

# Flu Shots and the Elicitation of Subjective Probabilities

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*work in progress*

*Rotterdam, December 4, 2008*



# Research Questions

- Why do people accept/decline (free) preventive care?

*Probabilities* are central. Accept prevention if :

$$\pi < (p_{\text{without}} - p_{\text{with}}) \cdot D$$

$(p_{\text{without}} - p_{\text{with}})$ : effectiveness of intervention

## Research Question (cont)

- Can we elicit the probabilities that are implicit in people's decisions?
  - What is the best way to formulate/ask probability questions?
  - How do people answer subjective probability questions?
- How do subjective expectations compare with epidemiological estimates?

“Probability Literacy”

# Why study Flu Shots?

- From Research perspective:
  - Annual, individual decisions
  - Age cutoffs create a natural experiment
- From Policy perspective:
  - Relationship between Socio Economic Status (SES) and health is in part due to differences in health investments
  - Evaluate/improve effectiveness of existing programs (e.g. by affecting probability perceptions)

# Flu Shots in the Netherlands

- Influenza & flu shots
  - Flu shot invitations to everyone 60+, plus other high risk individuals
  - Every year; paid for by the government
  - Invitation from GP
  - Some employers encourage taking flu shots
  - Epidemiological literature suggests it reduces risk by 80%

## We use data from 3 internet surveys:

	CentERPanel	MESS - LISS	ALP
Country	NL	NL	US
Survey date	Apr. 2007	Sept. 2008	Sept. 2008
Sample size	1913	4631	1227

# Internet surveys include questions on

- Use of prevention
- Invitation to use prevention
- Cost and time to use (expected and actual)
- Perception of importance of use (individual and doctor)
- Some reasons why people don't use
- Subjective probability that you get disease  
(with and without intervention) ←
- Subjective probability that you die from disease  
(with and without intervention) ←
- Friends who died from disease

# Consensus about how to ask Subjective Probability Questions (see e.g. Manski, 2004)

- *Now, we will ask some questions about future uncertain events. Try to think of all possible outcomes, and think about how probable they are. Try to estimate the percent chance that this will happen. Your answer must be a number between 0 and 100.*

# How to Ask Subjective Probability Questions (cont.)

- *“0” means absolutely impossible*
- *Numbers such as 2 or 5 per cent chance mean nearly no chance “”.*
- *Around 20 per cent mean “not much chance” means.*
- *Around 50 per cent chance “for even”.*
- *Around 80 per cent means a “very good chance”*
- *95 or 98 per cent means “nearly certain”.*
- *“100” means “absolutely certain”.*
  
- *You can also see “percent chance” as the number of times out of 100.*
- *You can also use numbers after the decimal point.*

## Trial question

- *C. We start with the weather where you live. What do you think is the chance that tomorrow it will be cloudy where you live?*

*----- % Chance*

We beginnen met het weer in uw woonplaats.

Hoe groot schat u de kans dat het morgen in uw woonplaats zwaar bewolkt is?

 % kans

Vorige

Verder

We beginnen met het weer in uw woonplaats.

Hoe groot schat u de kans dat het morgen in uw woonplaats zwaar bewolkt is?

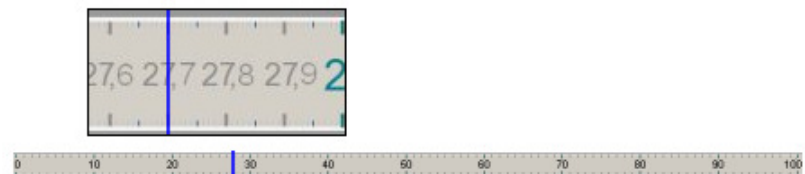


Vorige

Verder

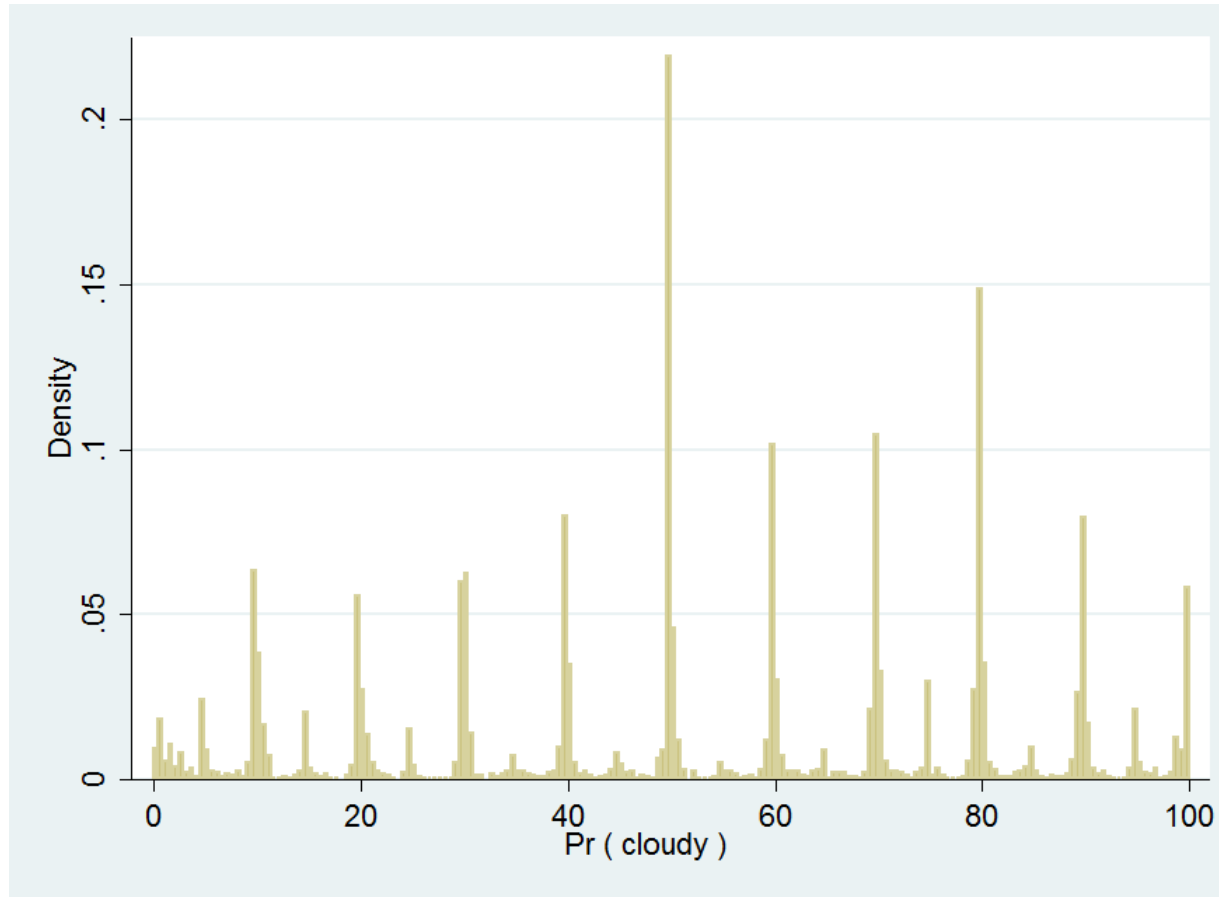
We beginnen met het weer in uw woonplaats.

Hoe groot schat u de kans dat het morgen in uw woonplaats zwaar bewolkt is?



Vorige

Verder



MESS-LISS Panel; n=5818

## Probability literacy: marginal vs joint probabilities

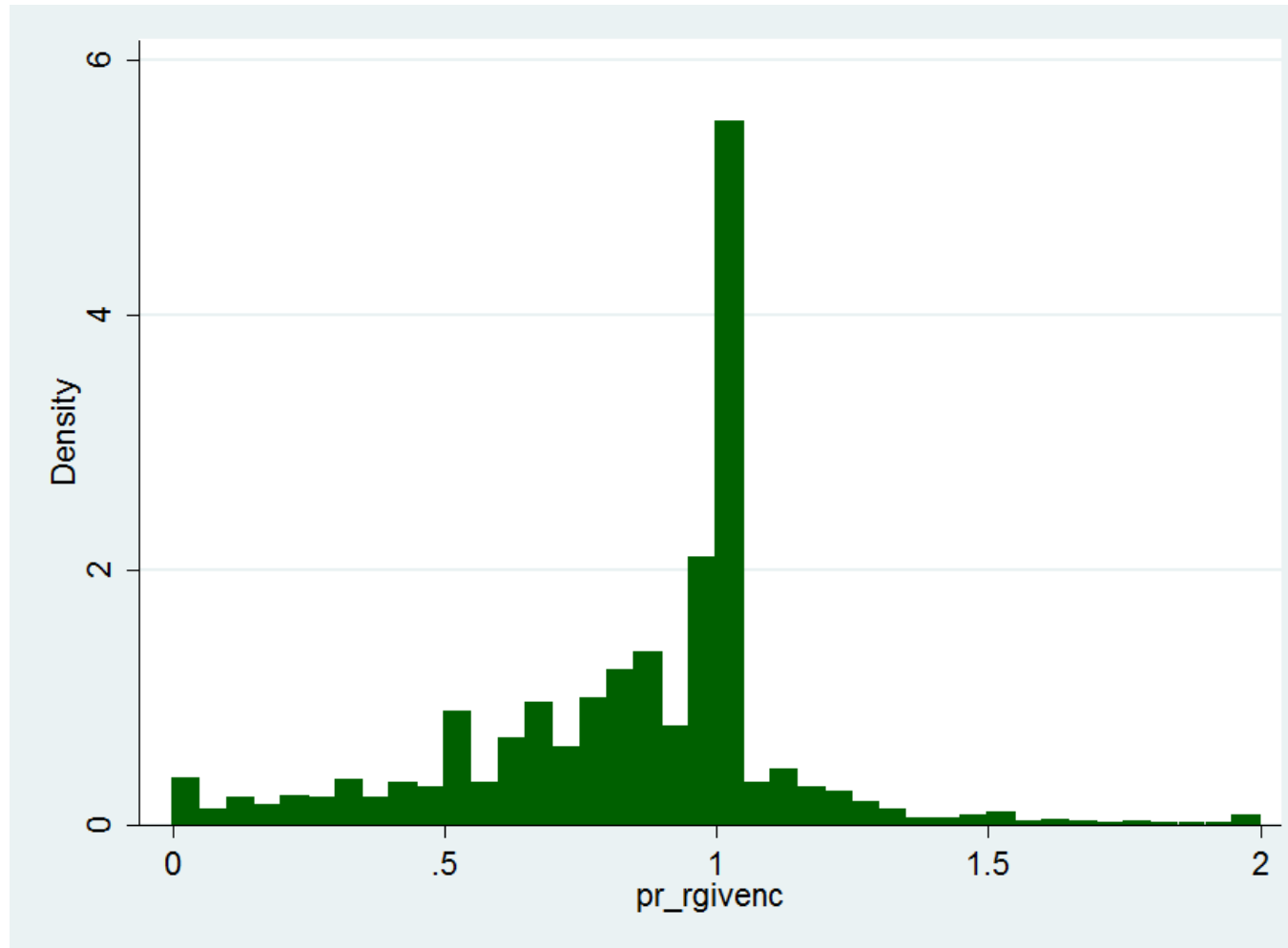
- **C.** *We start with the weather where you live. What do you think is the chance that tomorrow it will be cloudy where you live?*

----- % Chance

- **C&R.** *What do you think is the chance that tomorrow it will be cloudy and will rain where you live?*

----- % Chance

# Distribution of implied conditional probability



# of obs. 5818; fraction inconsistent 0.233;  
234 observations with pr>2 deleted in graph

# Who gives inconsistent answers?

	Coef.	Std. Err.	t	P> t
college or univ.	-.0455	.0117	-3.91	0.000
female	.0304	.0108	2.82	0.005
Leeftijd	.00072	.0003	2.09	0.037
Constant	.164	.0190	8.61	0.000

Linear Probability model;

Dependent variable: inconsistent answer;

n=5818.

# Subjective Probability: getting the flu

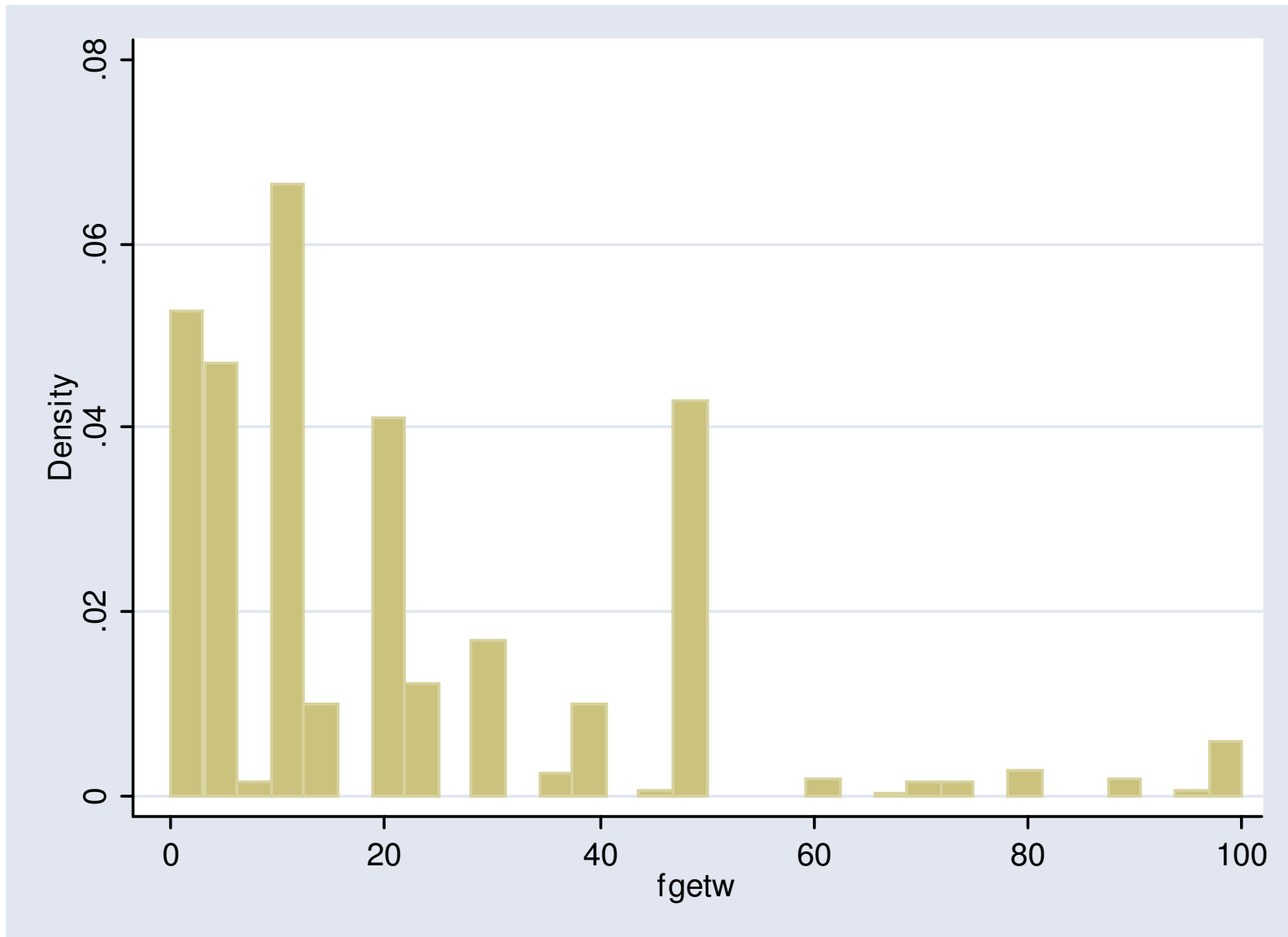
*How big do you think the chance is that you will get the flu next winter?*

*Assume that you have  
a flu shot next fall*

*----- % Chance*

*Assume that you do not have  
a flu shot next fall*

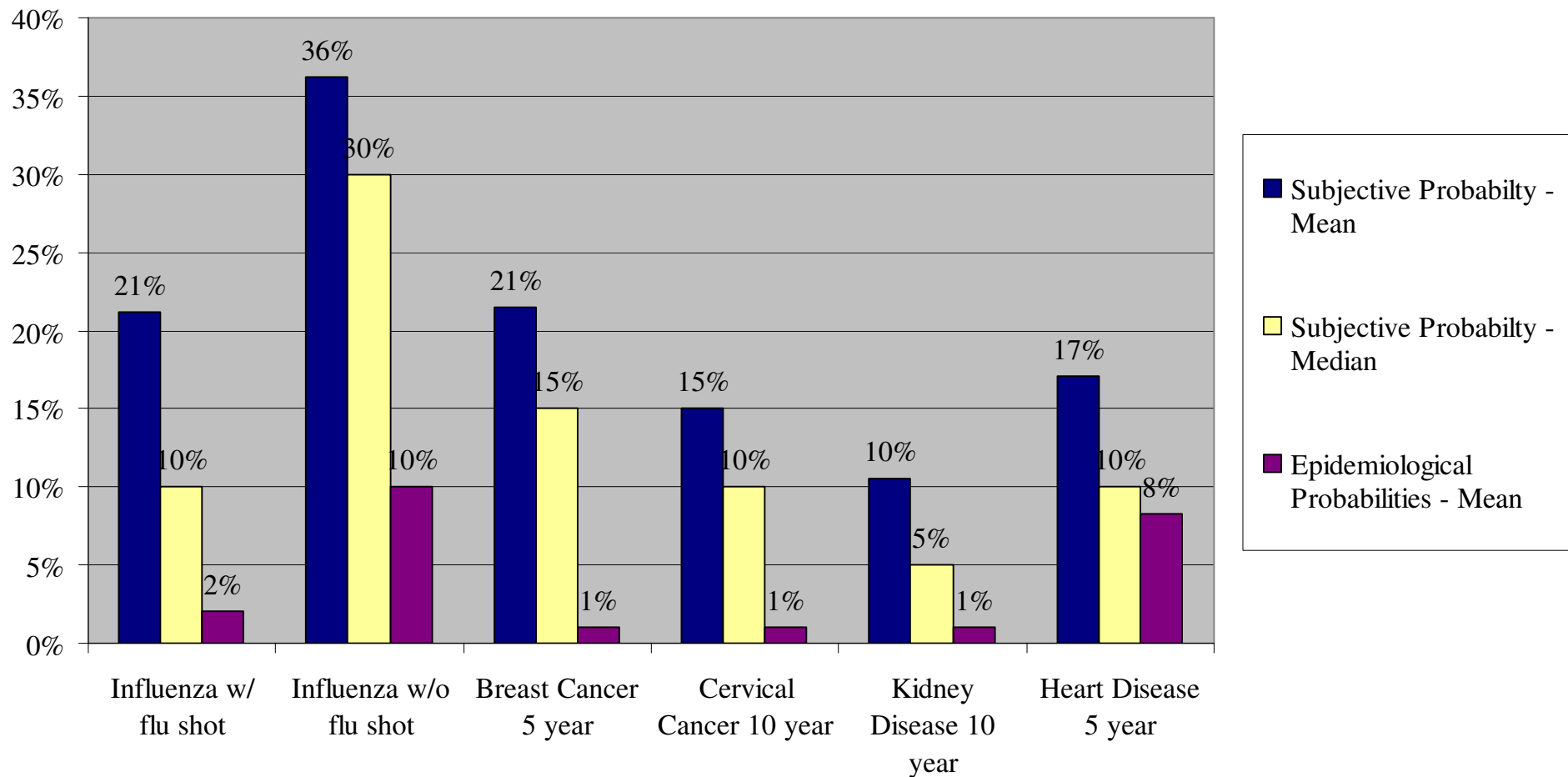
*----- % Chance*



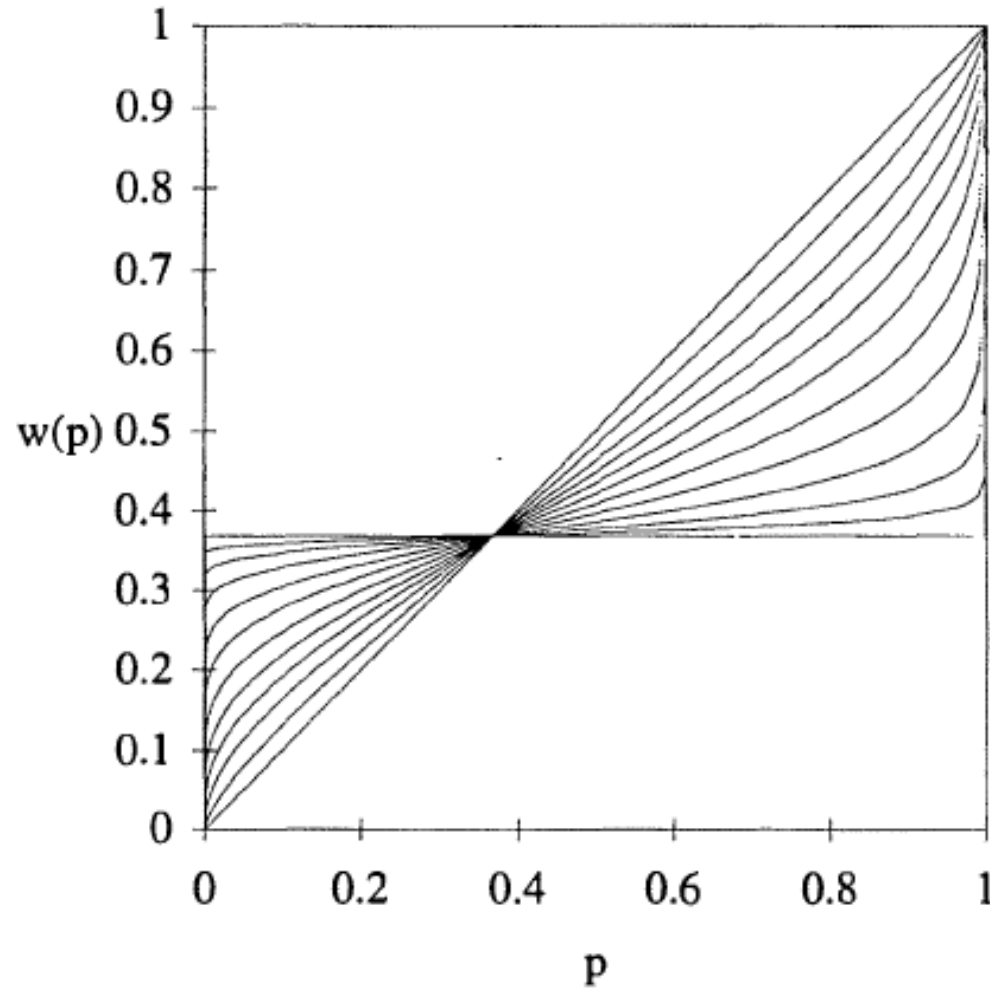
Distribution

Subjective probability to get the flu

# Subjective Probability of Contracting Diseases

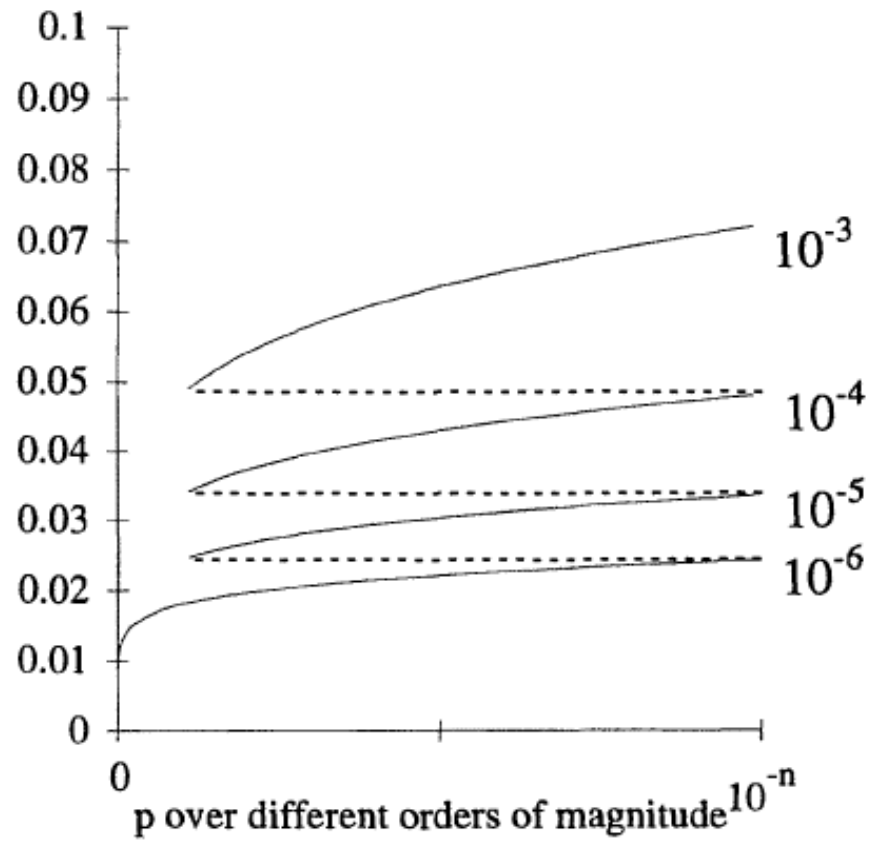


## Actual versus subjective probabilities



$$w(p) = \exp(-(-\ln p)^\alpha)$$

Source: Prelec (1998)



$$\alpha = .65$$

Source: Prelec (1998)

# Does a Flu Shot help to prevent the flu? (based on probability answers)

% of all respondents (column wise)	actual flu shot last year	no flu shot last year
Makes flu less likely	81%	56%
No effect	9%	37%
Makes flu <i>more</i> likely	9%	7%

## Median probability of recovery within 1 week

	assume flu shot	assume no flu shot	difference made by flu shot
actual flu shot last year	60	40	20
no actual flu shot last year	70	60	10

## Median probability of recovery within 2 weeks

	assume flu shot	assume no flu shot	difference made by flu shot
actual flu shot last year	90	65	25
no actual flu shot last year	95	90	5

consistency rate: 92 percent

## Wording effect:

Mean subjective probability to die from the flu  
(conditional on getting the flu next winter)

	P("die")	1-P("survive")	<i>t</i> -value difference
assume flu shot	6.0	10.8	5.4
assume no flu shot	9.1	13.0	4.1

## Probability of Getting a Flu Shot as a Function of Perceived Risks

Dependent Variable	Model 1 Perceived Probability of Future Flu Shot	Model 2 Received a Flu Shot in Previous year
→ Probability of getting the flu without a flu shot( $p_{wo}$ )	0.465*** [0.036]	0.056*** [0.011]
→ Perceived effectiveness of flushot ( $(p_{wo}-p_w)/p_{wo}$ )	0.336*** [0.025]	0.060*** [0.011]
Observations	1227	4631
R-squared or Psuedo R-Squared	0.544	0.7418
Data	ALP	MESS
Regression Type	OLS	Probit (Marginal Effects)

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ , Standard errors in brackets  
 Regressions also controls for Gender, Age 50-64, Age 65+, Education level, Expected time and cost for a flu shot, whether your doctor or employer offered a flu shot, and number of cases of influenza in the last 5 years

## Joint probabilities (cont)

- The following question is poorly phrased (from a statistical viewpoint)

*How large do you think is the probability that you will die from cancer within the next 10 years?*

3 possible outcomes:

- still alive
- died from cancer
- died from something else

## Eliciting subjective probabilities: empirical findings

- Rounding at multiples of 10 (and 5), in particular at 50%  
(less with ruler / magnifier )
- Probability literacy higher for:  
younger people, men, college graduates
- Subjective prob.  $\gg$  epidemiological prob.
- Perceived risks are strongly correlated with (intended) behavior

## Policy implications so far:

- Provide better quantitative information on the effect of a flu shot on
  - probability to get the flu
  - severity/duration of the flu (if contracted)
  - probability of death /survival (if contracted)(cf. current lack of info on [www.rivm.nl/grieprik](http://www.rivm.nl/grieprik))
- Personalize this information through a website  
(cf. [www.yourdiseaserisk.harvard.edu](http://www.yourdiseaserisk.harvard.edu))