



PARTICIPATORY GOVERNANCE OF NANOTECHNOLOGY

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PI: NSF NIRT #0809470 – Intuitive
Toxicology and Public Engagement,
2007-2011.

<http://pcost.org>

GOVERNANCE AND PARTICIPATION

GOVERN

- Laissez-faire – allow current regulations to extend over nanotechnology.
- Incremental – update regulations, e.g., labeling on products, exposure restrictions, etc.
- Radical – ban some applications or ban all applications.

PARTICIPATE

- Referenda and initiative.
- Public hearings and commentary.
- Public proxy: NGOs.
- Public informed by bureaucrats and media broadly defined).
- Experimental conferences with limited input into policy making.

1. Expert Delphi Study

Multidisciplinary Expert Panel
(n=20):

- Chemistry.
- EHS Policy.
- Engineering.
- Environmental toxicology.
- Human toxicology.

Asked Experts to respond to
two primary questions:

- What are the characteristics of nanoparticles that are potentially or actually problematic to environmental health and safety (EHS)?
- Which nanoparticles are potentially or actually problematic to EHS?

**BERUBE et al.
DATA (Nanotoxicology 2010)**

Asked to respond to issues of:

- Nanoparticle toxicity,
- Potentially problematic uses,
- Potentially problematic applications,
- Estimations of public perceptions of risk.

followed a three-round model:

1. **Round One:** The study began with a questionnaire that sought individual responses. Once initial responses were received, the data were summarized and a new questionnaire was developed based on the results.
2. **Round Two:** The second questionnaire was disseminated among respondents who were asked to reconsider their original answer to the questions.
3. **Round Three:** The process was repeated again in round three in order to evaluate the strength of consensus among respondents.

CHARACTERISTICS AND CLASSIFICATION OF NANOPARTICLES: EXPERT DELPHI SURVEY

Table I. The top ordinal rankings of problematic nanoparticle characteristics.

Characteristic	Mean	Std. Deviation
Reactivity	1.44	1.42
Size	2.56	1.10
Composition	3.94	2.13
Surface area to volume	4.28	1.87
Surface charge	5.53	2.04
Surface coating	6.19	2.01
Shape and surface curvature	7.06	2.10
In soluble and durable	7.84	2.90
Contaminants and impurities	8.58	2.06
Surface hydrophobicity	9.38	2.35
Fibrosity	10.44	1.48
Surface Defects	10.99	1.57
Porosity	12.02	1.28
Density	13.27	1.00

Table II. The top ordinal rankings of the problematic tendencies of nanoparticles.

Nanoparticle Tendency	Mean	Std. deviation
To be reactive	1.17	.383
To bind with proteins	2.65	.681
To stimulate cellular reproduction	3.83	1.38
To bind to or mimic	5.00	1.33
To aggregate	5.11	2.11
To redistribute	5.17	1.69
To function as vehicles	5.67	1.61
Special challenges*	6.79	2.20

CHARACTERISTICS AND CLASSIFICATION OF NANOPARTICLES: EXPERT DELPHI SURVEY

Table III. The top concerns for how nanoparticles react with the environment.

Life Cycle Complications	Mean	Std. Deviation
Environmental persistence	1.67	.970
Bioaccumulation	1.83	.786
Mobility in groundwater	2.83	.514
Byproducts of the production process	3.64	.837

Table IV. Expert estimations of potentially or actually problematic nanoparticles.

Nanoparticles	Mean	Std. Deviation
Carbon nanotubes (CNTs)	1.89	1.49
Quantum dots	2.33	1.03
Metal oxides	3.22	1.31
Metals	3.56	1.34
Fullerenes	3.94	1.30
Polymers	5.72	.46

Table V. Expert estimations of potentially or actually problematic metal oxides.

Metal Oxides	Mean	Std. Deviation
Silver oxides	1.94	.73
Zinc oxide	2.13	1.49
Cerium dioxide	3.13	.90
Iron oxides	3.56	1.37
Titanium dioxide	3.71	1.02

Dillman National Public Survey (w U South Carolina, N=307)

- Impressions of nano and synthetic bio (non-framed),
- General risk levels (Slovic),
- Concerns of nanoparticle risks,
- Perceptions of expert ratings of risk,
- Sources and use of various media for risk info
 - Trust
 - Social media sources,
- Demographics
 - Religion
 - Ideology

BERUBE et al. DATA (JNR 2010 submitted)

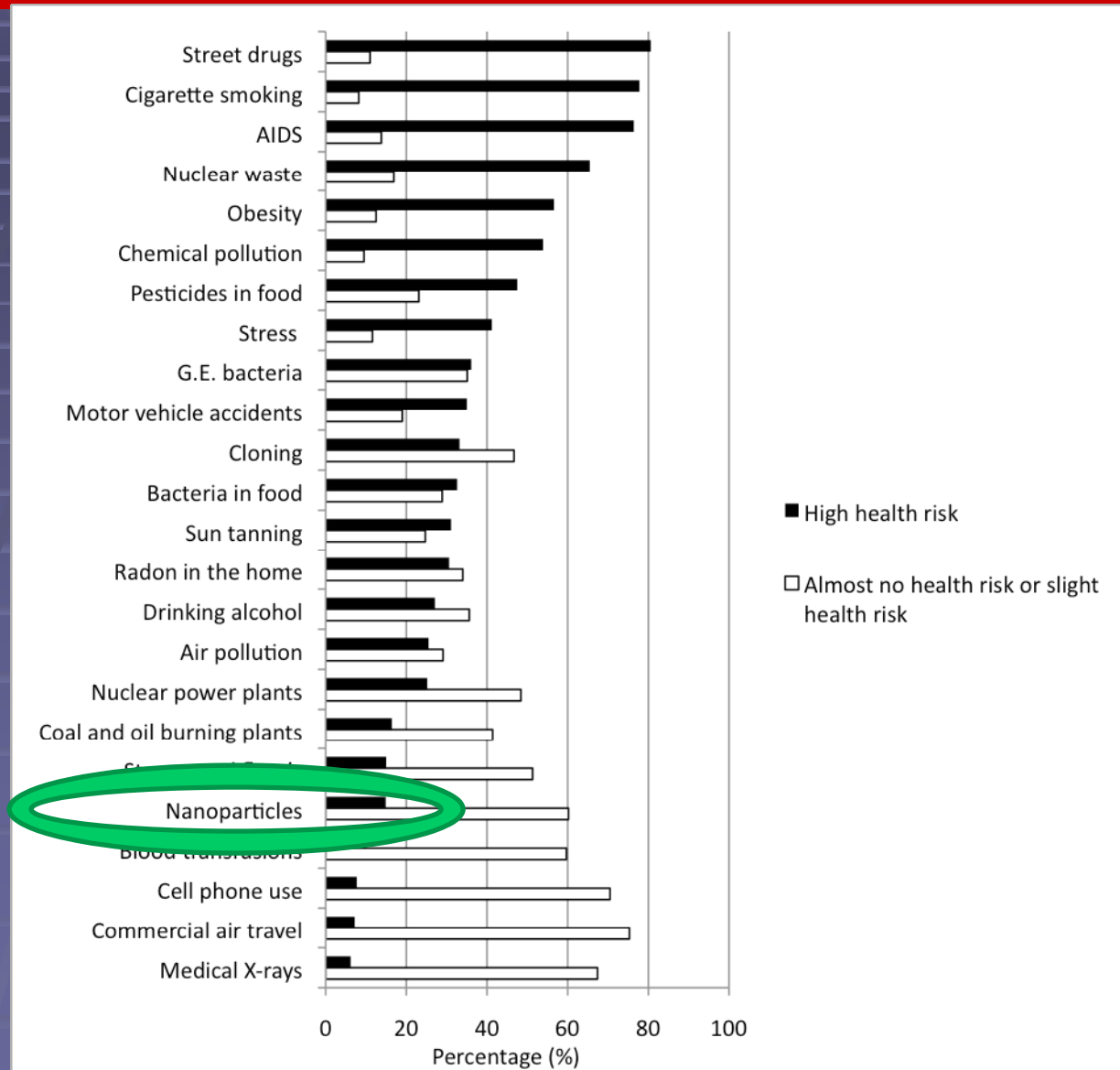
•Avoided priming respondents.

•Nanotechnology ranked 19th in terms of overall risk and 20th in terms of “high risk” among the 24 items.

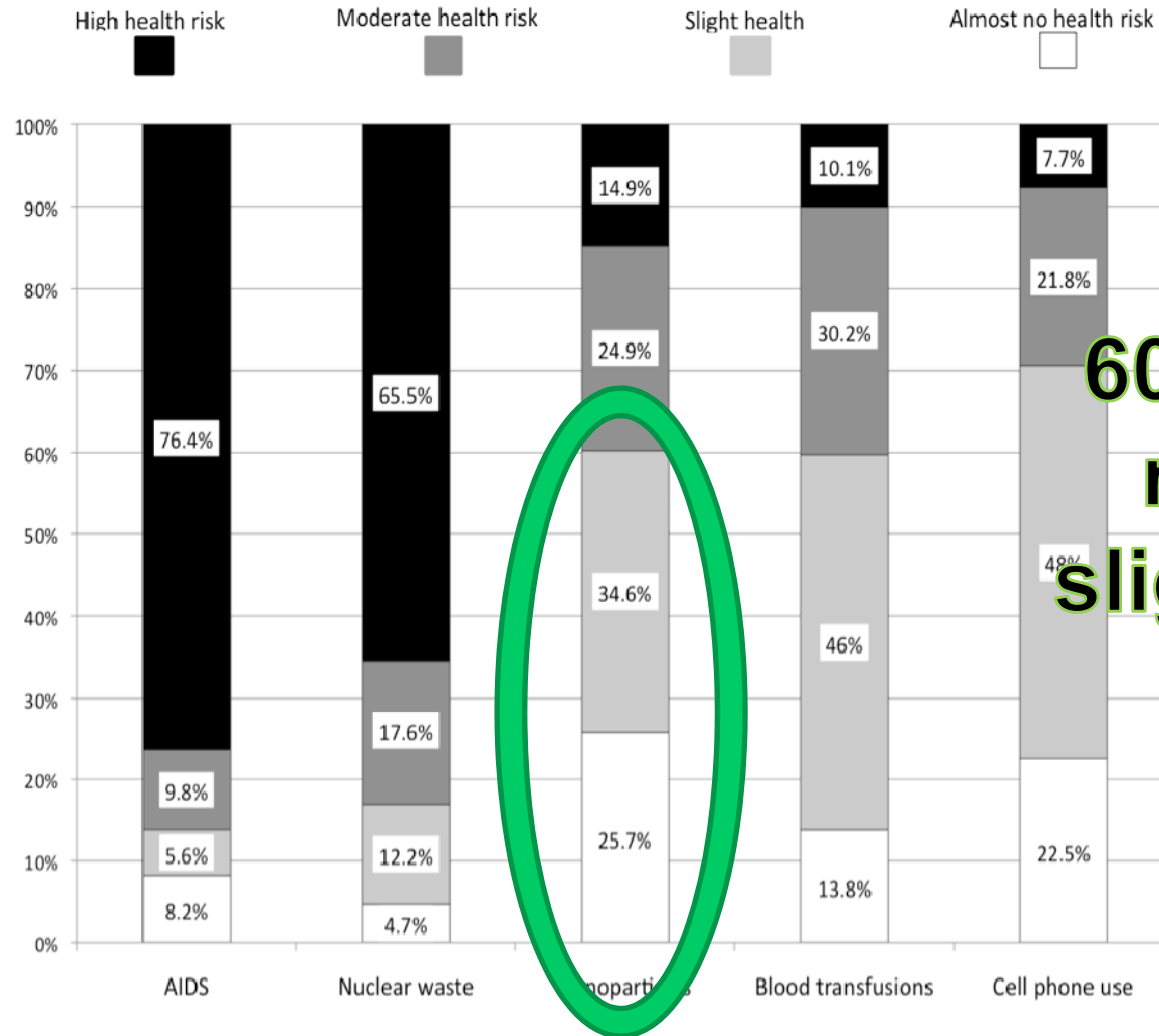
Risk	Mean	SD	N
Cigarette smoking	3.61	0.85	306
Street drugs	3.58	0.95	294
Chemical pollution	3.35	0.89	306
Nuclear waste	3.32	1.11	296
Obesity	3.32	0.98	304
AIDS	3.18	0.92	305
Stress	3.18	0.92	284
Pesticides in food	3.01	1.18	303
Motor vehicle accidents	2.97	1.05	306
Sun tanning	2.82	1.13	296
Bacteria in food	2.75	1.19	298
Air pollution	2.67	1.15	306
Genetically engineered bacteria	2.66	1.29	305
Radon in the home	2.63	1.24	297
Drinking alcohol	2.56	1.23	306
Cloning	2.4	1.36	289
Coal or oil burning plants	2.34	1.18	304
Nuclear power plants	2.28	1.3	306
Storms and floods	2.12	1.2	300
Nanoparticles	1.94	1.2	269
Blood transfusions	1.91	1.14	298
Medical X-rays	1.71	1.05	307
Cell phone use	1.67	1.06	298
Commercial air travel	1.57	1.02	304



BERUBE et al. DATA (JNR 2010 submitted)



BERUBE et al. DATA (JNR 2010 submitted)



**60.3% no
risk to
slight risk.**

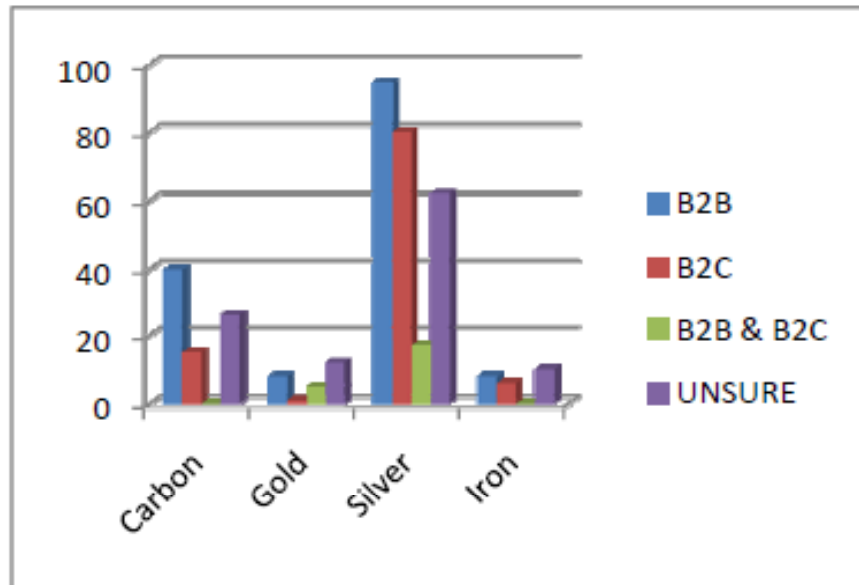
Project on Emerging Nanotechnologies' (PEN)

Quantitative Content Analysis of Consumer Products Inventory (CPI):

- Motivated by the frequency that the CPI was cited in reports and articles discussing nanotechnology.
- The CPI details over 1000 consumer products purportedly involving nanotechnology.
- A Google Scholar search using the descriptors—PEN, CPI, consumer products, and nanotechnology—produced over 700 academic publications citing the PEN Consumer Products inventory.

BERUBE et al. DATA (NLBJ 2010)

Distribution Channels for Products



B2B (Business to Business) 39% (N= 153).

B2C (Business to Consumer) was 26% (N= 103).

Companies that were both B2B and B2C 5% (N= 22)

Unknown 29% (N= 113)

Shortcomings of the CPI:

- 1. Almost anyone can post a product on the CPI.**
- 2. There is no indication when the CPI is updated.**
- 3. Also, the list does not delineate between B2B and B2C companies.**

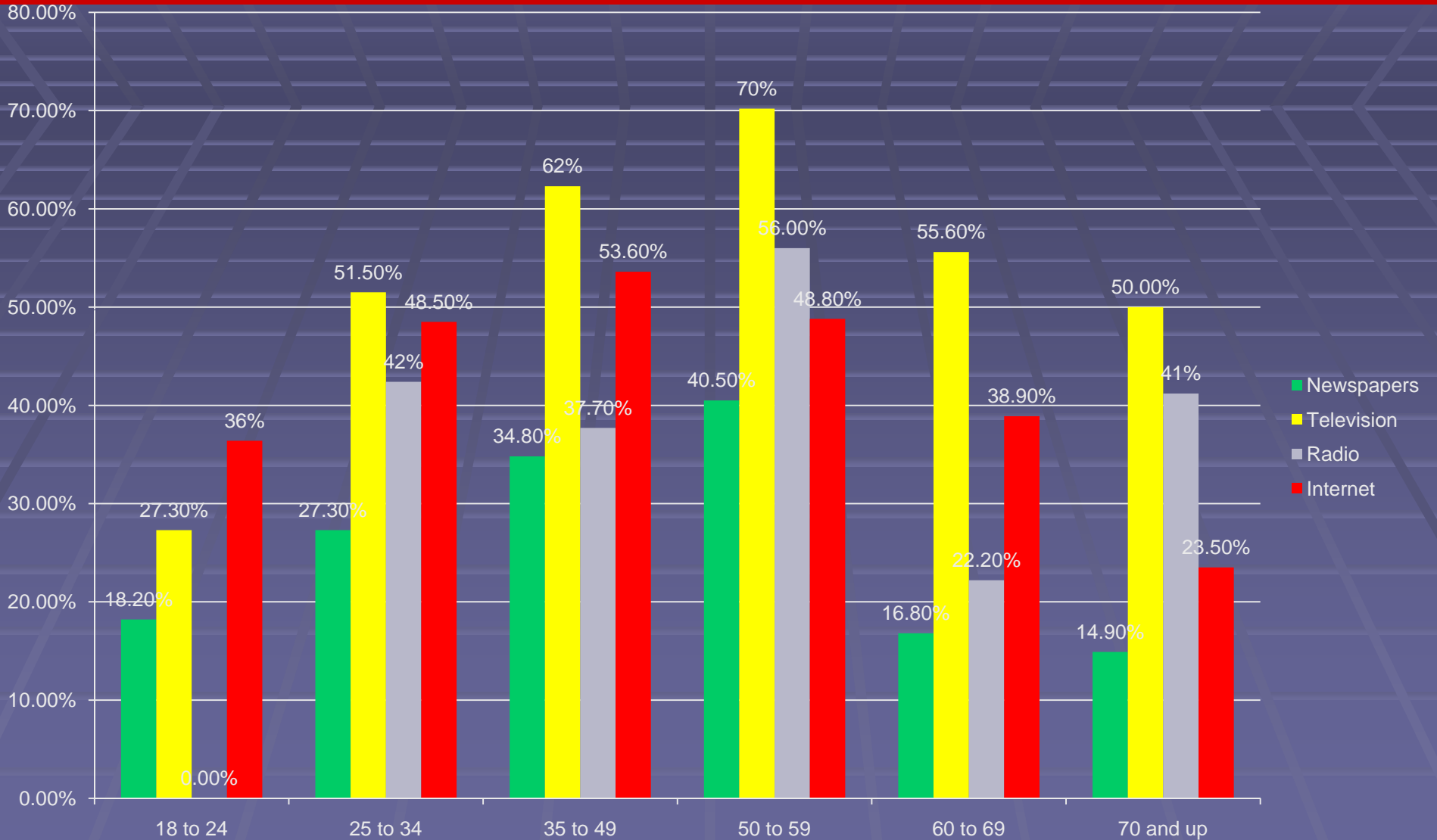
Berube, Binder et al CURRENT PROJECTS

- Current Projects:
 - EHS info-seeking, ESP NEW MEDIA.
 - Socio-economic indicators of risk perceptions - MOVING PAST ATTITUDES.
 - Updating risk perception data (Slovic 15 years later).
 - Open ended responses coded against risk aversion – LINKING KNOWLEDGE TO ATTITUDE ATTRIBUTES.

EHS INFO-SEEKING

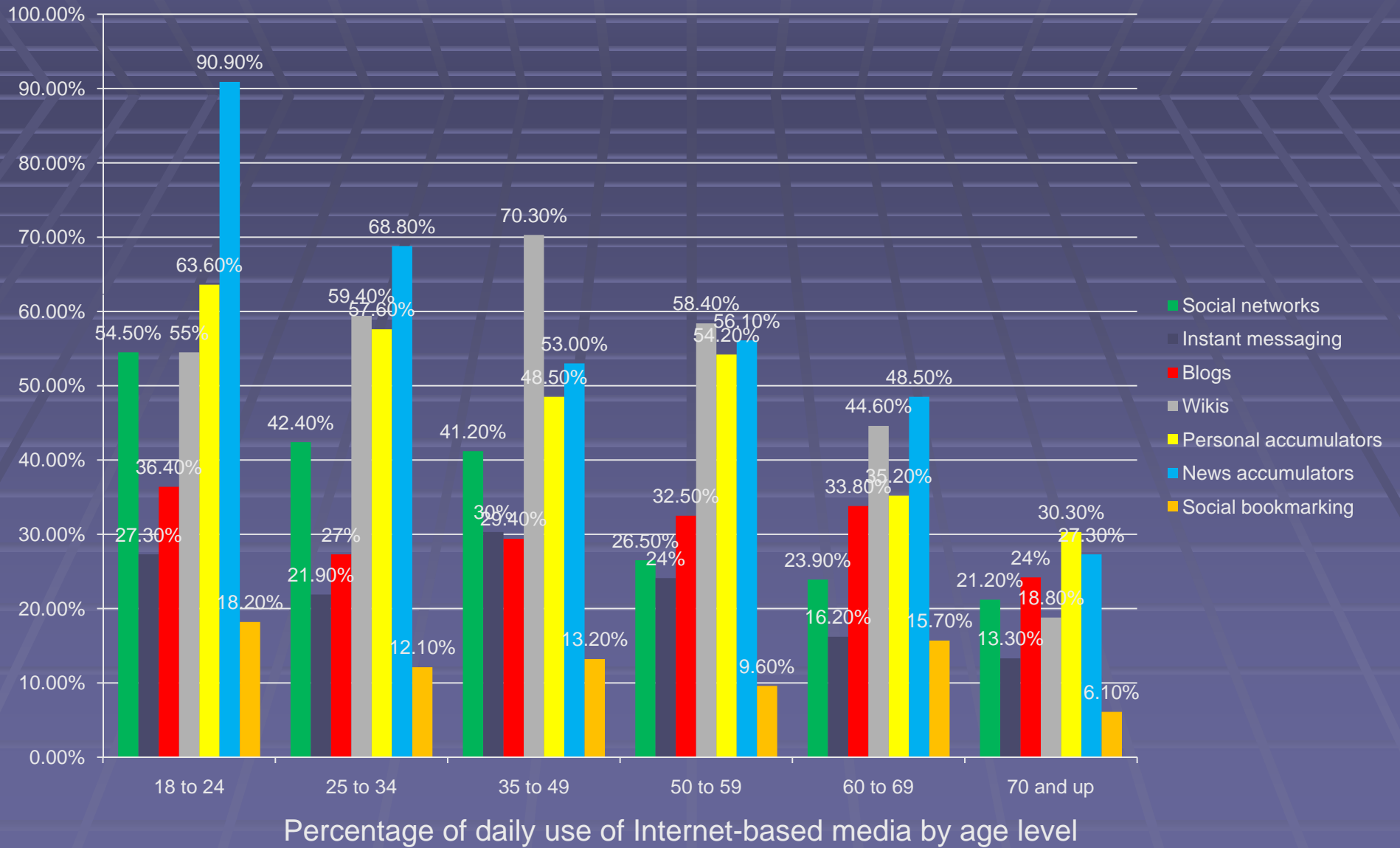
- EHS info-seeking:
 - Public is moving online for information about EHS risks
 - television was the most frequently used (M= 3.38, SD= 0.86) followed by the Internet (M= 3.08, SD= 1.03) and radio (M= 2.85, SD= 1.13). Newspapers were reported as the least used medium (M= 2.82, SD=1.05).

EHS INFO-SEEKING



Percentages of daily use of major media by age

EHS INFO-SEEKING



UPDATING GENERAL RISK PERCEPTION DATA

- Updating general risk perception data (Slovic 15 years later):
 - Updated index of 24 hazards
 - Will note general shifts in public's risk perceptions of various hazards (subject of follow-up research).

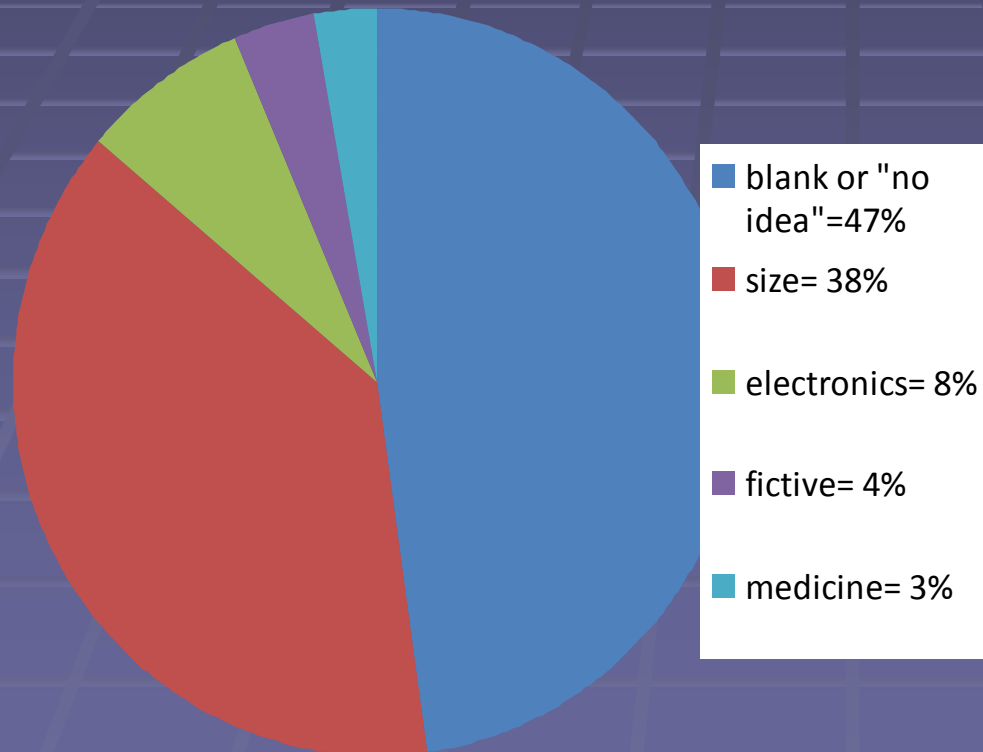
SOCIO-ECONOMIC INDICATORS OF RISK PERCEPTIONS

- Religiosity and Culture merge with Ideology on debates over regulation. Active variable may have little to do with the object under study.
 - Income and Education are likely to be better predictors of risk perceptions for the greater population.
 - OLS (ordinary least squares) regression modeling underway to estimate unknown parameters.

UNPRIMED PUBLIC KNOWLEDGE/INTEREST DATA

“What comes to mind when you hear the word “nanotechnology”?”

Public perceptions of nano



- *“Very very small subject matter- beyond microscopic.”*
- *“Cutting edge research and technology that has made products smaller, faster, lighter, and stronger.”*

ATTITUDE FUNCTIONS

- Social-adjustive.
- Social identity.
- Self-esteem (ego-defensive) (Smith, Bruner & White 1956, Shavitt 1990).
- Personal utility.
- Social utility.
- Value expressive.
- Social adjustive (easing social interaction).
- Social identity.
- Self-esteem maintenance (Gastil 1992)

UNPRIMED PUBLIC KNOWLEDGE/INTEREST DATA & ATTITUDE FUNCTIONS

- Different people favor different attitude functions and personality characteristics to stand in for more direct assessments of function (Snyder 1974).
- Function of an attitude toward an object is shaped by the nature of the object because objects can differentially (sic) lend themselves to attitude function (Shavitt 1990).
- Messages with appeals matching the receiver's attitude function are more persuasive (Herek 1986).

SUBAWARDS

- Wisconsin – working on trust variables involving messages on nanotechnology.
- Minnesota – working on public understanding of messages on food and nanotechnology.
- South Carolina – completing a set of four engagement events (organic) with high levels of ecological validity.

FROM HERE

- Information seeking behavior associated with **digital media** including mobility (news online?).
- Trust associated with digital media and interactive effects with traditional sources (e.g., government officials, NGOs) and intersectional trust issues when they use **digital media**.
- Media contagion phenomena involving **digital media** (virality).
- Risk fatigue (redundancy, repetition) examining frequency, intensity and complexity across media.



RISK ANALYSIS AND MANAGEMENT: NANOSCIENCE

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THANKS

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