



Health Economics Research Unit

Promoting Excellence in Health Economics

Bias in personalised Decision Aids

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Format

Bias in Personalised Decision Aids

- Lab study: students 'as' doctors
- 91 participants before COVID-19
- Early results, seeking your comments
- About 30 mins presentation + majority of qus

Economics & SG COVID-19

- Testing data / strategy
- Informing model development
- Linking PHS and SG
- About 15 mins, both presentation and qus

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Summary

- Personalised medicine → algorithmic decisions?
- One aspect \rightarrow potential biases in algorithms
 - Missing attributes of decision
 - Out-of-sample prediction
- Doctors balance costs of information acquisition with signal quality
- Early results respondents less likely to choose a tool that gives a bad signal





Characterising the problem

- Patient / Doctor Asymmetric information
- Decision Aids aim to reduce this in a variety of settings
 - Non-acute / emergency
 - When one choice is not clearly superior
 - Summarise information for patients, allow patient to ask more relevant questions

DECISION AID | Use this decision aid to discuss options | Page 1 of 2

Atrial Fibrillation: Treatment Options to Lower Stroke Risk

Atrial fibrillation is an irregular heartbeat. It can make your heart beat too fast or too slow. It limits how well your heart pumps blood and increases the risk of blood clots and strokes.

CUSTOMIZED FOR: Under 65 Years; Female; Hypert

This decision aid is not for people who have atrial fibrillation because of heart valve problems.

Patient Questions	Patient Questions Warfarin		Asp
What does the treatment involve?	does the ment we?Warfarin is a strong blood thinner that makes it less likely for blood clots to form. You will take a pill once a day. You will need to avoid some food and limit alcohol use. You will need regular blood tests to 		Aspirin is a weak bloo it less likely that clots take a pill once a day. blood tests.
My risk of stroke due to blood clots?	6) may have a stroke h year.	1 out of 100 people (1%) may have a stroke due to blood clots each year.	
My risk of major bleeding needing treatment?	risk of major eding needing atment?3 out of 100 people (3%) may have major bleeding each year.3 out of 100 people (3%) may have major bleeding each year.		1 out of 100 people (1 bleeding each year.
Other risks and side effects? Side effects are not common. 1 out of 100 people (1%) may have a fracture related to weak bones.		 Out of 100 people: About 11 (11%) get upset stomach About 6 (6%) get acid reflux Fewer than 1 (less than 1%) might have a heart attack due to the drug, but this is not a confirmed problem 	Up to 18 out of 100 pe upset stomach or pair
Can blood thinning effect of the drug be reversed?	blood thinning Yes Yes Yes eversed?		No
What is the cost? Warfarin is available at low cost in non- brand-name form.		Dabigatran is only available as brand name. Discuss cost, but it will depend on your insurance and may cost more than non- brand drugs.	Aspirin is available at l name form.



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Characterising the problem

- New DA use Stated Pref methods
 - Ranking / Conjoint Analysis
 - Contingent valuation



Rochon, 2014 – adaptive conjoint analysis for osteoarthritis

- Predict patient's
 - Relative rankings of attributes
 - 'most preferred' treatment





Characterising the problem

- Development process (necessarily) restricts the attributes & presentation
- Clustering models used for out-of-sample prediction
- Missing attributes give misleading answers (self-knowledge?)
 - Necessity of travel options / independent functioning
- How information is presented could influence choices
 - Main outcome vs side effects
- If model is designed with one group, may not translate
 - Assumes clusters are stable in different contexts or do we re-do the model for every different context (age, country, health system etc.)





How do doctors react when a Decision Aid provides a biased estimate of patients' preferences?

- Doctors know treatments but can't costless-ly observe which the patient prefers

- Health outcomes are separate from utility outcomes
- Doctors exert effort to learn patients' preferences and make a recommendation

3-arm between-groups experiment in oTree





Toy model



 $V = w - c(e) + \lambda E[U]$

Patient type I (A or B) 3 treatments: a, b, 0 $U_{I}: i > j > 0$

Doctor effort: e Signal: s (A or B) Pr(s = I) conditional on: - effort

- arm of study

Doctor can choose to ignore recommendation





Experiment set up



- Role, Rounds and Payment
- Treatments and Patient Types
 - 3 treatments, 2 patient types
- Effort levels
 - Three discrete levels
- Arms of study
- Analysis plan







Experiment set up – Role, Rounds, Payment

- Students are in an explicit 'doctor' role some pro-patient preferences evidence
 - Super neo-classical approach -> min effort gets me most payment
- Participants play multiple (25) rounds, with feedback on previous 10 patients' choices and outcomes
- From all 25 rounds, we select one at random and pay
 - Participant: £10 minus their 'effort'. Range: £6, 8, 10
 - NHS Grampian charity: patient's utility. Range: £2.5, 6.5
 - Conversion rate: 1pt = 50p





Experiment set up – Treatments and Types

- Two patient types: A, B
- Three treatments, each with 2 side effects

		Treatment A	Treatment B	No Treatment
Health points	Benefit points	13	13	0
	Loss from Side Effect 1	0	8	0
	Loss from Side Effect 2	8	0	0
Utility points	Type A Utility	13	5	0
	Type B Utility	5	13	0





Experiment set up – Effort levels

Your salary for this patient is 20 points.

	Description	Cost (points)
Short consultation, no Decision Aid	You conduct a brief consultation, explaining the treatments to the patient. You get some information from the patient about what they prefer.	4
Decision Aid and short discussion	You give the patient a Decision Aid to use before the consultation. This computerised tool asks the patient about their views on side effects. This gives you a prediction about the patient's preferred treatment.	6
Longer consultation, no Decision Aid	You have a long and in-depth discussion with the patient, not using the Decision Aid. After the consultation you know exactly which treatment this patient wants.	12

After choosing a consultation style you will see a **'preferred treatment'** recommendation representing the best estimate of the patient's preferred treatment based on the consultation. You do not need to accept this recommendation. You will be asked which treatment you recommend for the patient.

- Same text for each arm
- Costs do not change
- Short returns prior distribution
- Long reveals type perfectly





Experiment set up – Effort levels

Outcomes of choices

Short: < get this statement >

DA: The Decision Aid predicts the patient prefers treatment A

Long: < get this statement >





Experiment set up – Arms of study

		Arm 1		Arr	n 2	Arm 3	
F	Р(В)	0.	.5	0.	65	0	.2
		q	r	q	r	q	r
S	Short	0.5	0.5	0.35	0.65	0.8	0.2
	Decision Aid	0.8	0.8	0.8	0.15	0.8	0.25
L	ong	1	1	1	1	1	1
A S	Arm summary	DA Ac	curate	DA biased many type B		DA biased few type B	
F	Prediction	Choose DA		Disfavo	our DA	Ś	Ś

• q = Pr(s = a | A)

• Can show V-maximising choices at different lambdas

Costs do not change between arms





Analysis plan

- Initial focus: final 10 rounds, to account for exploratory behaviour
 - DA use higher in arm 1 than arm 2. Compare the proportion of consultations DA is used in across arms
 - The rate at which recommendations are ignored
- Future work:
 - Panel approach to individual choices (will comment here)
 - Using posterior probabilities -> marginal gains? Bad parameters?
 - Valid strategies or misbehaving?





Prelim. Results – Decision Aid use

- To date, 91 participants have completed the experiment
- DA is chosen less often when it is inaccurate, but not significantly when accounting for the 'individual cluster'

% of choices	Arm 1 DA accurate	Arm 2 DA inaccurate for B, many B	Arm 3 DA inaccurate for B, few B
DA	31.8	24.8	24.4
Long	10.3	17	5.9
Short	58	58.2	69.7
Adj. Chi-sq	0.31		





Prelim. Results – Following recommendation

% choices matching rec.	Arm 1 DA accurate	Arm 2 DA inaccurate for B, many B	Arm 3 DA inaccurate for B, few B
DA	97.6	71.6	89.7
Long	100	100	73.7
Short	82.7	71.3	76.7

- Face validity arm 2 DA
- 'Misbehaving' participant in Arm 3?
- Short conversation??





Prelim. Results – Behaviour

- 18 participants choose 'short' throughout
 - not a bad thing?
 - Parameters not well chosen?
- 44% try all 3 tools
- 29% try 2 out of 3
- One participant always chooses [Short,B] are they maximising own income, or not engaging (are those the same thing?)





Prelim. Results – Panel structure

- Exploit that we get time series of individual choices
 - For each round: tool, rec of tool, choice, patient outcome
- Take views here we have initially grouped rounds into blocks of 5
- Estimate a probit with 'Decision Aid chosen' as dep var

Choice = *arm* + *roundblock* + *arm* * *roundblock* + *demogs*

- Significant negative marginal effects:
 - Arm 2 after first 5 rounds
 - Arm 3, but not consistently





Discussion / Next Steps

- Points on analysis
- Identifying misbehaviour
- Data collection move online?
 - Fairly feasible but lose experiment consistency and control of classroom environment
 - New payment methodology needed







Scottish Government Health and Social Care Analysis

COVID-19 Response



