

Medical Exposure Studies

Amy Berrington de Gonzalez, Dphil (Oxon), Chief and Senior Investigator
Division of Cancer Epidemiology & Genetics,
Radiation and Epidemiology Branch

Past

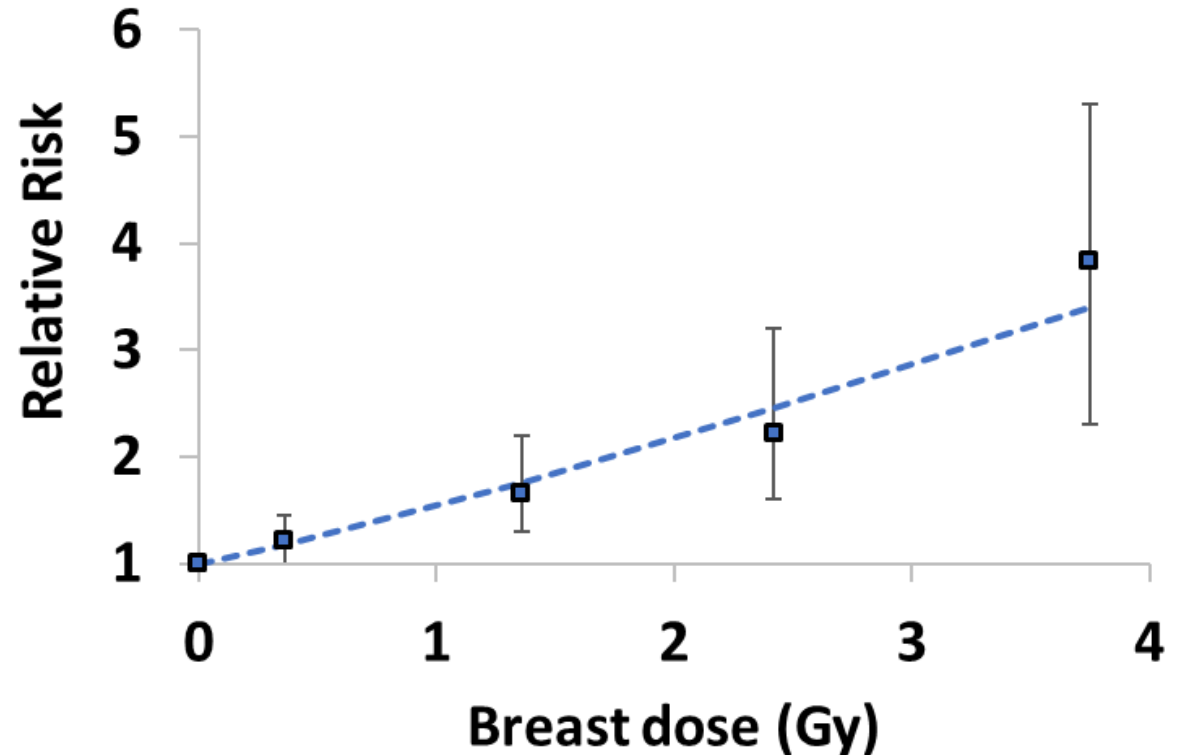
Multiple Fluoroscopies in TB Patients

4,940 TB patients (US cohort)

- 234 breast cancer cases

Repeated chest fluoroscopies

- Mean = 88 examinations
- Mean total dose = 0.8Gy



Boice et al (Radiat Res 1991); Howe and McLaughlin (Radiat Res 1996); Howe (Radiat Res 1995) ;

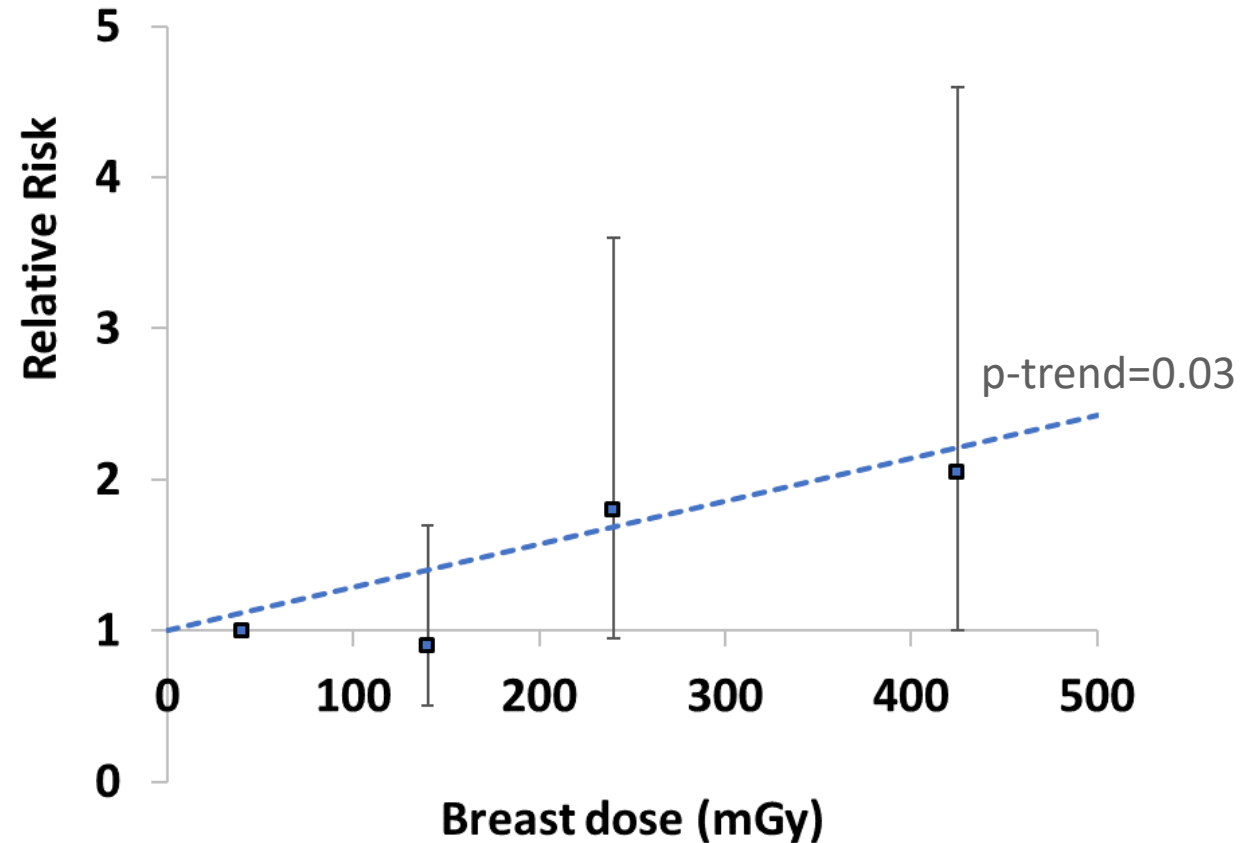
Multiple Spine X-rays in Scoliosis Patients

3,002 Scoliosis patients

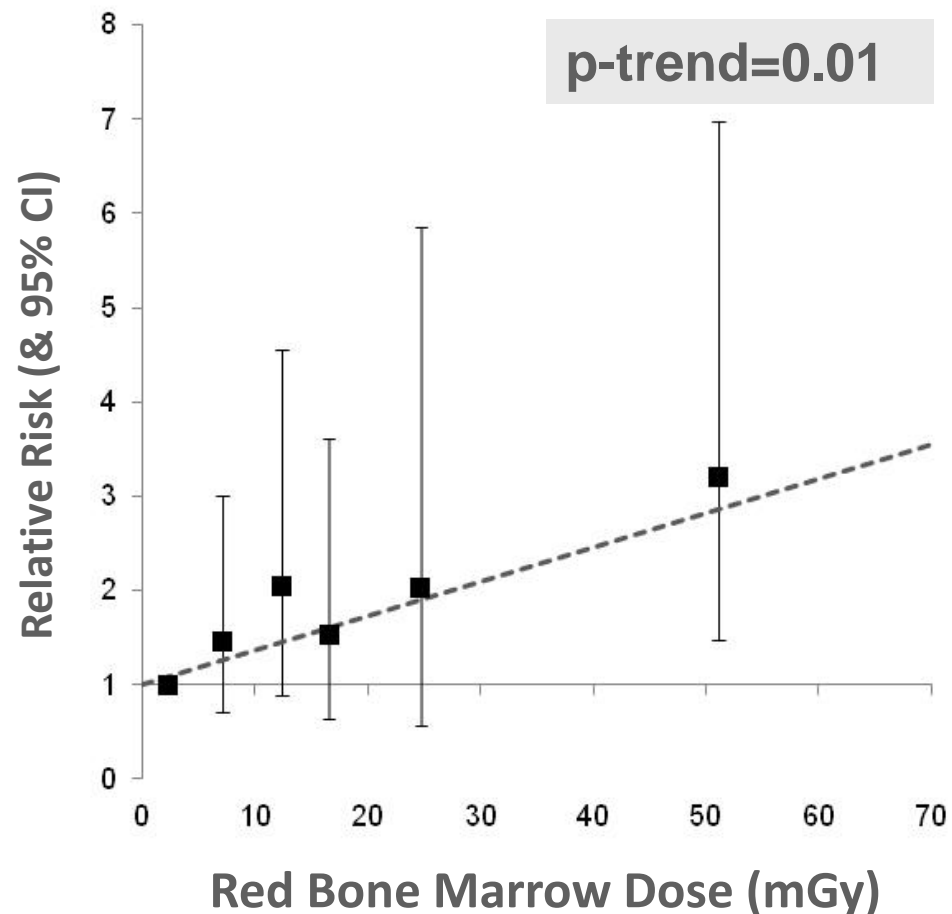
- 78 breast cancer cases

Repeated spine X-rays

- Mean X-rays = 27
- Max X-rays = 332
- Mean dose = 120mGy
- Max dose = 1110 mGy



UK Pediatric CT scans cohort



178,000 exposed children

- 74 leukemias/MDS
- 135 brain tumors

300,000 pediatric CT scans

- 64% head CTs

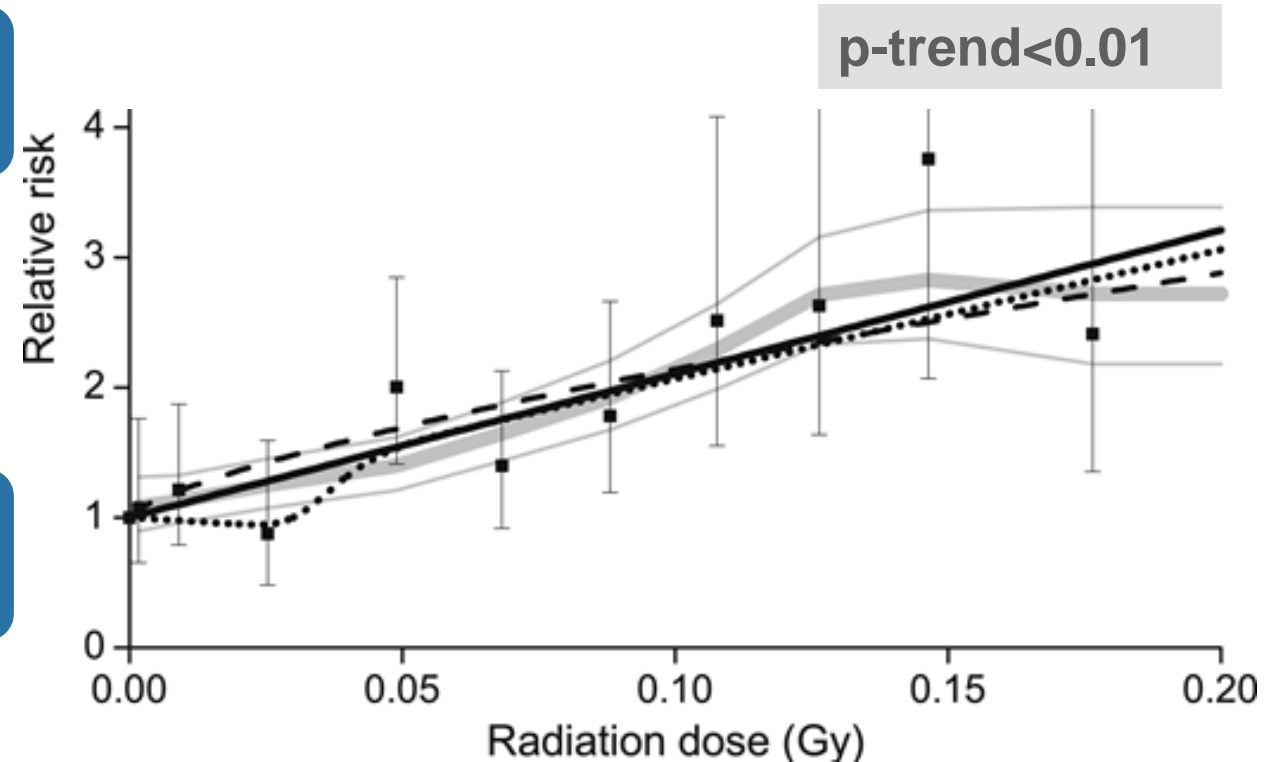
Pooled Analysis of Medical Cohorts and Thyroid Cancer/Leukemia

9 cohorts of childhood exposure

- 394 thyroid cancers
- 221 leukemias

Diagnostic/Therapeutic radiation

- Restricted to <200 or $<100\text{mGy}$



Summary of Key Results from Past Studies

Repeated low-dose medical exposures related to increased cancer risk

Evidence of excess risks from cumulative doses $<100\text{mGy}$ for childhood leukemia & thyroid cancer

Risk estimates for non-uniform exposures and children and women (not covered by occupational studies)

Risk estimates compatible with Life Span Study of A-bomb survivors

DDREF = 1 ?

Present

EPI-CT: 1 Million Children from 9 Countries

Expanded UK cohort + 8 countries

- UK 320k
- Netherlands 150k
- Sweden 120k
- 150+ leukemias
- 200+ brain tumors

CT scans from RIS/PACs

- 1.4m CTs (72% head CT)



USA Kaiser Pediatric Imaging Case-Control Study

4 Kaiser HMOs

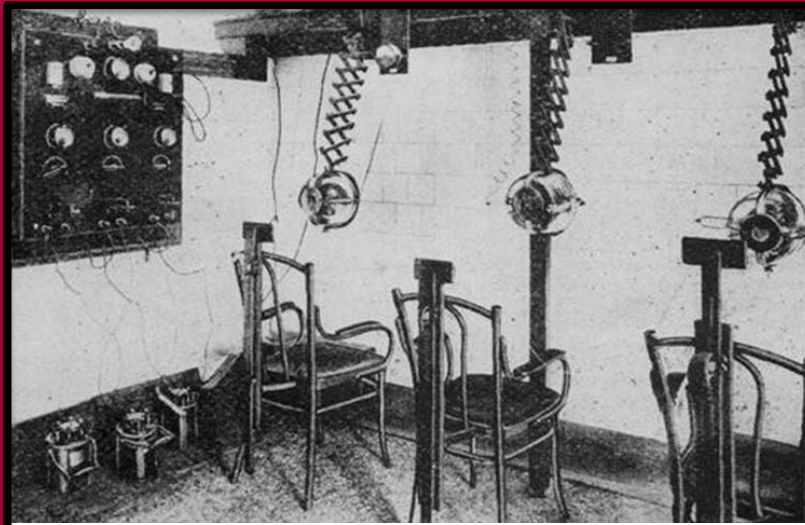
- 750 leukemias (estimated)
- Controls matched on age & time in health plan (exposure window)

Imaging data from PACs

- In utero & childhood exposures

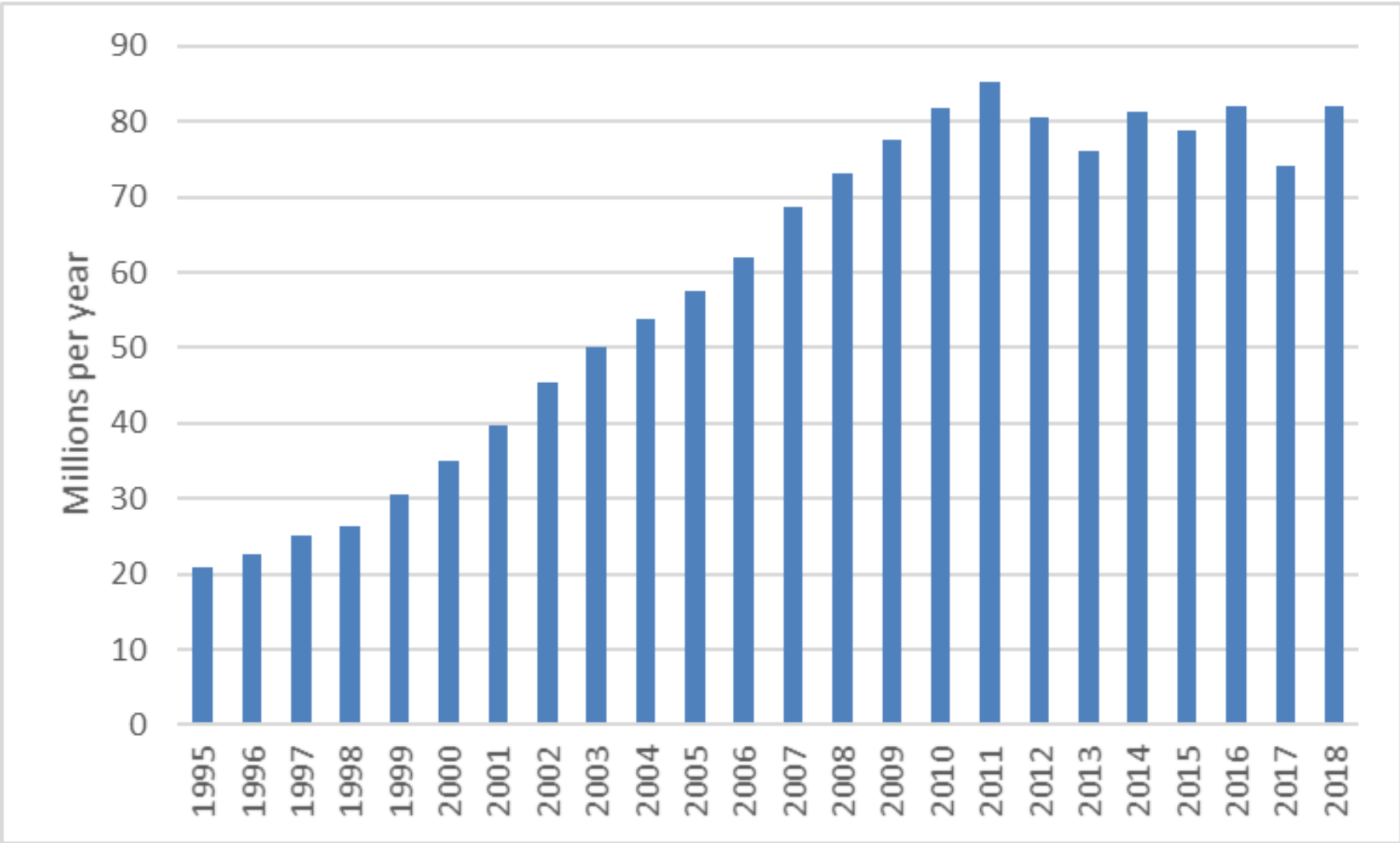


Future

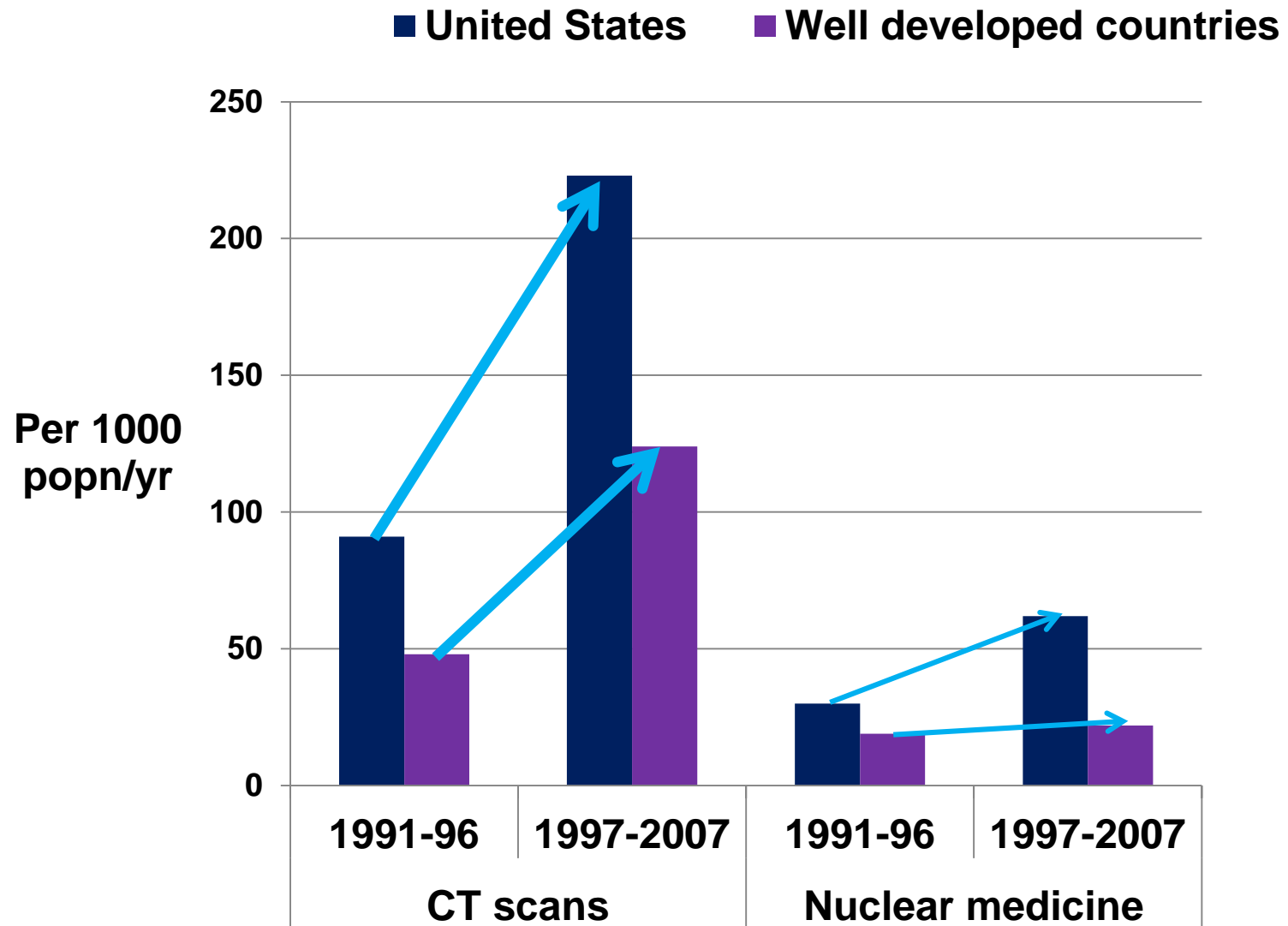


Progress in Uses of Medical Radiation and Radiation Protection

Recent trends in CT scan use in the USA



International Trends in Diagnostic Imaging



Reduction in Doses for Pediatric CT scans

	Head CT	Chest CT
Organ	Brain	Lung/Breast
<1990	60mGy	30mGy
2000+	30mGy	5mGy

Lee...Berrington, Br J Radiology (2016)

Summary of Future Opportunities

Diagnostic medical radiation exposure continues to expand and evolve

Increasing low-dose exposure from modern radiotherapy (scatter dose)

Expansion of electronic medical records facilitates studies

Opportunities to study non-cancer outcomes from low-doses eg CVD & cataracts

Summary of Epidemiological Considerations

Study highly radiosensitive populations/outcomes to maximize power eg children/leukemia

Retrospective record linkage design for efficiency & to avoid recall bias

Long follow-up periods necessary given minimum latency of 5+ years (solid cancers)

Confounding by indication & reverse causation need careful evaluation