PHYSICIANS´ KNOWLEDGE OF RADIATION DOSES AND RISKS

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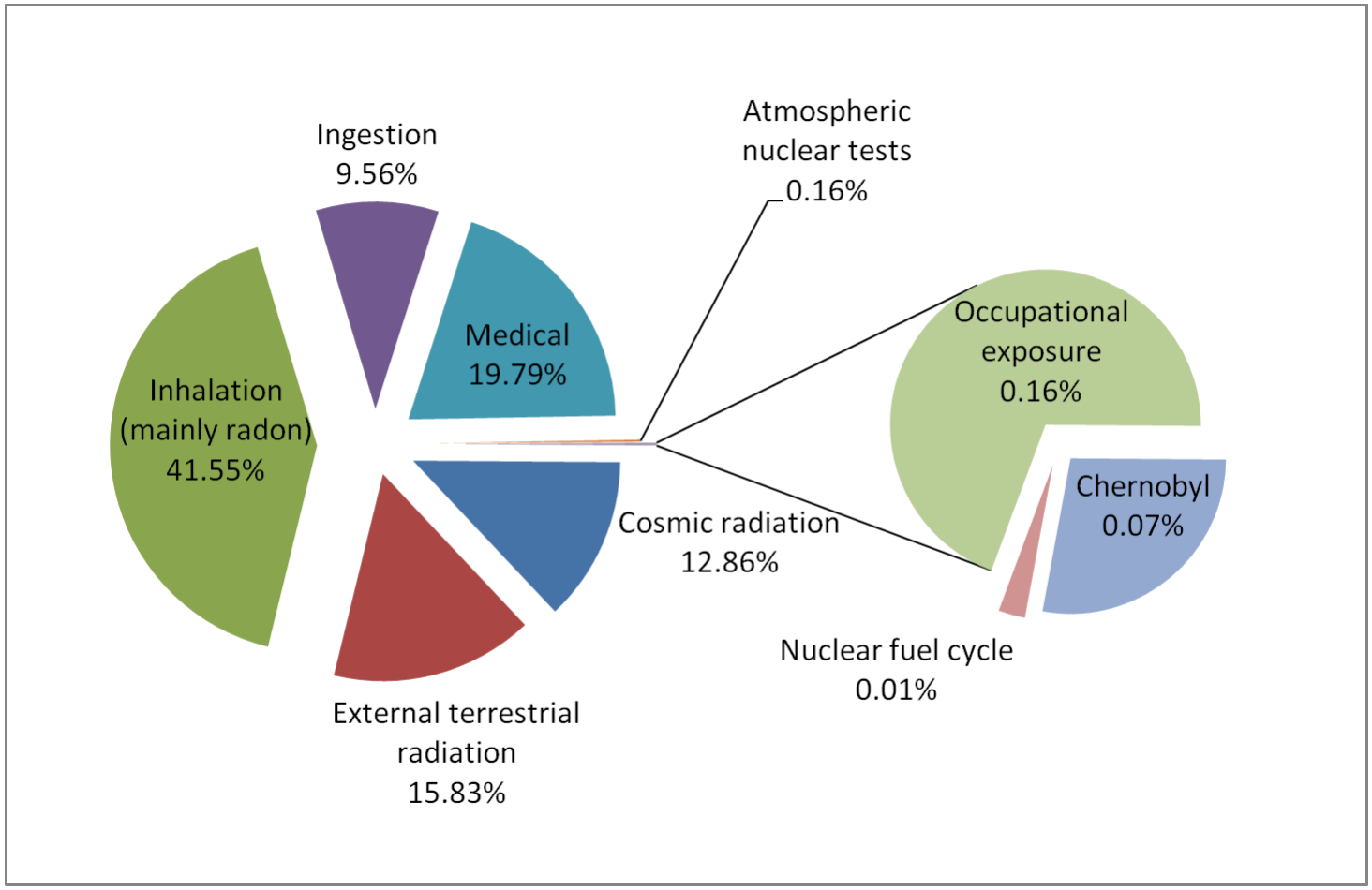
Overview

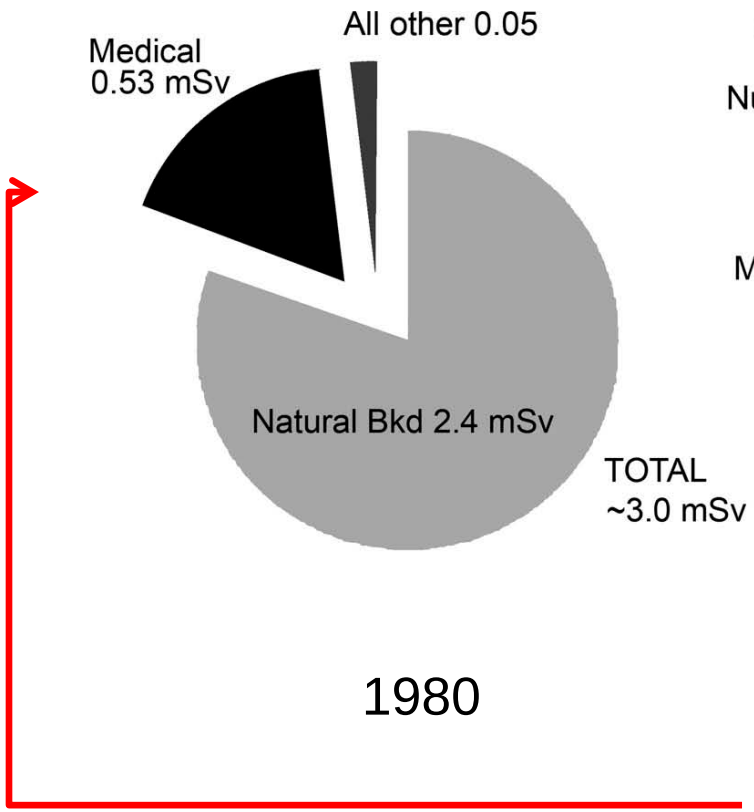
- Physicians – important stakeholders
  - Public trust
- Physicians´ knowledge on ionizing radiation
  - Literature review
  - Survey in Germany
- Conclusions

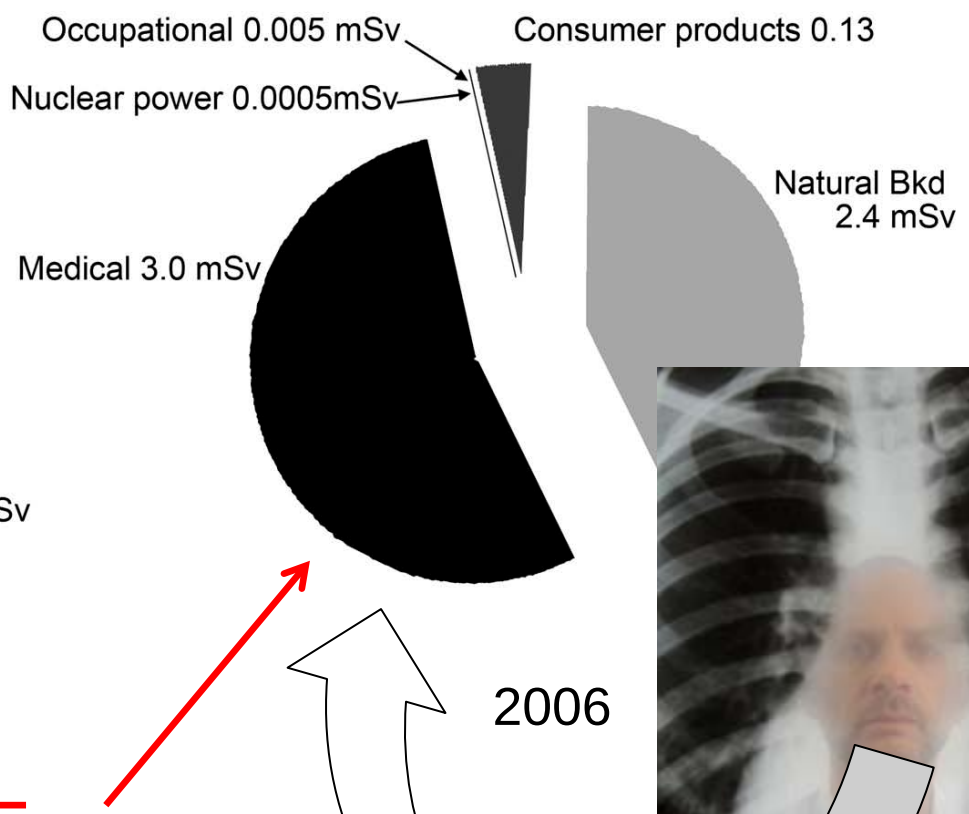
What contributes to radiation exposure of the public – the general picture?



UNSCEAR 2008

U.S. annual per-capita effective radiation dose from various sources





Hricak H et al. Radiology 2011;258:889-905

Physicians

- .. thus are a natural “point of reference“ for questions of the public regarding radiation
- primarily “medical radiation applications“
  - physician-patient interaction

- … but dose and risk considerations transferable to environmental, accidental exposures etc.

- Status as (medical) professional conveys public trust *

e.g. Thomson et al, 2012, Krewski et al 2004

Physicians – a trusted information source

Table 2. Level of Trust in Specific Health Information Across Information Sources Among US Adults*

Source	Level of Trust in Cancer Information: A Lot		Some	
Physician	62.4 (60.8-64.0)		30.7 (29.2-32.2)	
Internet	23.9 (22.4-25.4)		40.9 (39.3-42.6)	
Family or friends	18.9 (17.9-20.0)	48.9 (47.4-50.3)	25.3 (23.9-26.7)	6.9 (6.0-7.7)
Magazines	15.9 (14.7-17.0)	50.3 (48.7-51.9)	21.0 (19.9-22.2)	12.8 (11.8-13.8)
Newspapers	13.1 (12.0-14.2)	50.3 (48.6-52.0)	23.7 (22.3-25.1)	12.8 (11.7-13.9)
Radio	9.9 (8.8-11.0)	44.0 (42.2-45.9)	25.8 (24.3-27.4)	20.2 (18.9-21.6)

*Data are given as mean percentage (95% confidence interval) of adults (weighted).

- Similar results in many other countries

Hesse et al, Arch Int Med 2005

(Dr.) Twitter …

- Tweets with **#fukushima** increased from
  - a few per day to
  - + 230,000 in the first month after the disaster
- Credibility analysis
  - 2/3 from high-credibility sources (including academics, medical)
  - 1/3 from low credibility sources (incl. “conspiracy theorists“)

Thomson et al, Proceedings of the ISCRAM conference 2012

Role and Status of Physicians in (Radiation) Risk Communication

- Physicians as trusted sources of information
  - Unbiased, objective, honest
- Physicians as perceived experts
- Physicians as responsible and ethically motivated partners of patients (and the public)
- **So: what do they know about radiation and about risks ?**

Evidence from systematic review

European Journal of Radiology 76 (2010) 36–41

Contents lists available at ScienceDirect

European Journal of Radiology

journal homepage: www.elsevier.com/locate/ejrad

Review

Systematic review on physician's knowledge about radiation doses and radiation risks of computed tomography

Lucian Krille[a,*], Gaël P. Hammer[a,1], Hiltrud Merzenich[a,2], Hajo Zeeb[b,3]

Study questions

Context: medical diagnostic radiation, CT

Core questions adressed by studies:

- ***Do physicians correctly estimate radiation doses of medical imaging ?***
- ***How precisely can physicians estimate doses from certain procedures relative to others ?***
- ***Are physicians aware of possible cancer risks ?***
- ***What is the role of training and experience ?***

Methods

- Systematic review protocol
- Multiple electronic literature databases
- Handsearches of 4 journals

- Large number of initial hits, finally……

- **14 published papers** on relevant surveys/studies
  - 39 – 313 participants in individual studies
  - Different groups of physicians (radiologists, emergency room doctors, paediatricians)
  - Estimation of dose ranges associated with typical exams
    - in equivalents of chest X-rays

Results

- Adult chest x-ray (CXR): 20-60% correct dose range
- Adult CT: about 30% underestimation
- Paediatric CT: more than 50% underestimation
  - Small percentage in correct range

- Comparison CXR – CT (adult)
  - Mostly underestimation of CT (60-87% of respondents)

- Awareness of (very small) risk increase associated with a CT examination
  - Very heterogeneous results, (3.5 – 60% correct answers)

Role of experience and training

- Very little evidence from the literature !
- 2 out of 5 surveys report better knowledge associated with attendance of a radiation protection course
- No evidence on role of speciality, duration of professional experience (but hardly any data !)
- Repeat survey in German region showed some improvements across thematic areas

Own survey

Merzenich *et al. BMC Health Services Research* 2012, **12**:47
http://www.biomedcentral.com/1472-6963/12/47

BMC
Health Services Research

RESEARCH ARTICLE Open Access

Paediatric CT scan usage and referrals of children to computed tomography in Germany-a cross-sectional survey of medical practice and awareness of radiation related health risks among physicians

Hiltrud Merzenich[1], Lucian Krille[1], Gael Hammer[1], Melanie Kaiser[1], Shunichi Yamashita[2] and Hajo Zeeb[1,3*]

Methods

- Written/telephonic survey adressed to 811 physicians in two regions (east-west) in Germany
- Response: 295 (36%)
  - surgeons, paediatricians, general practitioners
- Survey includes 5 questions on knowledge, similar to earlier studies

1 What is your estimate of the average radiation dose of a standard chest radiograph applied to an adult patient? (mSv: effective dose, milliSievert). Please tick one box.

- ☐ < 0.01 mSv
- ☐ 0.01 – < 0.1 mSv c
- ☐ 0.1 – < 1 mSv
- ☐ 1 – < 10 mSv
- ☐ 10 – < 100 mSv
- ☐ > 100 mSv

3 The current estimate of the excess lifetime cancer risk of a 1 year old undergoing any CT scan is approximately:

- ☐ no excess risk
- ☐ 1 case of cancer in 100,000
- ☐ 1 case of cancer in 10,000
- ☐ 1 case of cancer in 1,000 c
- ☐ 1 case of cancer in 100
- ☐ not specified

2 If you consider the effective dose of an X-ray chest examination in an adult to be one unit - how many equivalent units do you estimate the following examinations would be?

	0<1 lower	1 reference	2-10 times higherr	11-100 times higher	101-1000 times higher	>1000 times higher
Chest X-ray, Adult		X				
Chest X-ray, newborn		c				
Chest CT, Adult				c		
Chest CT , children (without dose adjustment)					c	
Abdomen CT, Children				c		
Abdomen MRT, Children	c					
Abdomen US, Children	c					

(CT = Computed tomography, US = Ultra sound, MRT = Magnetic resonance tomography)

Main results

- Knowledge appears limited
  - Doses overestimated for conventional paediatric CXR
  - Doses underestimated for adult and paediatric CT
  - “Risk“ question with hardly any correct answer

Table 5 Assessment of equivalent units in relation to an X-ray chest examination in an adult

Imaging procedure	Patients age	Under-estimation	Correct answer	Over-estimation
Chest X-ray	Newborn	16.3%	8.8%	67.8%
Chest CT	Adult	47.5%	31.5%	13.5%
Chest CT	Child	66.1%	21.7%	4.1%
Abdomen CT	Child	25.8%	40.3%	26.8%
Abdomen MRI	Child	/	80.0%	12.9%
Abdomen Ultrasound	Child	/	90.5%	3.1%

* n.a., no answer

Merzenich et al, 2012

Interpretation

- Limits in radiation dose - and risk knowledge among office-based physicians in Germany
- Survey among non-specialists
  - but even radiologists may not know everything….
  - .. and these are the doctors referring for x-ray exams
- Education and training welcomed by many physicians
  - e.g. 40% were interested in training to better understand the radiation-cancer link
- What they do know well: radiosensitive organs !

2012: Rehani et al - IAEA survey

- International online study on patient rad exposure
- 767 responses from 28 countries, 728 analysed
  - Somewhat unclear who answered (no Germans!)
  - Excluded: radiologists, radiation oncologists, nuclear medicine specialists
- Knowledge on doses:
  - 35 % correct relation CXR – CT
  - 58 % underestimate CT abdomen dose (in relation to CXR)
  - 47 % overestimate abdomen and pelvic CXR
- 75% find radiation units confusing

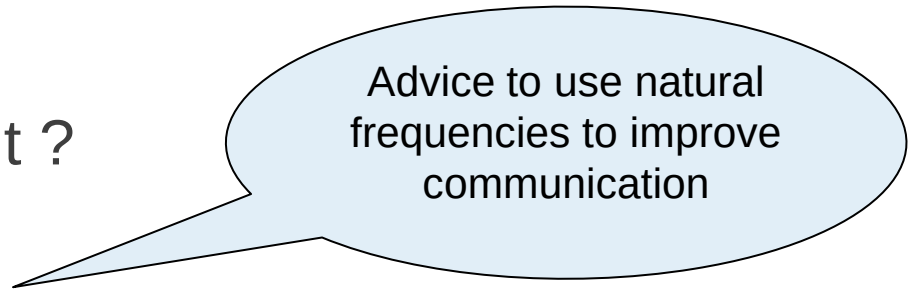
Needed for risk communication: knowledge on risk perception

- Common problem: dealing with numbers

- Germany 1998*: Survey among 1000 people
- Question: What does “40%“ mean ?
  - 1 out of 4 ?
  - 4 out 10 ?
  - Every 40th person ?

- > one third unable to answer the question (> 33.3% !)

- Japan, US different ?



* reported in Gigerenzer 2002

Typical medical radiation risk communication approaches *

- Paternalistic approach
  - Trust me, I am your doctor
- Risk comparison only approach
  - 4 flights equal your CXR dose
- Risk numerology approach
  - The relative risk is 1.2 per 100 mSv effective dose
- Quality assurance approach
  - We only use the most modern machines

- Each approach has limits …
- Easily translated into communication after nuclear accident, environmental radiation etc.

Dauer et al, AJR 2011

A reminder…

"People want to know you care before they care what you know "

…probably true not only in the context of medical decisions …

Covello NCRP 2010

Suggestions for future action

- Physicians need …
  - Knowledge on benefits **and** risks of radiation
  - Effective strategies for communication
    - Engage with patients/public, evaluate understanding
  - Be aware of own beliefs and emotions
  - Ability to tailor communication to different populations
- Relevant training at present probably not adequate
  - more and better training required
- Support from
  - National (professional) bodies
  - International organizations (e.g. IAEA, WHO)

Thank you

and thanks to my colleagues and all respondents who answered the survey

www.bips.uni-bremen.de

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