

# Mental Health Sequelae of Radiation Disasters

Evelyn Bromet  
Stony Brook University

November 1, 2016

## Disclosures: no conflicts

TMI and Chernobyl studies funded by:

NIMH

W.T. Grant Foundation

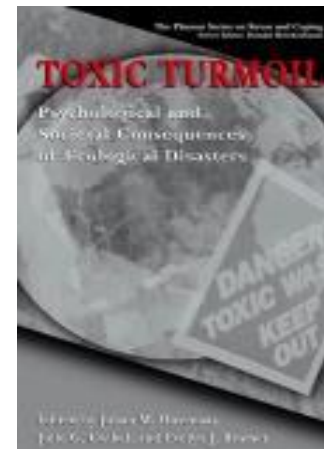
Current research funded by:

NIOSH

NIMH

## Some toxic disasters

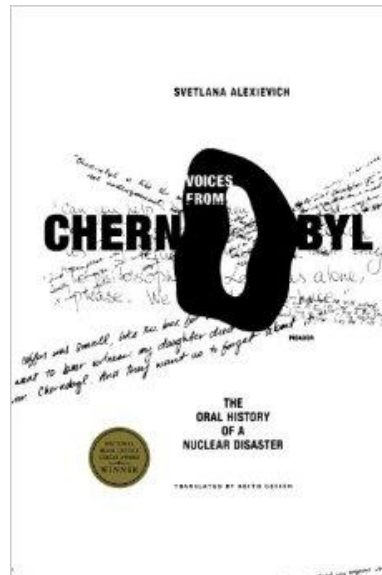
- **Atomic bombs (1945)**
- Seveso (1976)
- Love Canal (1978)
- **Three Mile Island (1979)**
- Bhopal (1984)
- **Chernobyl (1986)**
- Khamisiya (1991)
- Sarin attack on Tokyo subway (1995)
- World Trade Center (2001)
- BP oil spill (2010)
- **Fukushima (2011)**



# Radiation exposure

- Most dreaded of all risks (Slovic; *Science*, 1987, 3012 citations)
- Images (google image: radiation explosion)

# Terrifying images



# Radiation exposure

- One reason for the fear: experts never say that the chances of developing cancer are zero
  - Unlikely
  - Indiscernible
  - Undetectable
- Triggers persistent health anxiety, medically unexplained physical symptoms, PTSD, depression/grief
- Rates vary a lot (25%-75%), depending on severity of the disaster, mental health outcomes, who was sampled, phase of disaster when study was done

# Summary of findings on mental health

1. A-bomb survivors
2. TMI
3. Chernobyl
4. Fukushima

# Hiroshima, 1945





## English language reports of a-bomb survivors

3 relevant reports from RERF cohorts (mental disorders are outside its purview)

- *In utero cohort*:

↑ Mental retardation (gestation weeks 8-15)

*Schull & Otake 1999*

No increase in schizophrenia thru 1994 in Nagasaki sample (n=1867)

*Imamura et al. 1999*

- Adult Health Study (subsample; Cornell Medical Index; early 1960s)

↑ (Probable) DSM-IV somatization disorder and generalized anxiety disorder (GAD) in closest vs farthest from the blast

*Yamada & Izumi, 2002*

## A-bomb survivors (cont)

↑ Recent Nagasaki community studies; mail-out symptom surveys  
Significantly higher rates in exposed compared to controls

↑ PTSD symptoms described by Lifton from 75 interviews with a-bomb survivors in 1962 (*Death in Life*)

### Summary:

Mental health of a-bomb survivors has been given almost no attention in internat'l journals

Contrast: In the US, starting in the early 1950s, explosion of research on impact of stress on mental health

Yet the burden of stress of a-bomb survivors was not under anyone's radar.

34 years later, March 28, 1979, Three Mile Island  
(central PA)



## Partial meltdown

- Caused by combination of equipment malfunctions, design-related problems and worker errors (NRC)
- Half of the core melted
- Small releases of radioactive gas measured off site
- March 30 afternoon, Governor of Pennsylvania advisory for pregnant women and preschool children to evacuate the 5-mile area near TMI (later extended to 20 miles)
- 144,000 (~half of population) left the area temporarily

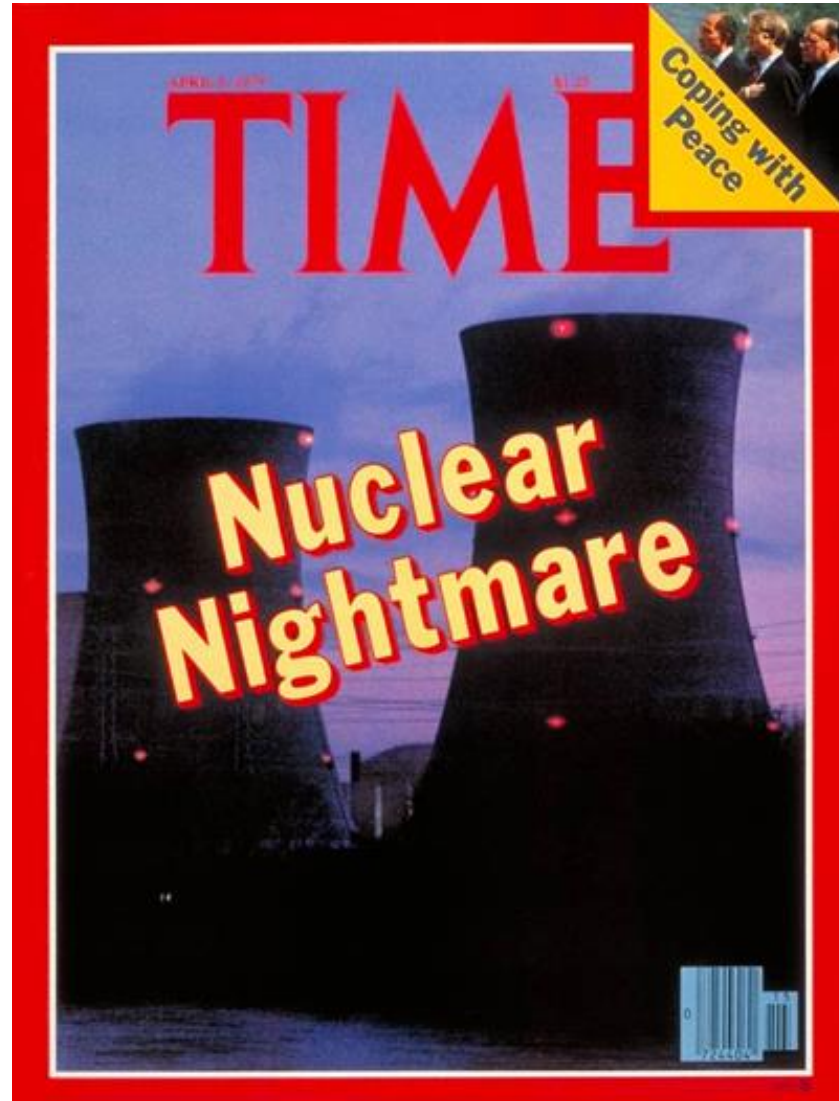
## Communications nightmare

State and federal officials and scientists repeatedly contradicted one other about what happened and potential for adverse health consequences

March 30: NY Times, “The Credibility Meltdown”

“Credibility was not enhanced by public statements... Was it a little leak, a bigger leak – or a general emergency? The reactor’s operators said one thing, state officials another, Federal officials yet another, not to mention the contributions of equipment manufacturers and politicians. ... Who is to be believed? The profusion of explanations and of contradictory statements has meant troubling confusion.”

April 9, 1979



## 2 contradictory narratives

President's Commission Report, December, 1979:

No injuries or *discernible* health effects

“the most important health effect ... was the mental stress experienced by the general population and the workers.”

Epidemiologic studies showing no health effects

Antinuclear claims:

Spokespeople like Jane Fonda (China Syndrome released 12 days earlier)

Distinguished physicist at Univ of Pgh showed data indicating an increase in still births downwind of TMI after the accident

Exposure → hundreds of deaths

## State of mental health disaster research in 1979

- Never been an epidemiologic study of post-disaster mental health
  - Studies of convenience samples; home-made measures
- Data in the President's Commission report was non-systematic (apart from the data on workers)
- NIMH ordered by the head of HHS to do a systematic mental health study
- Univ of Pittsburgh had the only psychiatric epidemiology program in Pennsylvania



## TMI studies

- University of Pittsburgh high risk groups
  - Mothers of young children (some were pregnant)
  - Workers
  - Outpatients in public MH system
  - Children at age 11
  - Comparison groups near a nuclear and a coal-fired plant
  - Trained 50 MH social workers on a clinical instrument
  - Multi-wave study
- Phone surveys by PA Dept of Health (including a panel that was followed up)
- Chronic stress by psychologists at Uniformed Services Univ; looked at physiological indicators of stress response
- Other smaller scale studies

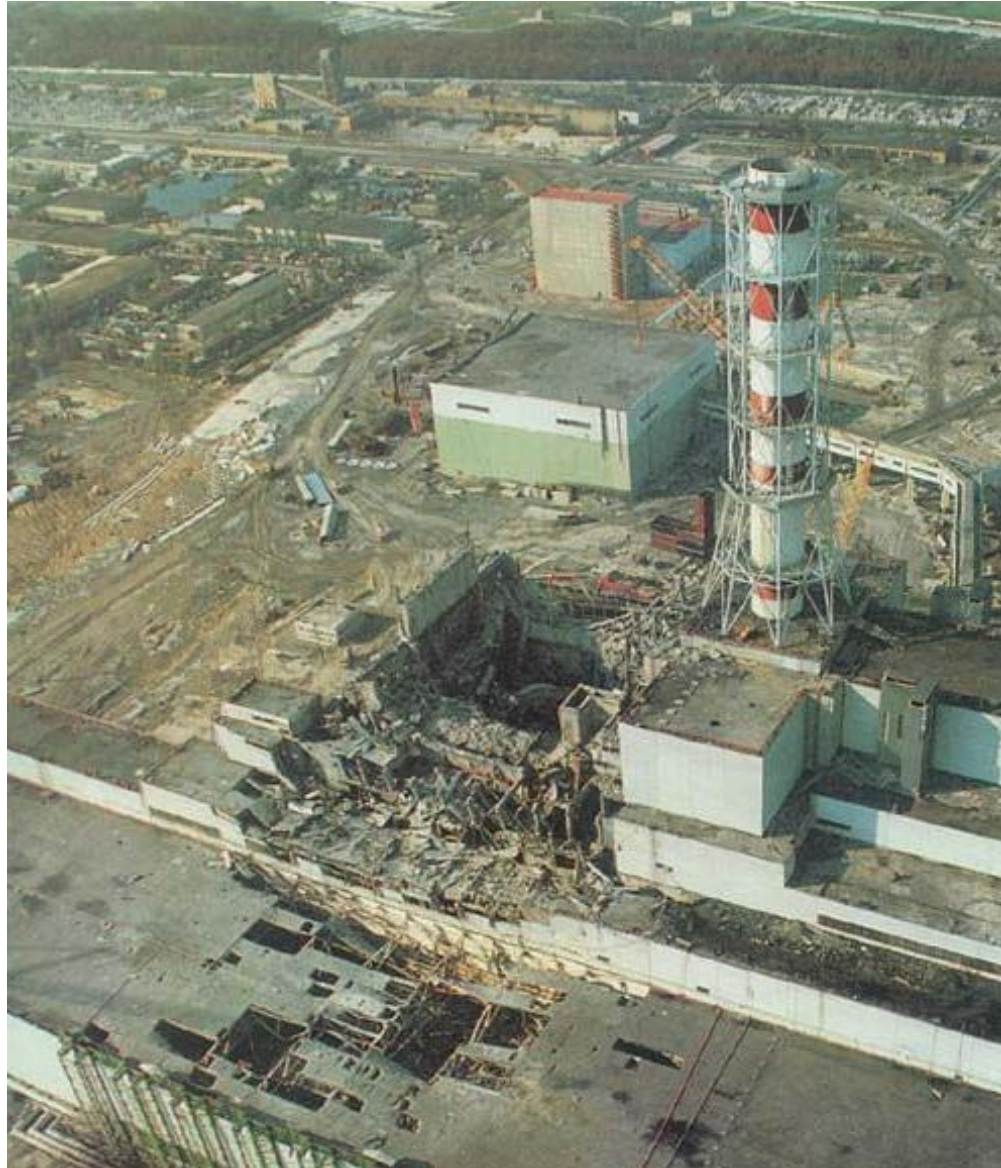
## Patterns were mostly consistent

- ↑ Depression and anxiety disorders, especially in mothers of young children during the first year
- ↑ Distress remained elevated up at 10 years (PA survey: subsided by year 5)
- Risk perceptions were related to mental health cross-sectionally and longitudinally
- No cognitive or MH effects in children
- Acute effect in TMI workers that was short-lived

## Findings viewed as inconsequential

1. No interest to radiation scientists
2. Stress researchers saw it as unique event that was not a real disaster and was non-generalizable
3. Research would have long been buried if Chernobyl and Fukushima had not come along.

7 years later, Apr 26, 1986, Chernobyl exploded



# Ukraine

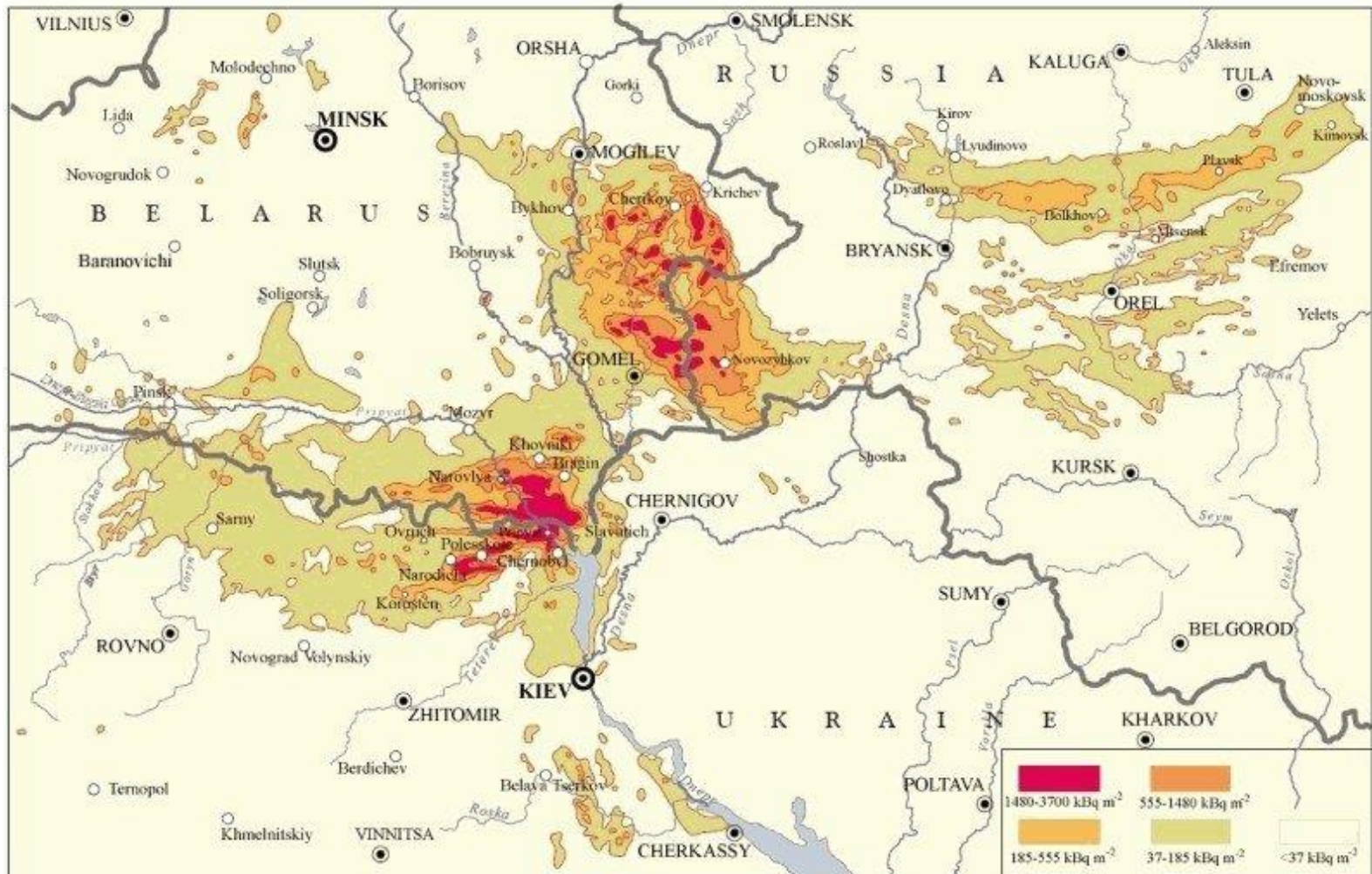


Figure VI. Surface ground deposition of caesium-137 released in the Chernobyl accident [11, 13].

## Psychosocial Aftermath (1)

- ~350,000 people were permanently evacuated and feared by receiving communities
- Official statements that nothing to worry about; Kiev officials sent their children as far away from Kiev as possible
- Doctors indiscriminantly attributed health problems to Chernobyl (official dx; vascular dystony)
- Soviet Union collapsed → shortages of basic goods and services and epidemic of cholera
- Epidemic of thyroid cancer was frightening

## Psychosocial Aftermath (2)

- Claims of local studies conducted with international \$
  - The highly exposed liquidators who had had acute radiation sickness → schizophrenia and dementias (no independent confirmation of diagnoses, unlike cancer)
  - Exposed children had > mental retardation, developmental delays, psychosis, etc, than non-exposed (also no independent confirmation of diagnoses; inappropriate controls)
- Fodder for the media

## Local nontransparent studies

- Continue to this day
- Limit my summary to the handful of transparent studies, with clear methodologies



# Samples

General population  
Mothers of young children  
Exposed children  
Liquidators

## Results

Community samples: > mental health symptoms and poor subjective health (but not dx) in exposed vs nonexposed.

- \*Mothers of young children = highest risk group

- \*Risk perceptions = powerful correlate

Evacuee moms: > PTSD, depression and poor subjective health compared to controls

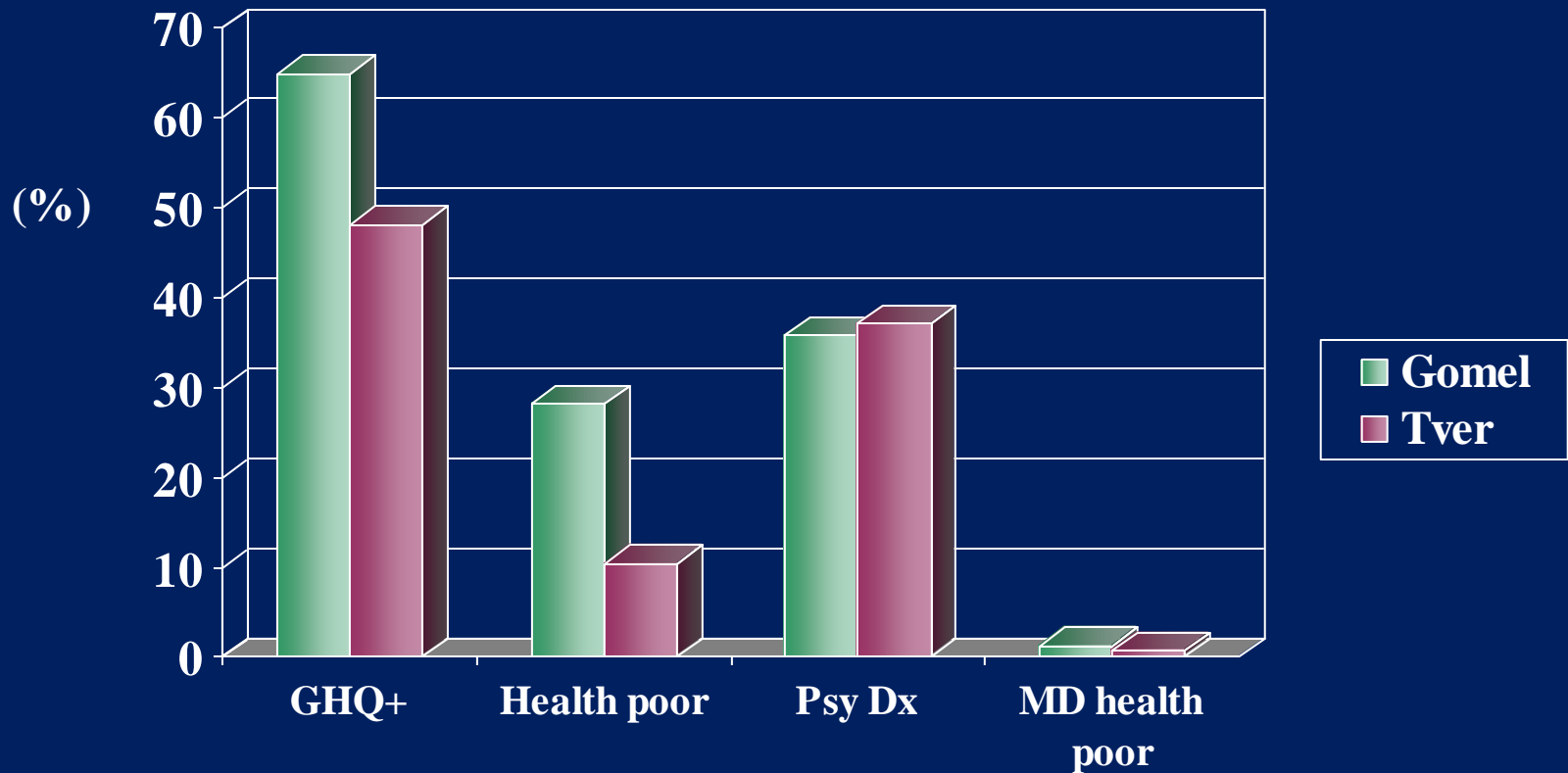
- \*Risk perceptions predicted mental health over 9 y

Liquidators: Excess suicide (Estonian cohort)

- > suicide ideation, severe headaches, depression and anxiety (Ukraine and Estonia) compared to controls

Exposed children: No differences in mental health and cognitive function compared to appropriate controls

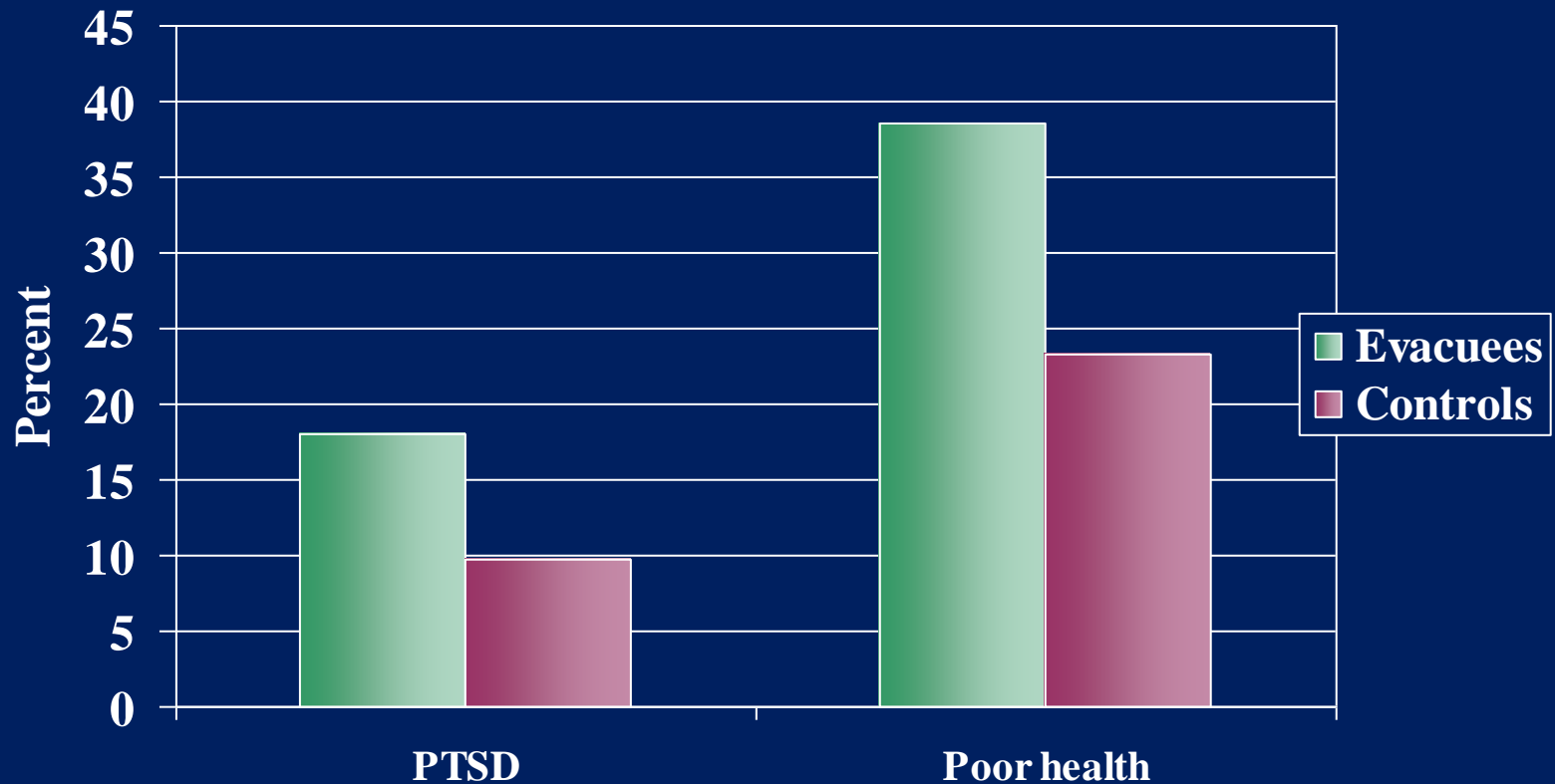
## From Havenaar 2-phase study of Gomel (Belarus) vs Tver (Russia)



N=1617 Gomel, 1427 Tver; working adults

Poor health = score of 5 on a 5-point rating scale

# Chernobyl-related PTSD and poor subjective health in mothers of young children



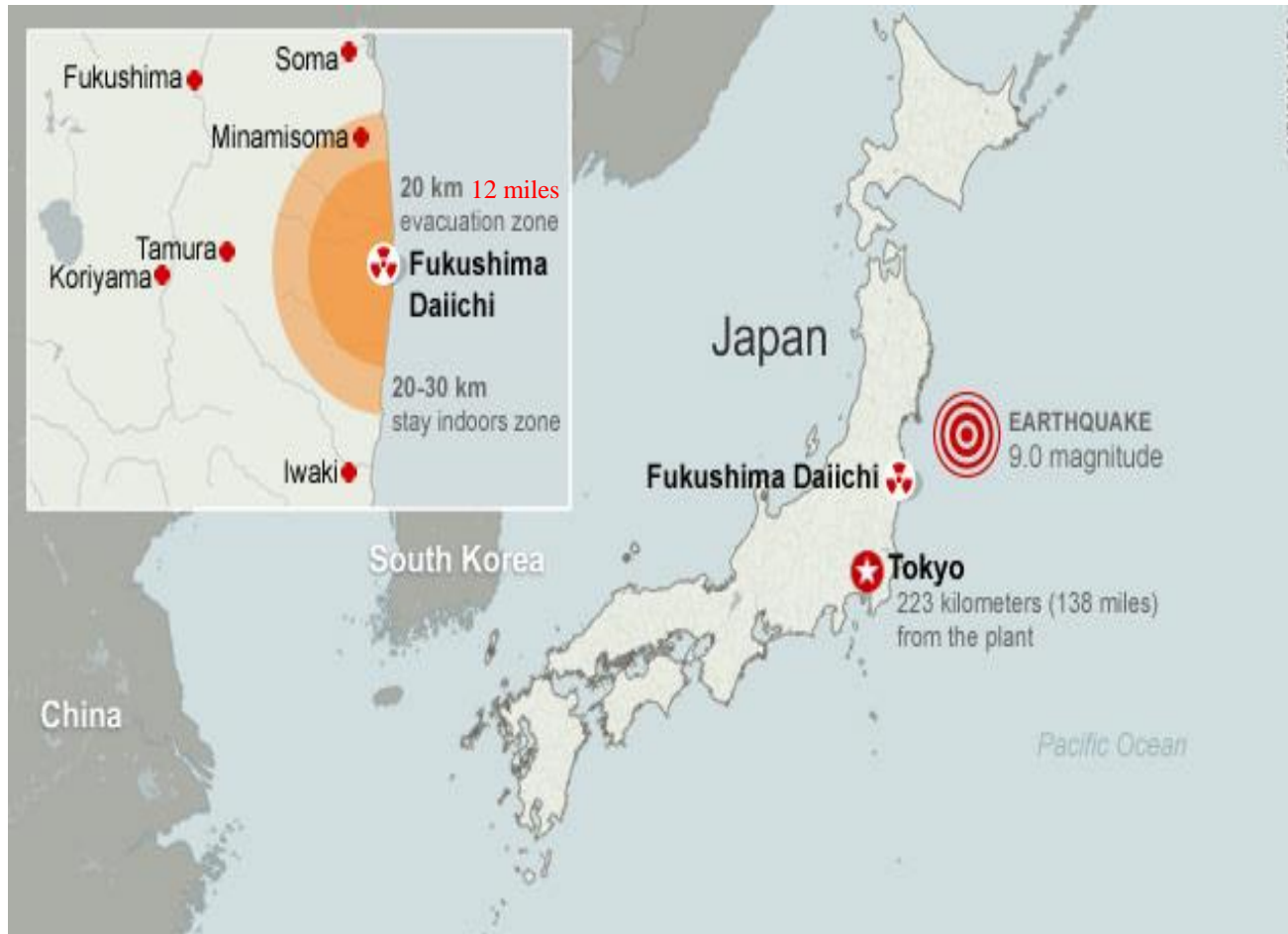
## Impact of Chernobyl mental health research

- Received no attention from the radiation health effects research community until the Chernobyl Forum report
  - Even then, no intervention programs established.
  - No attempt to screen for mental health in cancer cohort studies
- Lukewarm reception from disaster researchers because it was regarded as a unique event in a unique part of the world; pre-globalization
- Then, the Fukushima NPP exploded

25 years after Chernobyl,  
Fukushima, March 11, 2011



264 km (164 miles) from Tokyo



## Initial aftermath and communications nightmare

- 220,000 were evacuated (some voluntarily)
  - Evacuees resettled in other prefectures suffered discrimination and slurs
  - 96,519 still in temporary housing in 2014
- 350 institutionalized elderly died during and shortly after the evacuation
- Communications = replay of TMI: contradictory and incomprehensible statements → distrust in all authorities
  - Japan Times: **Cancer and Fukushima: Who to trust?**



## 6-month meeting; Sept 11, 2011:

### International Expert Symposium in Fukushima – Radiation and Health Risks

- Senior representatives from WHO, ICRP, UNSCEAR, IAEA, Japanese radiation institutes, RERF, internat'l experts
- Chernobyl researchers from Ukraine, Russia, UK, US
- Meeting → “conclusions and recommendations”

“...the physical health impact ... is likely to be *limited* ...  
However, the social, psychological, and economic  
impact ... are expected to be considerable.”

## International agencies agreed

- UNSCEAR (2013) and IAEA (2015): increase in thyroid cancer is *unlikely*  
“Mental health problems and impaired social well-being were the major health impacts observed following the accident.” (UNSCEAR)
- Meanwhile, Fukushima Health Management Survey was established:
  - 360,000 children received thyroid ultrasound screening
  - 210,000 evacuees targeted for a longitudinal health survey, and a separate mental health survey (PTSD and distress scales)
  - 16,000 women were targeted for a pregnancy and birth survey (2 depression items)

## Results on mental health to date

- Fukushima Health Management
  - a. >20% of evacuees screened+ for PTSD; rates > pregnant women and mothers with young children; rates declining over time (<3% in the Japan-World Mental Health survey).
  - b. Adverse risk perceptions assoc with poorer mental health
  - c. Children: (Strengths & Difficulties Questionnaire): rates = 1.5-2 times higher than the norm
- TEPCO workers at Daiichi poorer MH than TEPCO workers at Daini (longitudinal)
- Suicide: initial decline; began increasing in 2013
- Many other descriptive studies from convenience samples, unfortunately using 20<sup>th</sup> century methods to study the aftermath of a 21<sup>st</sup> century event.

## Summary of consistent findings

- Trajectory: no research (a-bomb survivors) to “inconsequential” studies (TMI) to serious but not actionable findings (Chernobyl) to parallel findings in Fukushima and community programs designed to improve mental health (Fukushima)
- Similarities in specific aspects of mental health affected (especially long-term anxiety and somatization issues)
- Risk perceptions, the driver of poor mental health, can be minimized with consistent, clear, and understandable risk communication to the public

# Summary of consistent weaknesses

Top down approach; not a collaboration with affected comm's;

Low response rates

Missed opportunity for community education

Mental health outside purview of health studies

- WHO defined health as physical, mental and social well-being
- >60 y of research showing that mental & physical health are two sides of the same coin
- >60 y of research showing that MH → morbidity & mortality
- MH, the biggest public health problem after TMI and Chernobyl, and now Fukushima, should be part of a basic health assessment

• Why excluded?

- Stigma associated mental health
- Not seen as a “direct” effect of radiation; therefore irrelevant
- Myth that psychiatric sx's and disorders not measurable
- Stigma toward mental health researchers

# My perspective on a 30+ year study of Chernobyl

- Bottom up approach: participants involved in planning, content, execution, interpretation, and presentation of results
- Assess mental and physical health equally
- Assess resilience (not just ill health)
- Include biological/genetic risk factors and biomarkers of chronic stress
- Sample constructed from existing cohort studies
  - Don't want to do dose reconstruction or get retrospective accounts of experiences and fears in 1986
- Identify an appropriate comparison group
- Rigorous interviewer training and ongoing supervision and reliability checks
- Recontact information for future follow-ups
- Plan feedback methods for participants

# Participants in our study receiving findings



# Acknowledgments

TMI: Leslie Dunn and Charlie Schulberg

Chernobyl/Kiev: Semyon Gluzman, Natalia Panina, Evgenii Golovakha, Vlodymyr Paniotto

Chernobyl: Johan Havenaar, Gabrielle Carlson, Joe Schwartz

Fukushima: Jun Shigemura, Aya Goto, Hitoshi Ohto, Norito Kawakami

Biggest thanks to the men and women who participated in the research