Understanding Medication Adherence Using Stated-Preference Data

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BACKGROUND

- Adherence (compliance) to medications that treat chronic illnesses is suboptimal,[1,2] leading to poorer health outcomes[3,4] and higher health care costs.[5]
- Over half of all patients who experience a myocardial infarction (MI) are not adherent to their medication regimen.[6]
- Adherence to prophylactic cardiovascular treatments has been shown to be affected by medication attributes (e.g., medication costs, side effects) and patient characteristics (e.g., socioeconomic factors, comorbidities, perceptions about the efficacy, and necessity of medication).[6]

OBJECTIVES

- Quantify the effects of medication attributes on patients' assessments of likely adherence behavior
- Quantify the relative importance of adherence from the patient perspective

CONCEPTUAL FRAMEWORK

- Using the microeconomic theory of health production,[7] medication adherence can be described as a behavioral response to a particular set of medication attributes given individual patient characteristics.
- Figure 1 shows how people make tradeoffs between full cost (time and money) and health (risk reductions).
  - Moving along a utility curve (UA1 or UA2) shows tradeoffs between cost and health that leave patients equally well off.
  - Moving across utility curves shows combinations of income and health that change well-being, with movements to utility curves that lie farther up and to the right representing higher levels of subjective well-being.
  - Subjective well-being UA2 is greater than UA1.
  - Figure 1 and Figure 2 show how medication noncompliance can result in higher or lower subjective well-being, respectively.
- A1 represents the health outcomes and full cost when a patient is adherent to a particular medication. However, A2 shows that medication nonadherence can improve a patient's subjective well-being by trading off health for reduced costs.
  - Given patients' willingness to accept tradeoffs between costs and health (i.e., patients' utility curves), the optimal adherence level is determined by the patients' expectations of the effect of noncompliance on health (represented by the dotted line in each figure).

Figure 1. How Medication Noncompliance Can Improve Patients' Subjective Level of Well-being
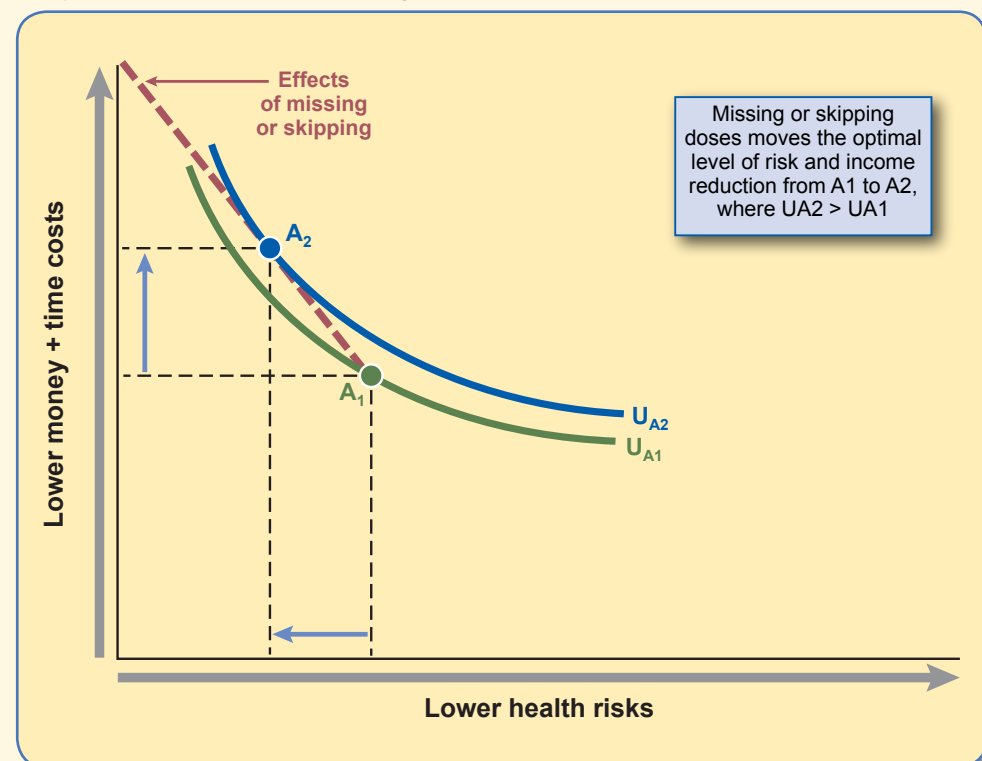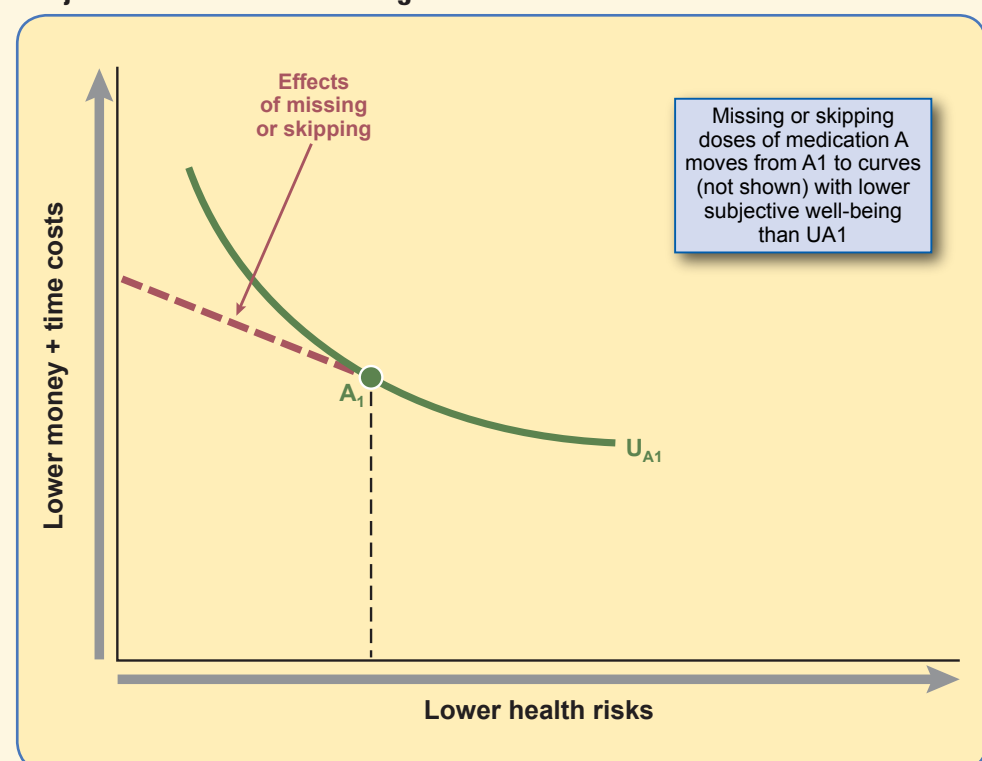

Figure 2. How Medication Noncompliance Can Worsen Patients' Subjective Level of Well-being

METHODS

Discrete Choice Experiment

- This study uses a discrete choice experiment (DCE) that elicits patients' stated preferences for alternative medications and medication outcomes by eliciting preferences for a series of paired hypothetical prophylactic cardiovascular treatments.
- DCE postulates that the benefit of a medication is a weighted sum of the medication's attributes. Weights reflect patients' perceived relative importance of each medication attribute.

Survey Design

- Two types of choice questions were designed to address two problems in using stated preference to study adherence:
  1. Social desirability bias: This study uses judgment tasks in which respondents assess the likely adherence of "people like them" rather than describing their own likely adherence.
  2. Medication choice and adherence likely are determined simultaneously: This study assigns patient adherence levels according to an experimental design.
- Type 1 Choice Question: Adherence, given treatment options (Figure 3)
  - Respondents rated likely adherence, indicating their assessments of a hypothetical patient's relative intensity of medication use
  - Results describe the influence of medication attributes on likely adherence

- Type 2 Choice Question, given adherence (Figure 4)
  - Respondents chose patient with preferred outcomes, given levels of adherence.
  - Results describe relative preferences for different levels of adherence.
- Responses to both types of questions reflect both the shape of utility curves and patients' expectation of the effect of noncompliance on health.
- Each hypothetical medication included five attributes with varying levels (Table 1).

Experimental Design

- Hypothetical medication profiles and pairs were constructed using an efficient experimental design and the information in Table 1.
- Respondents answered 11 choice questions.

Figure 3. Example: Type 1 Question

Figure 4. Example: Type 2 Question

Table 1. Treatment Attributes and Levels

Attribute	Levels
Number of moderate-to-severe heart attacks prevented in the next year	Reduction in risk from 50 out of 1,000 (5%) to 10 out of 1,000 (1%)
	Reduction in risk from 50 out of 1,000 (5%) to 30 out of 1,000 (3%)
	Reduction in risk from 50 out of 1,000 (5%) to 38 out of 1,000 (3.8%)
Number of deaths from heart attack or stroke prevented in the next year	Reduction in risk from 20 out of 1,000 (2%) to 12 out of 1,000 (1.2%)
	Reduction in risk from 20 out of 1,000 (2%) to 15 out of 1,000 (1.5%)
	Reduction in risk from 20 out of 1,000 (2%) to 18 out of 1,000 (1.8%)
Increase in the chance of serious infection in the next year	None
	3 out of 1,000 (0.3%)
	10 out of 1,000 (1%)
	50 out of 1,000 (5%)
Mode of administration [Appeared in Type 1 questions only]	Daily tablet
	At doctor's office, hospital, or clinic—injection every 3 months
	At-home auto-injector every 3 months
How people take their medicine [Appeared in Type 2 questions only]	Almost always take medicine as prescribed
	Skips less than one-half of the doses
	Skips more than one-half of the doses
Personal cost	$20 per month ($240 per year)
	$40 per month ($480 per year)
	$100 per month ($1,200 per year)
	$250 per month ($3,000 per year)

Sample

- AllPoints administered an online survey to 464 adult residents of the United States with a self-reported history of MI.

Analysis

Type 1 questions:

- Likely medication adherence was modeled using an ordered probit model:
  - The model estimates the impact of medication attributes on ratings of likely medication adherence.
  - Adherence weights are measured relative to the mean adherence, as defined by respondents, and indicate the direction and intensity of the attribute level's effect.

Type 2 questions:

- Treatment choice was modeled using a random-parameters logit (RPL) with effects-coded categorical variables:
  - The model accounts for the panel nature of the data and preference heterogeneity.
  - The RPL model results in preference parameters for all attribute levels, estimated relative to the mean effect.
  - The preference weights for the medication attributes were estimated using a model that assumed full adherence.

RESULTS

Type 1 questions:

- The model specification with the best fit included an interaction between reductions in risk of cardiovascular death and cost.
- The results (Figure 5) indicate that out-of-pocket costs (conditional on risk reductions) and non-fatal risk reductions are the most important drivers of likely adherence, which is consistent with the health production model.
  - At higher costs per unit of efficacy (risk reduction), noncompliance results in greater tradeoffs between total cost and health outcomes.
  - At higher efficacy per unit of cost, noncompliance results in lower tradeoffs between total cost and health outcomes.

Type 2 questions

- Adherence levels and out-of-pocket costs were the most important components of the well-being derived from treatment (Figure 6). That is, respondents expected lower levels of well-being when noncompliant or when medications were more expensive.
- On average, the disutility from reducing medication adherence from "Always adherent" to "Adherent more than half of the time" could be offset by the following:
  - Reducing the monetary cost from $100 to $23 per month
  - Decreasing the chance of serious infection from 50 out of 1,000 to 2.5 out of 1,000
  - Reducing the risk of a nonfatal MI from 5% to 0.5% instead of from 5% to 3.8%
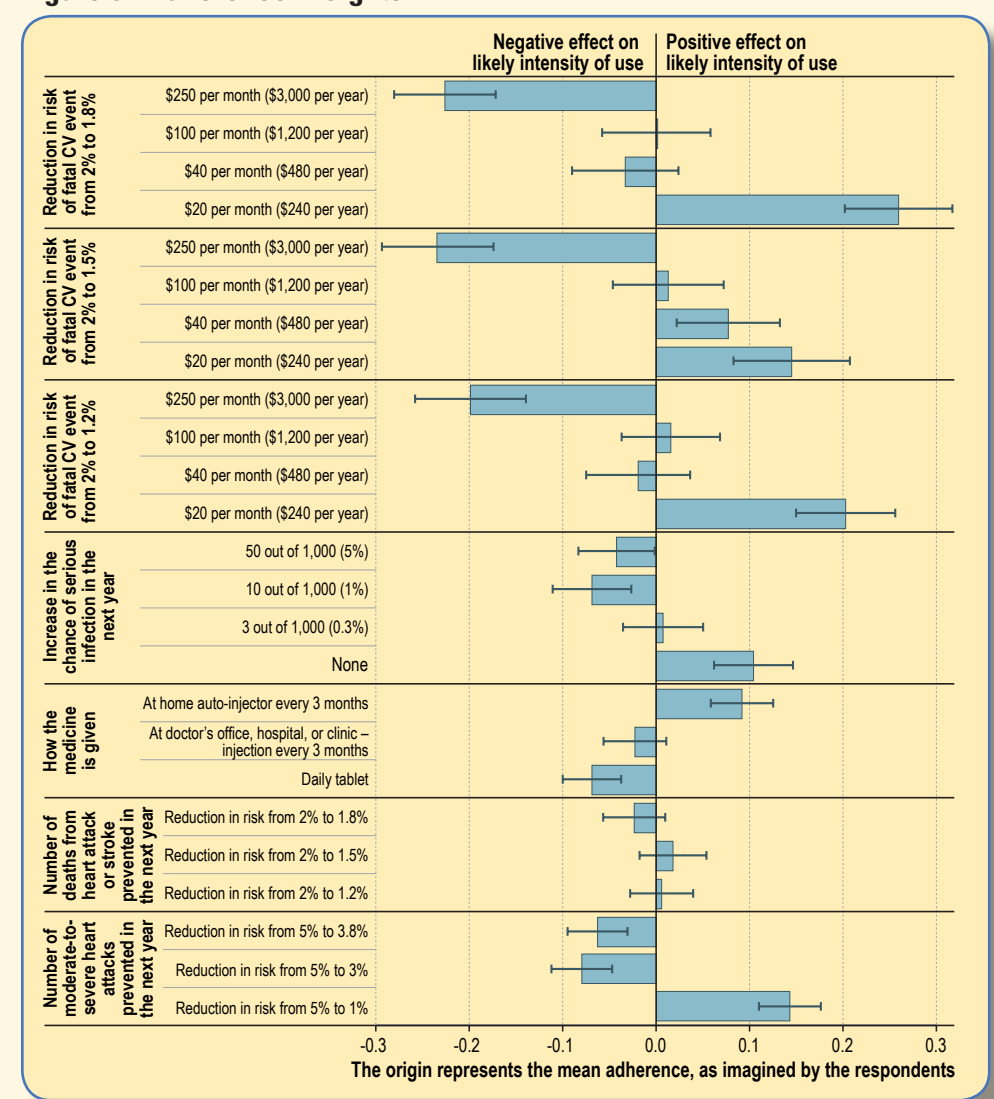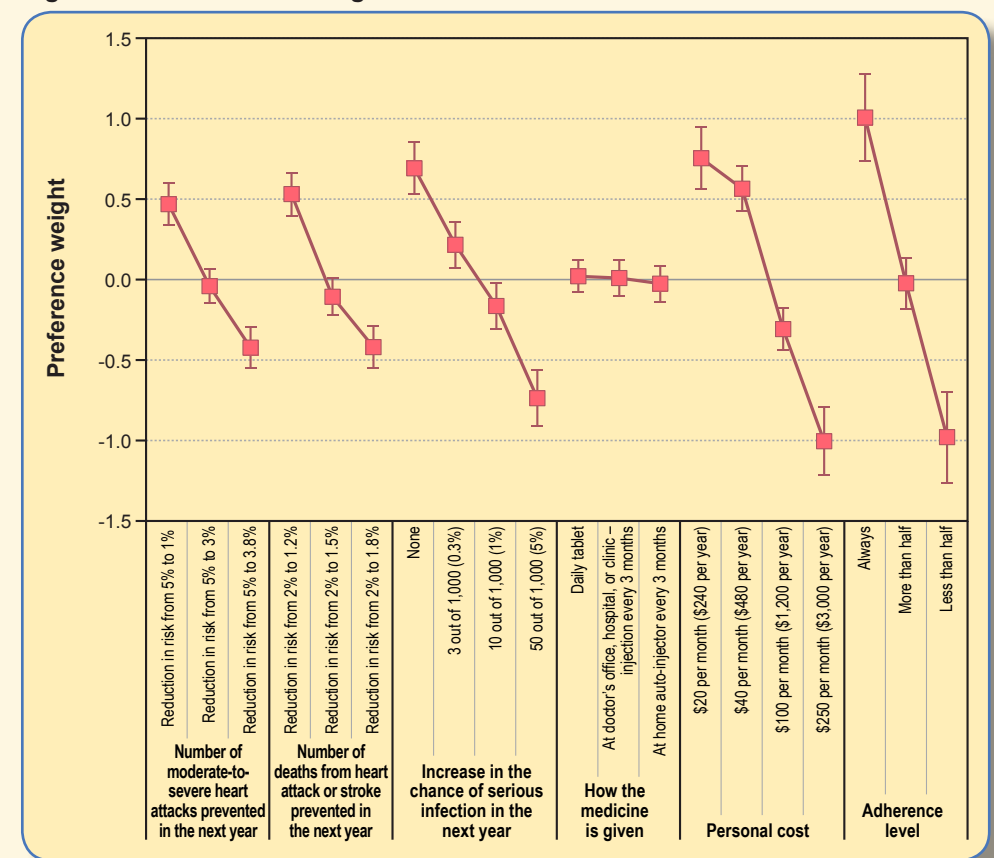
Figure 5. Adherence Weights

Figure 6. Preference Weights

DISCUSSION

- The analysis of data from the type 1 questions indicates the potential effects of various clinical and nonclinical factors on likely medication adherence.
  - Risk reductions and out-of-pocket costs are important factors in determining likely medication adherence.
- The type 2 results indicate that adherence to prophylactic cardiovascular treatments has a significant effect on the perceived value of these treatments.

CONCLUSION

The ability to include a variety of factors within stated preference studies can be useful in understanding medication adherence.

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