Measuring Risk Attitude: Implications for Decision Analyses

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Background

- Decision analyses typically assume risk neutrality, such that the distribution of outcomes is ignored in favor of comparing expected values.
- Example: These choices are valued the same
  - Choice A: 100% chance of life expect. = 10 yrs
  - Choice B: 50% chance of life expect. =20 yrs
    50% chance of immediate death
- This is consistent within the policy framework where the goal is to maximize health for the population, but may not reflect an individual's preferences.

Paradox

- It is possible to have a strategy be optimal for a group, yet not be optimal for any individual.
  - Example:
    - Choice A: 100% chance of life expect. = 10 yrs
    - Choice B: 51% chance of life expect. =20 yrs
      49% chance of immediate death
  - Do you take the drug?
  - Expected values tell you "Yes".
  - People may tell you otherwise.

Distribution of Outcomes

- The distribution of outcomes may be important
- Example (Schrag D et al, JAMA, Feb 2, 2000):
  - Women with BRCA-associated breast cancer
  - 30 year old women, prophylactic strategies
  - Moderate penetrance, node-negative
  - Measure: Gain in life expectancy
- In response to a letter (Miller, L-AN and Singer ME), Schrag responded that only 2% of these women would die without prophylaxis. Thus, almost 98% would have no benefit in LE, while 2% would experience major gains.

Insurance Mentality

- Insurance is a winning proposition for the insurer.
- People know this.
- People buy insurance.
- Why? Catastrophic events are over-valued.
- Purchasers of insurance are exhibiting risk averse behavior.

Risk Aversion

- Do people approach some medical decisions like they do the purchase of insurance?
- Do people adopt a strongly risk averse position when confronted with the possibility of an extremely adverse outcome?
- If so, assumptions of risk neutrality will bias results against preventive measures.

Concept

- People may have a utility function for outcomes. Whereas risk neutrality uses expected values, such that all outcomes are weighted equally, it may be that people assign additional weight to particularly bad outcomes. Similarly the variance and skewness of the distribution of outcomes may factor into the evaluation.

Patient Characteristics

- While patient characteristics are known to play a significant role in explaining health care utilization, little is known about how they relate to risk attitude in making health care decisions.
- Certain health care decisions may be made by a highly selected population. Perhaps their risk attitude differs from that of the general population.

Objectives

- Examine how risk attitude is affected by the magnitude of risk
- Examine how risk attitude is related to sociodemographics.
- Examine how risk attitude may differ for different populations.

Methods

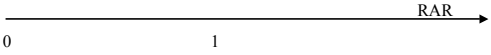
- A survey was conducted of 167 people in a jury waiting room in Cleveland, Ohio.
- Each person was presented with 5 standard gambles with varying degrees of risk.
- For each scenario, we varied the probability of losing the gamble until the patient valued the gamble the same as current health. This is the patient's point of indifference.

Methods (cont'd)

- For each gamble, we calculated the point where the expected value of the gamble was the same as current health. This was the "expected" point of indifference.
- The Jewish Community Center of Cleveland hosted an evening of genetic education with the opportunity for free genetic testing at the end of the session. This was done 4 times. We surveyed 116 people using two of the gambles used in the Jury room. All were Ashkenazi Jews, the one known high-risk group for the BRCA mutation.

Risk Attitude Ratio

- We created a measure called the Risk Attitude Ratio (RAR), which is the ratio of the patient's point of indifference to the "expected" point of indifference.



RAR < 1	RAR = 1	RAR > 1
Risk Averse	Risk Neutral	Risk Seeking

Scenario (abbreviated)

- You have an illness that is completely asymptomatic. It has no effect on your life, *except* it will cause you to die an instantaneous, painless death in 5 years. The only treatment is a pill that will either kill you **immediately** or allow you to live for 15 years. Circle the pie chart with the biggest risk you would be willing to take.
- Time until premature death caused by pill was varied: 0, 1, 2, 3, 4 years.

Risk Attitude and Discounting

- Health benefits should be discounted
- Discount rate deals with relative value along a continuous time spectrum.
- Risk attitude relates to the valuation of a specific situation.
- For this study, we assume a 3% discount rate and attribute any variance in valuation to risk attitude.

Sample Calculation of RAR

- Scenario: Death in t = 2 years
- Interviewee point of indifference, p_i = 20%.
- "Expected" point of indifference:
  - EV (gamble) = EV (sure thing)
  - Separate Discounting from Risk Attitude
  - p_e = .734, using a 3% discount rate.
- Risk Attitude Ratio, RAR = .2 / .734 = .27

Variables

- Outcome Variable
  - Risk Attitude Ratio (RAR)
- Study Variables
  - Age
  - Race (Caucasian, African-American)
  - Sex
  - Marital Status (single, married, prev. married)
  - Education (No post-HS, post-HS, college grad.)
  - Income (< $25,000/yr, >= $25K)
  - JCC (1 = JCC sample, 0 =Jury sample)

Primary Analysis - Jury Data

- Hierarchical Linear Model
  - Nested by interviewee
- Outcome Variable = Risk Attitude Ratio
- Independent Variables
  - t (time until death), t^2
  - Age, Sex, Race
  - Income, Education, Marital Status

Stratified Analyses – Jury Data

- In what risk situations do patient characteristics play a role?
- Outcome Variable
  - Risk Attitude Ratio for given scenario
- Independent Variables
  - Age, Sex, Race
  - Income, Education, Marital Status

Multivariate Models – JCC vs. Jury

- Multivariate models were also used to compare the risk attitude of the Ashkenazi Jewish sample to the general population, adjusting for sociodemographic variables.
- Outcome variables:
  - RAR for death in 0,4 years
  - Difference in RAR between death in 0, 4 yrs scenarios
- The following sociodemographic variables were used in the regression models:
  - Age, Race, Sex, Education, Income, Marital Status

Sample Characteristics

	JCC	Jury
N	116	167
Age	55.6	41.7
Female	75.4%	51.8%
Income over $100K	46.5%	6.0%
Married	83.9%	56.3%
College Graduate	75.0%	34.1%

Results

Die in:	p_i	p_e	**RAR**	$p_i = 0$
0 years	.065	.616	.105	47.3 %
1	.129	.671	.192	17.6 %
2	.197	.734	.268	12.7 %
3	.257	.808	.319	10.3 %
4	.349	.895	.390	9.0 %

p_i = individual point of indifference; p_e = expected

Results – Stratified Regressions

Outcome Variable = Risk Attitude Ratio (RAR)

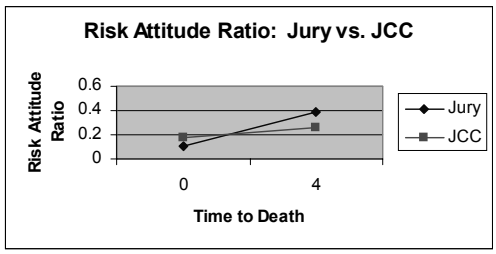
Die in	Significant Variables
0 yrs.	None
1	Sex
2	Sex, Race, Previously Married
3	Sex, Race, Previously Married
4	Sex, Race, Previously Married

Results – Hierarchical Model – Jury Data

Variable	Estimate	p-value
t	.129	<.0001
t^2	-.021	<.0001
Male	.092	<.0001
African-American	-.085	<.0001
Previously Married	.107	<.0001

Income, Education, Single – Not Significant

Results - Risk Attitude



Results - Refusal to Gamble

- A non-gambler is someone who refuses to take the gamble under any circumstance, i.e. he refuses to accept *any* risk of the bad outcome.

Scenario	Jury	JCC	p
Die Now	47.6%	32.3%	.0193
Die in 4 Years	9.0%	21.3%	.0075

Fisher's Exact test was used for the comparisons.

Multivariate Models – JCC vs. Jury

- Both samples in both scenarios showed risk aversity.
- For the Die Now standard gamble, there was a trend toward less risk aversity in the JCC sample (RAR .07 *higher*, p=.057).
- For the Die in 4 Years standard gamble, those in the JCC sample had significantly greater risk aversity (RAR .124 *lower*, p=.012).

Results - Difference in RAR

- Outcome variable = difference in the RARs for the Die Now and Die in 4 years scenarios.
- After adjusting for sociodemographic variables, we found that the difference in RARs for the JCC population was .19 less than for the general population (p<.0001).

Conclusions

- Risk Attitude Ratio (RAR) may be a useful tool for measuring risk attitude
- Risk attitude varies according to the magnitude of risk as well as sociodemographic characteristics.
- Assumptions of risk neutrality may be poor not only on the individual level, but even on the aggregate, policy-setting level.

Conclusions (cont'd)

- RAR was useful in identifying a difference in risk attitude between a highly selected population and the general population.
- Decision analyses may be biased against primary or secondary prevention if people actually adopt the "insurance" mentality for these decisions and overvalue catastrophic events.