Overview

* Models of decision making
* What is a good decision and ways to measure decision quality
* Ways to improve: decision aids
* Ways to measure patient preferences
* Does incorporating patient preference input into routine cancer counseling improve care?
Decision choice for a man with moderate risk localized prostate cancer

- **surgery**
  - Robotic prostatectomy
  - Open radical prostatectomy

- **radiation**
  - External beam radiotherapy

- **Active surveillance**

- **Brachytherapy**

If I choose surgery, I may leak urine… if I choose surveillance, I may worry about cancer spreading.

‘Experimental’ options (cryotherapy, focal therapy, etc.)
The double-edged sword

* Constant innovation in treatments for oncology patients
* Treatments can offer trade-offs
* Decisions have multiple moving parts
* Patient preferences can vary for specific risks and outcomes
What is the ideal decision?

- A patient-centered decision is one which reflects the needs, values and expressed preferences of a well-informed patient

Sepucha 2004
Many definitions

Shared decision making is the collaboration between patients and caregivers to come to an agreement about a healthcare decision. It is especially useful when there is no clear "best" treatment option.
* Interest has grown as treatment options have expanded

* Legal liability for choice

* Decrease in paternalism/increase in consumerism

* Potential for reducing inappropriate use

* Included in the Affordable Care Act
“Outcomes” measures
The degree to which patients are:
- Informed
- Meaningfully involved in the decision
- Select a treatment that reflects their values

Sepucha 2004

Also consider: Satisfaction, Decisional Conflict
“Process” measures (e.g. CollaborRATE)
- How much effort was made to help you understand your health issues?
- How much effort was made to listen to the things that matter most to you about your health issues?
- How much effort was made to include what matters most to you in choosing what to do next?

Elewyn 2014
Decisional influencers in men with prostate cancer

* Physician recommendation (51%)
* Friends and family (19%)
* Books/journals (18%)
* Internet (7%)

* Patients choosing surgery perceived prostate cancer as more serious, had more distress about deciding, and had more concern regarding cancer spread

Diefenbach 2002
Audiotaped interviews at 4 VA urology clinics where 252 men were counselled:

1/3 of the men had a partial set of options presented/ active surveillance omitted

High quality discussions happened in 29%

Limited correlation with visit length

holmes-rovner 2015
Shared Decision Making: hurdles

* Time

* Not compensated

* Not taught

* Not all patients prefer this mode of decision making/feel comfortable with numbers/ science
“Bounded rationality”

* Complex decision
* Time constraints
* Limits on human computational ability

Can software expand these “bounds?”

Potential solution: decision aids

* Many formats

* Can take advantage of IT to personalize information, use video, interactivity

* Save time, can be used at home, in waiting rooms, etc
Decision aids vs usual care

* Increase patient involvement
* Increase patient knowledge
* Clarify values, increase concordance between values and choices
* Reduce decisional conflict, regret (? lawsuits)
* Increase appropriate use
* No effect on outcomes, satisfaction

Cochrane Collaboration 2011
Does the decision aid:

- Provide information about options in sufficient detail for decision making?
- Present outcome probabilities in an understandable and non-biased way?
- Include structured guidance for deliberation?
- Include methods for clarifying and expressing patient values?
Systematic review of decision aids
14 had published data, reviewed for IPDAS criteria
* 71% included discussion of active surveillance
* 71% had values clarification prompts
* 28% commented on quality of evidence used

Adsul 2015
Software solution: decision analysis

* “Rational model”
* Accounts for all possible outcomes
* Accounts for the probabilities of the outcomes
* ‘Weighs’ the desirability of the outcomes
Possible solution: decision analysis

- **Surgery**
  - Erectile dysfunction 50%
  - Urinary incontinence 5%
  - Cancer death 15%

- **Radiation**
  - Erectile dysfunction 20%
  - Urinary incontinence 3%
  - Cancer death 30%

- **Active surveillance**
  - Erectile dysfunction 10%
  - Urinary incontinence 1%
  - Cancer death 35%
Possible solution: decision analysis

- **Surgery**
  - Erectile dysfunction 50%
  - Urinary incontinence 5%
  - Cancer recurrence 15%
  - Value: 40

- **Radiation**
  - Erectile dysfunction 20%
  - Urinary incontinence 3%
  - Cancer recurrence 30%
  - Value: 80

- **Active surveillance**
  - Erectile dysfunction 10%
  - Urinary incontinence 1%
  - Cancer death 35%
  - Value: 5
Software solution: decision analysis

* Can be modeled at the individual or population level

* More widely used in public policy/academics

* Barriers to implementation at the bedside: lack of computer resources, patient acceptance, time, assessing preferences
Concerns with decision analysis

* People don’t think like that (e.g. “Blink”)
* May be normative if not descriptive
* Method of determining the valuations (patient preferences/utilities) can make all the difference
How can we measure the strength of your desire to avoid diapers after surgery?
What is a ‘utility’ value?

* Derived from classical economics
* A health ‘utility’ is a number, ranging from 0.0 to 1.0, which corresponds to a person’s desire for a health state
* Determined under a conditions of uncertainty
* Expected utility theory is a ‘normative’ description

Von Neumann and Morgenstern 1944
Ways in which we can use patient preferences

1 year in health state with a utility of 0.85

= 0.85 quality adjusted life years (QALY)
Ways in which we use can use patient preferences

Cost-effectiveness analysis → QALY → NICE FDA
Traditional ways to quantify preferences:

- Standard Gamble
- Time Trade Off
- Rating Scale
Standard Gamble

- Life with a health condition
- Normal life
- Death

Probability (P) and (1 - P)
Standard Gamble

Pros: Theoretically supported, long history

Cons: complex, hard to perform, risk aversion issues, axioms of EUT are often violated in practice (Prospect theory)
Time Trade Off

Series of choices

“Would you prefer 10 years of life with urinary incontinence to 2 years of life in perfect health?”

“Would you prefer 10 years of life with urinary incontinence to 3 years of life in perfect health?”
Value converted to a 0-1 scale and then standardized against 1 year

If 10 years with current erections are equivalent to 8.5 years with impotence, then the utility for impotence is 0.85
Pros: simpler to use, still mimics some aspects of medical decision making

Cons: not strictly speaking, a utility still vulnerable to ‘framing biases’
Rating Scale

Severe Post-Thrombotic Syndrome

100% of Perfect Health

Perfect Health

Death

Continue

Find the level that you feel reflects your quality of life with this condition.
Rating Scale

Pros: Simplest to understand

Cons: biases in using scales, very unclear if these are ratio level numbers

Derived from studies of perception on light, totally different theoretical background/relationship to medical decision making.
Problems with utility measures

- 57 men with advanced CAP ranked 8 health states in an ordinal manner

- Measured utilities for those states with SG, TTO, RS, and willingness to pay

- Calculated differentiation and inconsistency scores
  
  Giesler Med Care 1999
Rating scale allowed unique assignment of value to 70% health states, other methods around 40%

All had similar levels of inconsistency, around 10% of states mis-ordered
Problems with utility methods

Are these numbers ratio level numbers?

Is moving from 6.0 to 7.0 the same as moving from 1.0 to 2.0?

Ceiling effects

How do you incorporate risk aversion
Cost-Utility Analysis of Chemotherapy Using Paclitaxel, Docetaxel, or Vinorelbine for Patients With Anthracycline-Resistant Breast Cancer

RESULTS: Each of the three drugs led to a similar duration of quality-adjusted progression-free survival. Vinorelbine was the least costly strategy, with an overall treatment expenditure of $3,259 per patient, compared with $6,039 and $10,090 for paclitaxel and docetaxel.

CONCLUSION: Palliative chemotherapy with vinorelbine in anthracycline-resistant metastatic breast cancer patients has economic advantages over the taxanes and provides at least equivalent quality-adjusted progression-free survival. These benefits are largely related to its lower drug acquisition cost and better toxicity profile.

Lueng, JCO 1999

Implications of Pitfalls:

- Used time trade off method to assess utility. Are these ratio level numbers?
Conjoint analysis: solution?

- Developed in mathematical psychology, marketing, and business research literature
- Proven method to measure consumer preferences and predict consumer behavior
- Courtyard by Marriott, smartphones, glucometers are examples of products developed using conjoint analysis
Potential solution: conjoint analysis

- Can more easily incorporate non-clinical treatment attributes of importance to patients
- More accurate assessments of preferences may lead to treatment choices more congruent with patients’ goals
- May improve public policy/ CEA estimates
Conjoint Analysis

* Designed to help decide between products with varying levels of attributes

* Usually one product or service is more desirable in terms of one attribute, while the others have different desirable attributes
Conjoint Analysis

- Users are presented with two products, each with varying attributes
- Limited number of possible combinations shown
- Strength of preferences for attribute levels is determined by one of a few modeling approaches

Conjoint Analysis
Consumer preference measurement: conjoint analysis

Phone A
- Touch screen
- 2 month wait
- 4G network

Phone B
- Keyboard
- No wait
- 3G network
Data are examined using multinomial logit regression to estimate a utility function:

\[ V = B_1X_1 + B_2X_2 + B_3X_3 + \ldots + B_nX_1 \]

* \( V \) is the utility of the treatment, \( X_j \) (\( j = 1, 2, \ldots, n \)) are the different attributes of the treatment, and \( B_j \) (\( j = 1, 2, \ldots, n \)) are the coefficients of the model to be estimated.

* Coefficients indicate the relative importance of each attribute in composing the final overall treatment utility.
Conjoint Analysis

Pros:
Lower cognitive burden: CA rated as ‘difficult’ or ‘very difficult’ much less frequently than the traditional methods in knee arthroscopy evaluation

Proven to predict consumer behavior: empiric evidence that preferences are being captured

Cons:
Limited track record with health care decisions

2006
Byrne J Clin Epi
* CA survey of patients with peripheral vascular disease
* Preferences for treatment near home were strong
* Subjects willing to accept higher mortality and morbidity rates for treatment near home

Shackley J Health Svc Res
Pol 2001
“Conjoint analysis: overcoming obstacles to routine formal preference assessment”

Phase 1: ‘Voice of the customer” analysis

Phase 2: Develop/pilot preference assessment tools

Phase 3: Two randomized controlled trials:

- Conjoint analysis vs TTO or RS in men s/p prostate biopsy (300 men)
  Compare predictive ability (“hold outs”)

- Decision aid with or without conjoint analysis in newly diagnosed men (160 men)
  Compare decision quality, time requirements
### Voice of the Patient

| 60-90 min. Interviews: treatments, Side effects, outcomes | Side effects, Outcomes 1,000 quotes | Research Team Identifies 15 Themes | Researchers Narrow From 1,000 to 70 quotes | Patients Group Similar Quotes into piles | Researchers Analyze piles Using AHC for consensus groupings | Team Identifies Conjoint Attributes From piles |

#### Process Steps:
- **Listen**
- **Parse**
- **Themes**
- **Select**
- **Affinity**
- **Analyze**
- **Translate**

#### Additional Notes:
- **Objective**
- **Subjective**
- **More Subjective**
Sample narratives from men treated for prostate cancer

**Treatment Issues**

*Cutting:* I don't want to be cut

*Others' Advice:* I only follow doctors' advice up to a point. Not 100%

*Caution:* I could wait for a while if the numbers stay stable...

*Action:* I was just thinking "we have got to do something"

**Side Effects**

*Sex:* If you have an understanding partner, the ED thing can be ok.

*Urinary:* Changing pads frequently...feels as if you don't have control of your life.

*Lifespan:* It is more important to stay alive, regardless of the side effects.

*Bowel:* The bowel issue is the biggest deal because it is socially unacceptable.
Patient-derived attributes

* Sexual function effects
* Urinary function effects
* Bowel function effects
* Survival
* Opinion of others
* Need for incision
* Treatment makes man feel like he is “taking action”
Adaptive best/worst

73% Treatment 1

Doctor and Family Support this treatment
Sex: Decreased compared to before treatment
Cautious: Treatment gives me months or longer to decide
No Cutting: Treatment does NOT require any surgery
Lifespan: Live my expected lifespan

2

Best

Worst

73%

Treatment 2

Doctor and Family Support this treatment
Sex: Decreased compared to before treatment
Active: Treatment requires action within weeks
Cutting: Surgery with some risks and hospital time
Bowel: No problems
Lifespan: Live 5 years fewer than expected

16

Treatment 3

Doctor and Family do not favor this treatment
Sex: Unable to engage in sex
Cautious: Treatment gives me months or longer to decide
No Cutting: Treatment does NOT require any surgery
Bowel: Short term urgent & frequent bowel movements
Lifespan: Live 5 years fewer than expected

11

Treatment 4

Doctor and Family Support this treatment
Sex: Unable to engage in sex
Cautious: Treatment gives me months or longer to decide
Cutting: Surgery with some risks and hospital time
Bowel: No problems
Lifespan: Live 5 years fewer than expected

15

45% Complete

Next
Prostate Cancer Treatment Preferences

Wednesday, January 05, 2011

About this report: Men with prostate cancer face several treatment choices. Often, their personal values are important in deciding which of those treatments is best for them.

The chart below was created by analyzing your answers to the study questions. The chart shows how important each of the treatment factors or side effects were to you.

* The length of the bars show how important the items are relative to each other, in your view, when considering a treatment that could result in any of the side effects or factors described.

* The longest bar represents the most important factor to you, based on your answers.

Please feel free to show this to your doctor as a way to start the conversation about how prostate cancer will affect the most important things to you about your quality of life.

If you have any questions about this chart, please ask the study coordinator.

<table>
<thead>
<tr>
<th>Category</th>
<th>Ranking</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex Life</td>
<td>MOST Important</td>
<td>57%</td>
</tr>
<tr>
<td>Treatment preserves partial or full sexual function</td>
<td>2nd most important</td>
<td>24%</td>
</tr>
<tr>
<td>Urination</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment preserves partial or full urinary function</td>
<td>3rd most important</td>
<td>5%</td>
</tr>
<tr>
<td>Bowel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment preserves full bowel function</td>
<td>4th most important</td>
<td>1%</td>
</tr>
<tr>
<td>Lifespan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment enables you to live your full lifespan</td>
<td>LEAST important</td>
<td>1%</td>
</tr>
<tr>
<td>Avoid Surgery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment does not require any surgery</td>
<td>6th most important</td>
<td>1%</td>
</tr>
<tr>
<td>Others Approve</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Doctor &amp; those close to you agree with your choice</td>
<td>7th most important</td>
<td>1%</td>
</tr>
<tr>
<td>Active &amp; Immediate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>You're taking quick and decisive action</td>
<td>8th most important</td>
<td>-1%</td>
</tr>
</tbody>
</table>

Accuracy (r-sqr): 97% of the variation in your answers are explained by the above chart.
RCT of different methods

* Recruited men at the VA urology clinic undergoing prostate needle biopsy for suspicion of prostate cancer

* Eligible men:

  Negative biopsy, able to read English

* Subjects and task order randomized to:

  Rating Scale vs. Adaptive Best-worst Conjoint

  Time Tradeoff vs. Adaptive Best-worst Conjoint
Results

Outcome metrics:
- Compared internal validity of methods
- Comparative ability of stated preference data to predict preferences for health states that were not explicitly rated by patient
- Compared patient acceptability in men being evaluated for prostate cancer
Results: Internal validity

\( R^2 = \% \text{ of variance in 16 stimuli scores explained by utility functions} \)

<table>
<thead>
<tr>
<th></th>
<th>Mean R(^2)</th>
<th>P-values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conjoint</td>
<td>88%</td>
<td>P &gt; .05</td>
</tr>
<tr>
<td>Ratings</td>
<td>87%</td>
<td></td>
</tr>
<tr>
<td>Time Tradeoff</td>
<td>55%</td>
<td>P = .001</td>
</tr>
</tbody>
</table>

P-values are from paired comparisons (t-tests) with conjoint analysis.
Results: Predictive validity for 3 methods

(hit rate: 1st choice out of 4 options)

P-values are from paired comparisons (McNemar tests) with conjoint analysis.
Results: Three most important attributes

- Sex
- Live Full Lifespan
- Urinary
- No Cutting
- Others Approve
- Bowel
- Active Treatment

Note: TTO highlights Lifespan
Results: Patient satisfaction and Ease-of-Use scores

Preference assessment method ease of use and satisfaction (categories collapsed)

<table>
<thead>
<tr>
<th></th>
<th>Conjoint analysis (N = 31)</th>
<th>Time tradeoff (N = 15)</th>
<th>Rating scale (N = 16)</th>
<th>Conjoint vs. time tradeoff (N = 15)</th>
<th>Conjoint vs. rating scale (N = 16)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ease of use</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very easy/easy/ somewhat easy</td>
<td>18 (58%)</td>
<td>10 (67%)</td>
<td>14 (88%)</td>
<td>P = .99</td>
<td></td>
</tr>
<tr>
<td>Somewhat/very difficult</td>
<td>13 (42%)</td>
<td>5 (33%)</td>
<td>2 (12%)</td>
<td></td>
<td>P = .03</td>
</tr>
<tr>
<td><strong>Satisfaction</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extremely/somewhat</td>
<td>26 (84%)</td>
<td>9 (60%)</td>
<td>13 (81%)</td>
<td>P = .38</td>
<td></td>
</tr>
<tr>
<td>Neutral/not very/not at all</td>
<td>5 (16%)</td>
<td>6 (40%)</td>
<td>3 (19%)</td>
<td></td>
<td>P = .99</td>
</tr>
</tbody>
</table>

P-values obtained by comparing responses within same subjects using the exact version of McNemar’s test of paired proportions.

Rating Scale perceived to be easier than Conjoint... but Conjoint’s satisfaction ratings are just as good
Conjoint analysis is a feasible method to collect real-time, individual level preferences from patients.

Conjoint analysis is viewed by patients as a highly satisfactory way to collect preference data, though challenging.
Conclusions

* Conjoint analysis and rating scale-derived utility functions outperform time trade off in regards to explanation of variance in stated preferences

* Conjoint analysis has superior predictive validity compared to the other two methods regarding preferences for novel health states
RCT of conjoint analysis and decision quality

Recruited men at VA urology clinic undergoing prostate needle biopsy

Eligible men:
positive biopsy, localized disease, able to read English

Subjects randomized to:
- Educational pamphlet
- Educational pamphlet followed by preference assessment
Methods

* Men randomized to education and preference assessment receive a report detailing their preferences

* Counseling physicians briefed on report interpretation

* Physicians could use the report during the counseling session.
Methods

Decision quality measures (pre/post):

- Satisfaction with care
- Disease specific knowledge
- Decisional Conflict Scale
- Shared decision making questionnaire
- Yes/No has made a treatment choice
Decisional conflict:
Improvements in:
- Uncertainty
- Perceived effective decision making

Satisfaction with cancer care:
“Thoroughness of main cancer practitioner”
(1.6 vs 1.2, p = 0.04)

No difference to date in measures of shared decision making, knowledge
Conjoint analysis is a feasible method to collect real-time, individual level preferences from patients in a busy clinic.

Addition of preference assessment to education results in:
- reduced elements of decisional conflict after CA
- perception of physician thoroughness enhanced with CA
Decision choice for a man with moderate risk localized prostate cancer

- **surgery**
  - Robotic prostatectomy
  - Open radical prostatectomy
  - ‘experimental’ options (cryotherapy, primary hormonal therapy, etc)

- **radiation**
  - External beam radiotherapy

- **Active surveillance**
  - Brachytherapy
Towards better decisions for men with prostate cancer

* Make the evidence useful for patients and physicians when deciding
* Find ways to support incorporation of patient values into the discussion
* Measure and report the quality of decision making
Thank You