Damage caused by ionizing radiation
  - DNA is the genetic code (instructions) for every cell in the body
  - Direct Damage to DNA (known in 1960's)
    - Cause cell death or cancer
      - 24 difference types of cancer – lung, bone, breast, liver, brain
    - Can cause latent cancers (30-50 years after insult)
    - Usually DNA damage cannot be transmitted over the generations (humans)

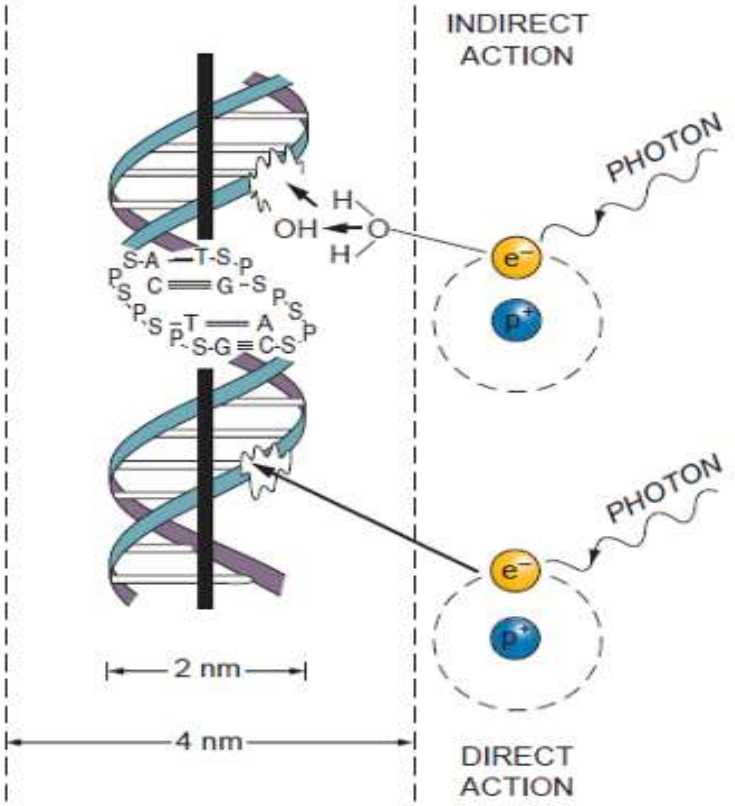
- Epigenetic Illness (2000's to present)
  - DNA is not damaged
  - Epigenetics is about how the DNA code is interpreted and translated
    - Particular genes that control cell growth or tumour growth or suppression, or other health conditions can be turned on or off inappropriately
    - Epigenetic changes are affected by the environment (socio, cultural , environmental)
    - Can be passed through generations
    - Beyond ionizing radiation and health , about the trauma to people because of how the testing was done

Source: chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.dkfz.de/en/medizinische-physik-radioonkologie/Teaching/07_Radiation_Biology_PCPTnew.pdf

DIRECT AND INDIRECT ACTION

The biologic effects of radiation result principally from damage to deoxyribonucleic acid (DNA), which is the critical target, as described





Cultural Trauma – Historical Trauma

- Major adverse event takes place to a culture or people
  - Forced displacement from home
    - Nuclear Nomads (Ocean View)
  - Sudden disruption of lineage and cultural constructs
  - Generation subjected to harsh conditions

- Offspring do not have to be alive at the time
  - May have same internal stressors from prior generations
  - Environmental Stress
    - Passed by epigenetic mechanisms

Medical

- Who was / is exposed
- If exposed--- what is / are the health risks
  - for cancer
  - for transgenerational health
- Not all cancers are due to radiation exposure
- Epigenetics and cancer – evolving
- What should I tell my patients?

Half Life

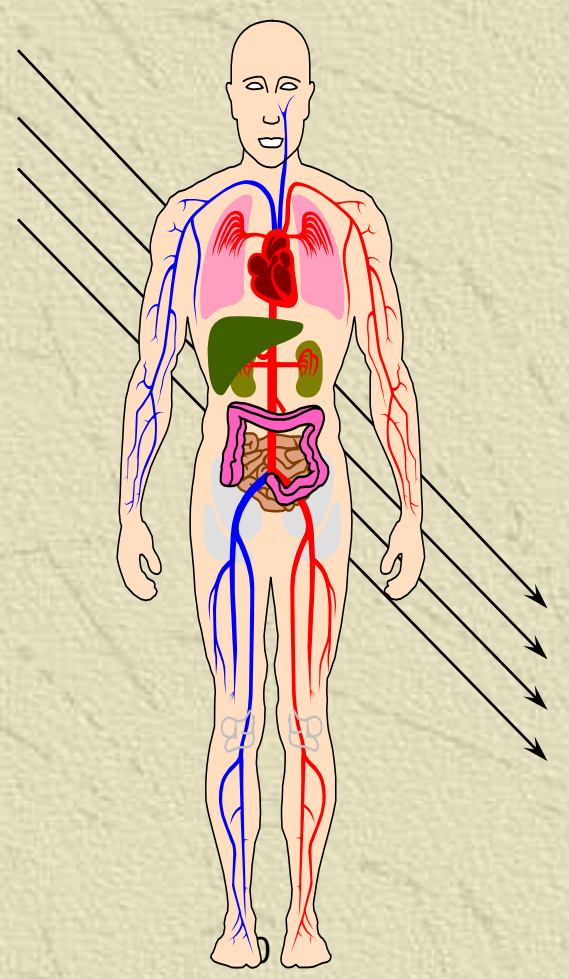
- Physical Half Life is the time for a quantity of radioisotope to decay by half (Cs-137 = 30 years)

- Biological Half Life is the time for 1/2 of the amount of a radionuclide to be expelled from the body (CS-137 = 70 to 100 days)

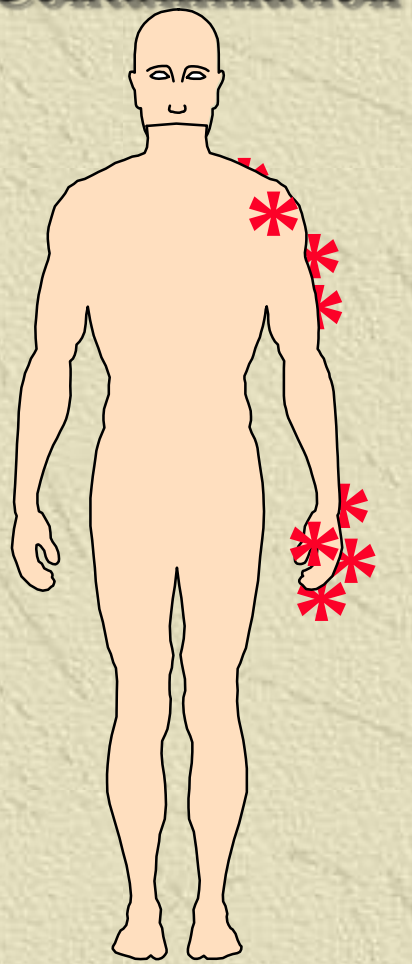
- Effective Half Life takes into account both physical & biological half lives

Radiation Exposure Types

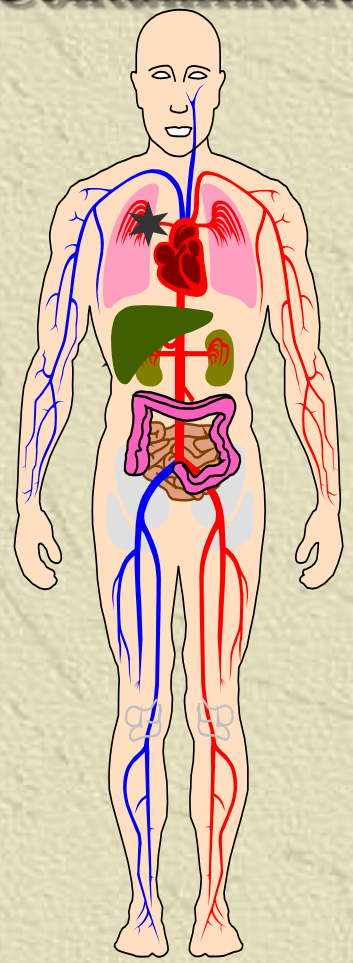
Irradiation



External Contamination



Internal Contamination



Reducing Exposure

- **Time**
  Reduce time spent near the source of radiation.
- **Distance**
  Increase the distance from the source of radiation.
- **Shielding**
  Place shielding material between you and the source of radiation.

Problem Solving

- Transformative and Resilient Pacifica
  - People must know what happened and what their health are, and how to address those risks
  - Education -
- Healing must be through the Indigenous Pacific Lens
- Indigenous Perspectives
  - Aina – Value of Land – Land is identity, belonging , and cultural context
  - Family , relationships
  - Indigenous Ways of Knowing
- Trauma Informed
  - Historical
  - Cultural
- What does healing look like
  - Trust ?
  - Espousal?
  - Make whole
    - Runit Dome
  - Prevent and does not happen again
- Approach
  - Equity
  - Discover - know what we currently don’t know

Problem solving - What to do?

- What do we know about the consequences of Nuclear Testing
  - What is the real / true history and facts of the Pacific and your country
    - Concerned Groups and Movements
      - Guam, French Polynesia, Australia, Outside of Pacific
    - Confusion of Purpose … often used together … hard to separate
      - Addressing Health, Economic, Cultural , Consequences
        - Development and Resilience
      - Anti War – Anti Military
      - Anti – Nuclear
      - Anti -colonialism
  - We don’t know what we don’t know
    - Medical Health and Nuclear Science Knowledge is evolving
    - Continuing relevant research

Mechanisms to address

- What does problem solving look like?
  - Damages and Assets
    - Past, Present, Future
    - Health
    - Cultural
      - Resilience
    - Development

Paths Forward

- Courts
  - World Courts and Tribunals
  - Country Specific Courts and Jurisdictions
- Treaties and Compacts
  - RMI – Changed Circumstances
    - Form foundational approach and science for Pacific

Changed Circumstance

- What is it?
  - New Knowledge or Evidence
- Comprehensive
  - Health Care
  - Compensation
    - Personal Injury
    - Land Loss
  - Environment
    - Restoration
  - Research
  - Healing – Education and Evaluation

Comprehensive Approach

- Community Based: translating the medicine and science (curriculum)
- Systems for tracking pts and data
  - Evaluate and re-evaluate
- Hi Standard Cancer Screening, Diagnosis, and Treatment should be made available and sustained

Kommol tata

- Slide Pictorial Credits- Basic Disaster Lifer Support AMA
- https://www.dkfz.de/en/medizinische-physik-radioonkologie/Teaching/07_Radiation_Biology_PCPTnew.pdf
- https://asrc.jaea.go.jp/soshiki/gr/eng/mysite6/Radioactive%20materials%20and%20DNA%20damage%202.jpg
- NCI- Simon NCI Presentation Feb 2014 (Testing Site Map)