Discrete Choice Experiments in Health Economics: what can they do for you?

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Short Course

Health Economics Research Unit (HERU), University of Aberdeen
and O'Brien Institute for Public Health, University of Calgary

Using Discrete Choice Experiments in Health Economics: Theoretical and Practical Issues

AIMS OF THE SHORT COURSE

1. Introduction to the theoretical basis for, and development and application of discrete choice experiments (DCEs) in health economics.

2. Hands on experience of the design of DCEs, questionnaire development, data input, analysis and interpretation.

3. An update on methodological issues raised in the application of DCEs.

September 9 – 11, 2019
Banff Conference Centre, Banff, Alberta

Attribute based choices - Buying a puppy

Breed

Dog Breeder

Size

Price

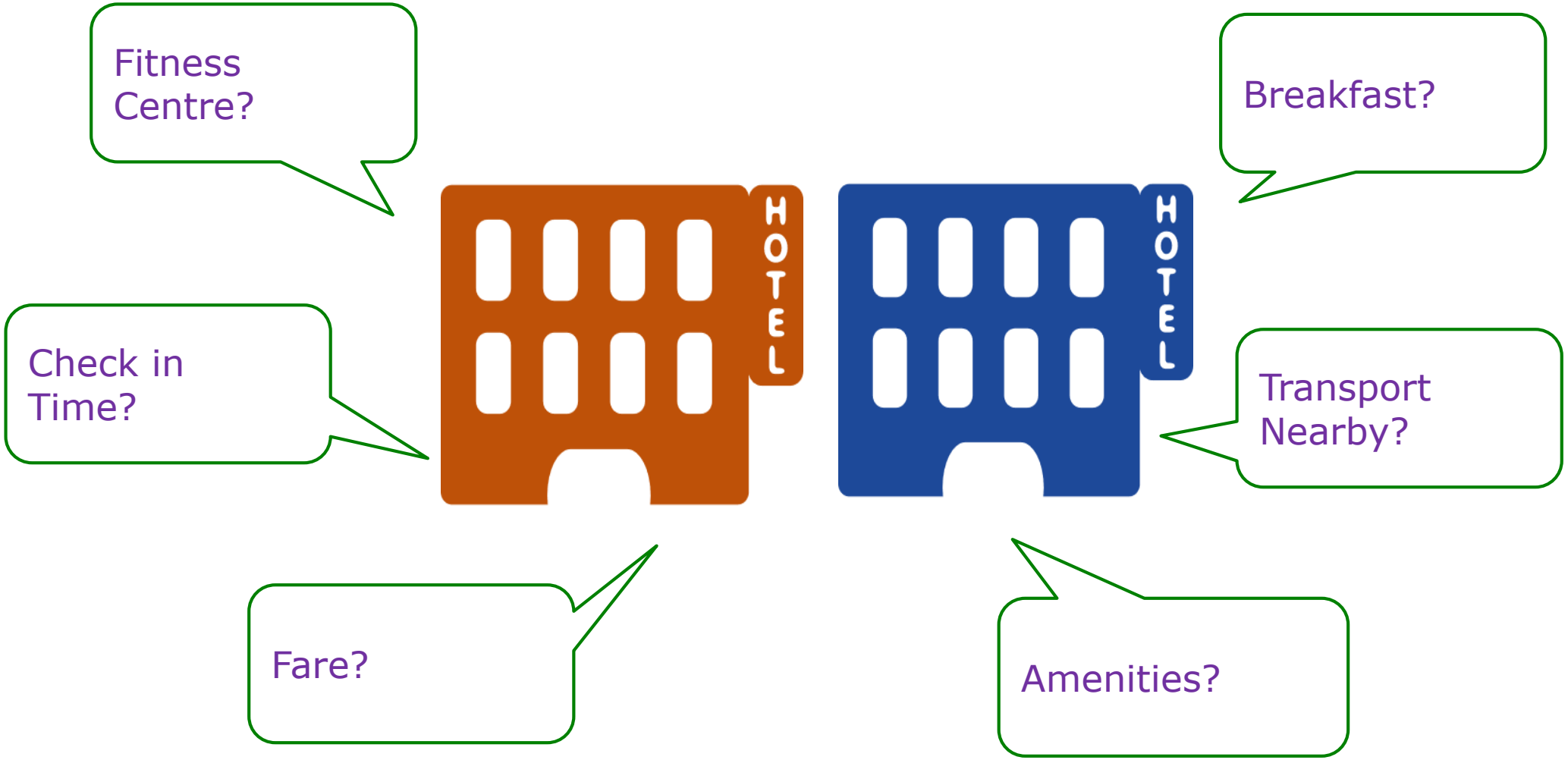
Care Needed

Personality

Life Span

?

Attribute based choices: Choosing a hotel?



Estimating the utility function

$$u_{jn} = \alpha_j + \beta_1 x_{1jn} + \beta_2 x_{2jn} + \cdots + \beta_k x_{kjn} + \varepsilon_{jn}$$

Deterministic Component

Random Component

$$u_{jn} = v_{jn} + \varepsilon_{jn}$$

Willingness to pay (WTP): $\beta_k / -\beta_{cost}$

Willingness to wait (WTW): $\beta_k / -\beta_{waiting\ time}$

Willingness to trade risk (WTTR/Benefit Risk trade-offs): $\beta_k / -\beta_{risk}$

Uptake probabilities

Utility scores

DCEs in Health Economics:

- **Patient Experiences and Trade-offs (cost; time; risk) - DEBORAH**
- **Workforce preferences for job characteristics- VERITY**
- Priority setting
- Doctor's/nurse's decision making
- Behavioural change
- **Decision aid tools - LUIS**

Case Example: Willingness to Pay for Exome Sequencing for Diagnosis in Children with Rare Disease

- **Objective**: estimate value of exome sequencing and a diagnosis for parents of children with rare diseases
- National sample of 319 parents of children with rare diseases
- DCE with 6 attributes and 3 alternatives
  - Diagnostic test, change of diagnosis from test, negative impact of diagnosis, positive impact of diagnosis, cost, time to answer (diagnosis or not)
- Valuation space model to estimate willingness to pay

Parents were willing to pay CAD $6,590 for exome sequencing compared to operative procedures

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- Marshall DA, MacDonald KV, Heidenreich S, et al. The value of diagnostic testing for parents of children with rare genetic diseases. Genetics in Medicine, June 2019 (in press) Doi: 10.1038/s41436-019-0583-1

Case Example (Wait Times): How do Patients Trade-Off Surgeon Choice and Waiting Times for Total Joint Replacement

If you were told at the time of referral to a surgeon that these were the only Scenarios available, which one would you choose? Please select the Scenario that is most appealing to you by marking the box with an 'X'.

Attributes	Scenario A	Scenario B	Common Scenario
Reputation of Surgeon	Satisfactory reputation	Good reputation	Good reputation
Referral to Surgeon	Surgeon selected by you	Surgeon selected by your doctor	Surgeon selected by your doctor
Your Wait Time to Surgeon Visit	12 months	18 months	6 months
Your Wait Time to Surgery After Deciding to Have Surgery	18 months	6 months	6 months
Your Travel Time to Hospital for Your Surgery and Follow Up	More than 1 hour	1 hour or less	1 hour or less
I would choose	☐	☐	☐

Attributes Describing each Scenario

Trade-offs

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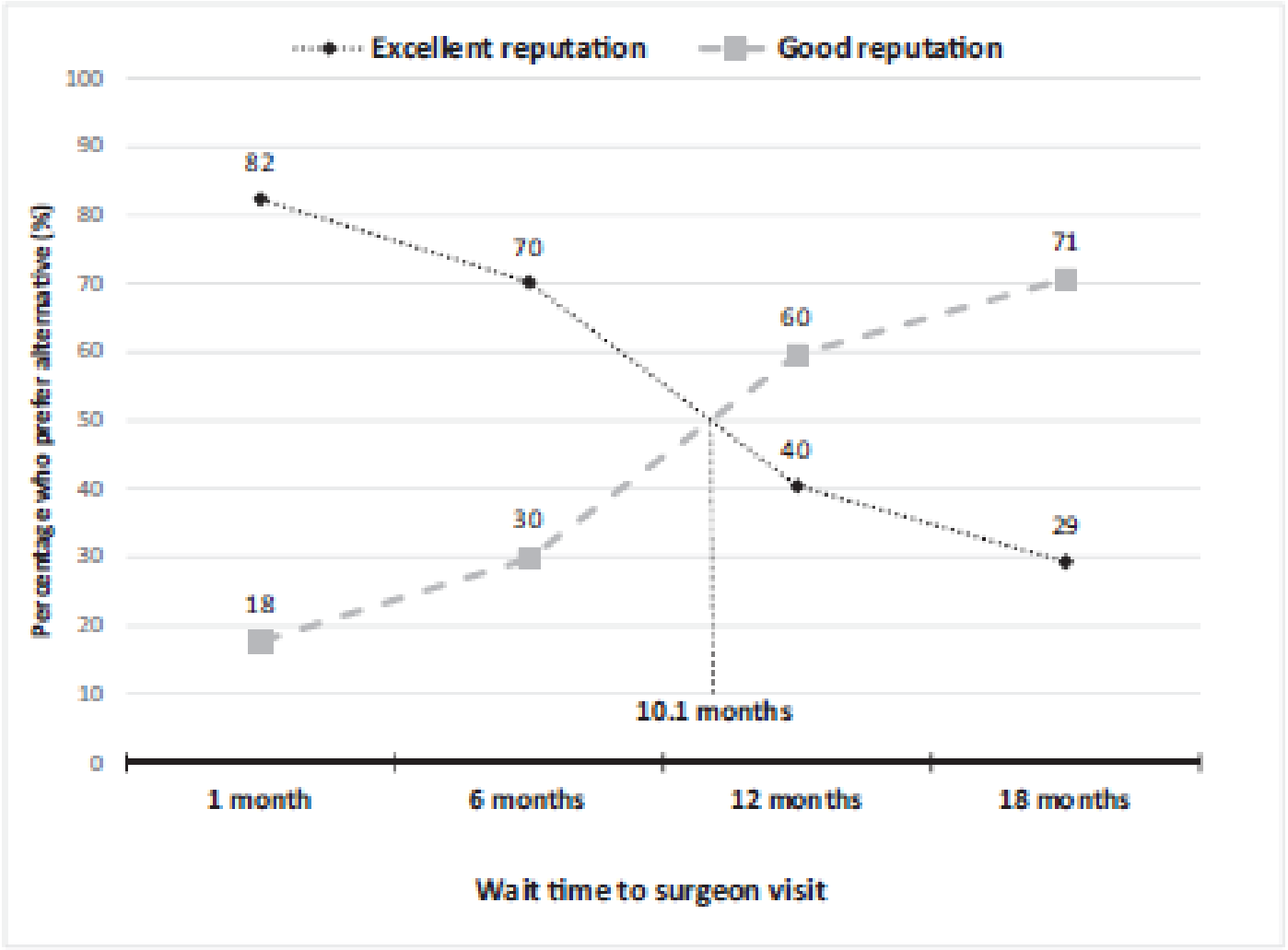
Case Example: Willingness to Wait for a Surgeon Visit Surgeon Reputation

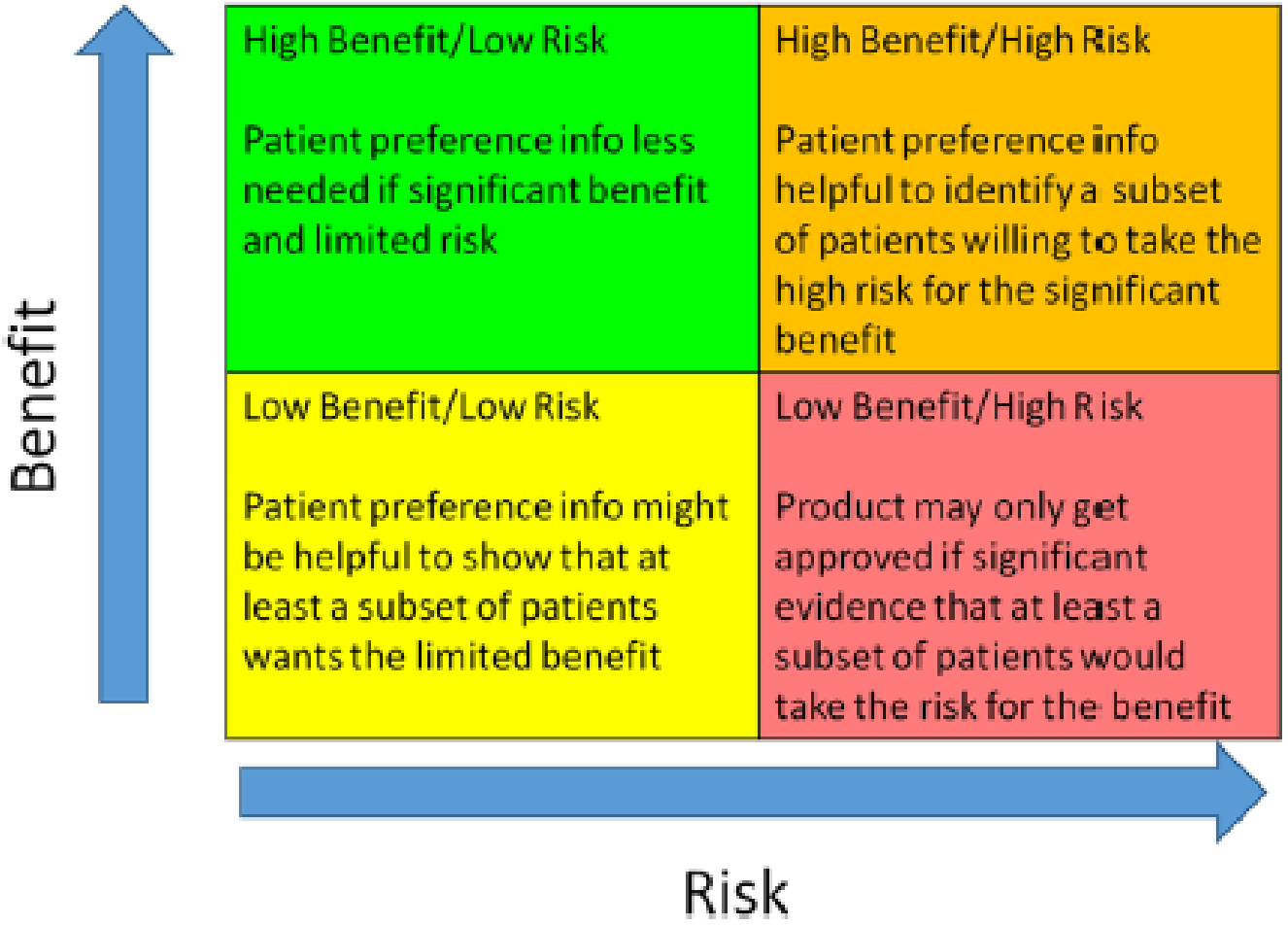


Patients are willing to wait ~10 months for surgeon consult

…to see a surgeon with an excellent reputation (vs a surgeon with a good reputation)

-Marshall DA, Deal K, Conner-Spady B et al How do Patients Trade-Off Surgeon Choice and Waiting Times for Total Joint Replacement: A Discrete Choice Experiment. Osteoarthrits and Cartilege 2018;26:522-530.

Value of Patient Preference Information as a Function of Benefit and Risk



Benefit - favorable effect or desirable outcome of diagnostic or therapeutic strategy

Harm – unfavorable effect or undesirable outcome

Risk – qualitative notion of the probability and / or severity of a harm

e.g. effectiveness, safety, side effects, mortality, morbidity

Early rheumatoid arthritis – Major symptoms improvement, reduce serious joint damage, risk of serious infection, risk of cancer *(Hazlewood GR et al. Rheumatology, 2016)*

Ho MP, Saha A, McCleary K, et al. A Framework for Incorporating patient preferences regarding benefits and risks into regulatory assessment of medical technologies. *Value in Health.* 2016; 19(6):746-750

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Case Example: Benefit-Risk Trade-offs in Gene Expression Profiling (GEP) for Chemotherapy Treatment Decisions in Breast Cancer

- Gene expression profiling (e.g. Oncotype DX) is a form of personalized medicine
- GEP provides information about the likelihood of BrCa recurrence in 10 years
- Identifies patients who may not benefit from chemotherapy
- Costs ~$4,000 USD
- Cost of test is not covered consistently across Canada

- 5 attributes (risks and benefits) describing Testing Scenarios:
  - MDs Clinical Risk Assessment
  - Trust in MD
  - Risk of Temporary Side Effects
  - Risk of Permanent Side Effects
  - GEP Test Score and Likely Benefit from Chemotherapy
- Sample – Canadian women (>18 years) from general population administered internet

Marshall DA, Deal K, Bombard Y, et al. How do Women Trade-Off Benefits and Risks in Chemotherapy Treatment Decisions Based on Gene Expression Profiling for Early-Stage Breast Cancer? A Discrete Choice Experiment. *BMJ Open* 2016; 6:e010981

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Example Choice Task GEP in Breast Cancer

If you had early-stage breast cancer,
under which of the following scenarios would you be most likely to choose chemotherapy, if you were to have chemotherapy?

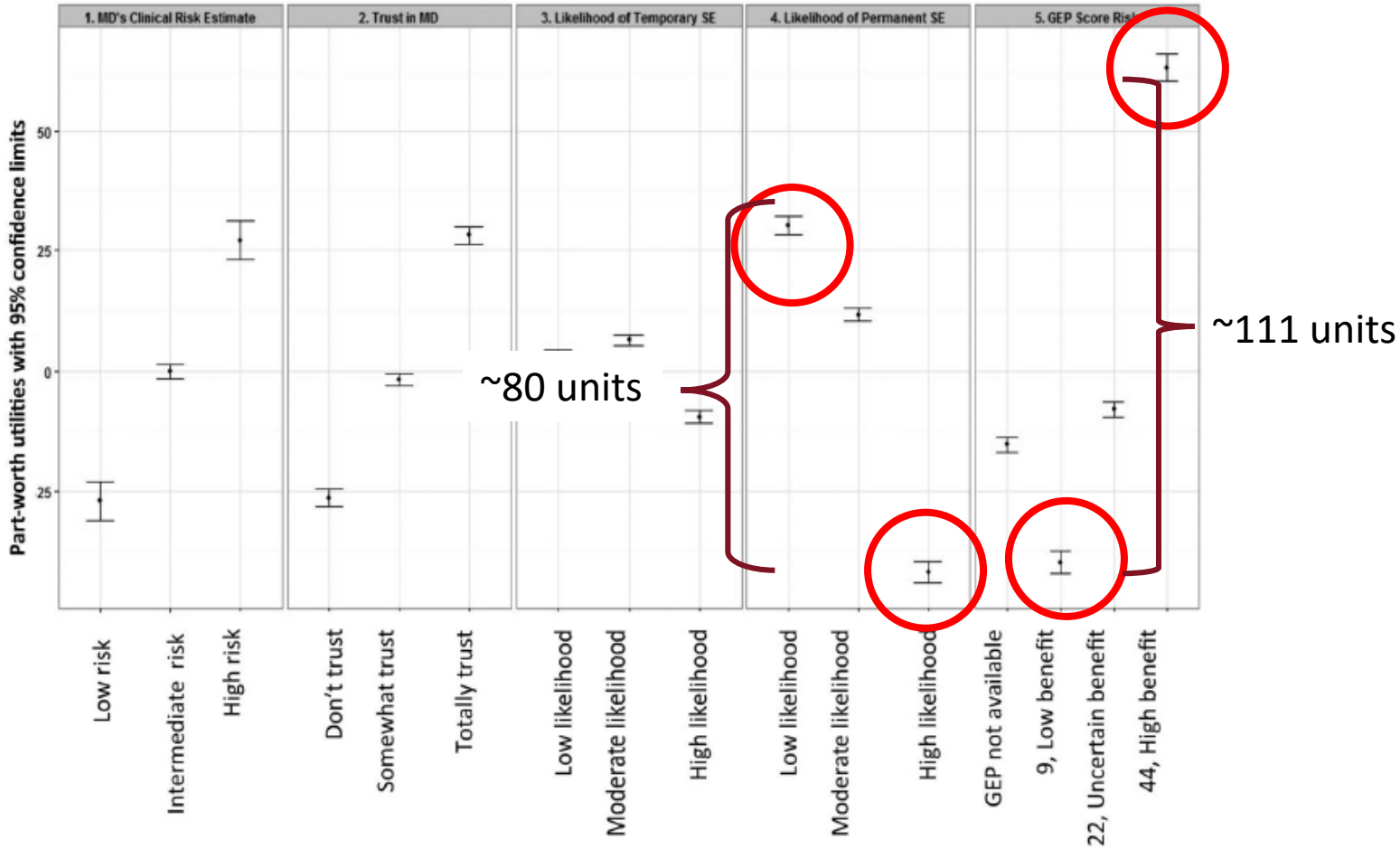
Choose by clicking one of the buttons below:

Your doctor's estimate of risk of cancer returning (without using a GEP test)	*High risk of cancer returning*	*Low risk of cancer returning*	*Intermediate risk of cancer returning*
Likelihood of *temporary side effects*	Moderate	Moderate	High
Likelihood of *permanent side effects*	High	Moderate	Low
Trust in your cancer treatment doctor	Moderately trust	Totally trust	Slightly trust
GEP test score	GEP test not available	22	44
Likely benefit from chemotherapy		Uncertain benefit	High benefit
	○	○	○

Now, if you had the choice to have chemotherapy, and if the scenario you chose above was really your situation, what would you do?

- ○ I would still have chemotherapy
- ○ I would not have chemotherapy

Benefit from Chemotherapy (Based on GEP Score) vs Risk of Permanent Side Effects



Trade off between:
High benefit of chemo compared low benefit of chemo (to achieve lower BrCa recurrence risk) based on GEP Score

AND

High risk of permanent side effects compared to low risk of permanent side effects

$$\Delta\beta_{benefit} / -\Delta\beta_{risk}$$

= ~111 /- 80 = 1.4

Expected benefit from chemo (based on GEP score) outweighs increased risk of permanent side effects

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Workforce preferences for job characteristics

Verity Watson

Workforce characteristics

- Jobs are also made up of a set a characteristics:
  - Location, working hours, training opportunities, salary…
- Used DCEs to explore
  - How to recruit and retain healthcare workforce in remote and rural areas
  - The factors that influence choice of training jobs and locations

Trainee doctors and medical students preferences for training posts

- Cleland, J. Johnson, P. Watson, V. Krucien, N. Skåtun, D. (2017), What do UK medical students value most in their career? A discrete choice experiment. *Medical Education* 51, 839-851

- Cleland, J. Johnson, P. Watson, V. Krucien, N. Skåtun, D. (2016), What do UK doctors-in-training value in a post? A discrete choice experiment. *Medical Education* 50, 189-202

Background

- UK doctors in training can choose their specialty and where to train
- But some specialities and locations find it difficult to fill all training posts
- What are the most important push and pull factors and how do doctors in training/medical students trade these off?

Job characteristics

- Familiarity with hospital or unit (Unfamiliar, Quite familiar, Very familiar)
- Geographic location (Desirable, Not so desirable)
- Opportunities for partner or spouse (Limited, Good)
- Potential earnings (Average, 5%, 10%, 20% above average)
- Clinical or academic reputation (Indifferent, Good, Excellent)
- Working Conditions (Poor, Good, Excellent)

Choice task

Choice 1 of 9: which position would you prefer?

	Position "A"	Position "B"
Geographical location	Not so desirable location	Desirable location
Familiarity with hospital/unit	Unfamiliar	Quite familiar
Opportunities for partner/spouse	Good opportunities	Limited opportunities
Potential earnings	Average earnings	20% above average
Working conditions	Poor conditions	Excellent conditions
Clinical/academic reputation	Indifferent reputation	Good reputation
Please tick one box	☐	☐

Photos

Results (Willingness to accept compensation)

Characteristic	Trainee sample	Student sample
Location – not so desirable	15.4%	12.6%
Partner opp.- limited	19.2%	12.0%
Familiarity – quite	1.9%	0.6%
Familiarity – unfamiliar	6.2%	3.39%
Working conditions – poor	38.6%	25.3%
Reputation – indifferent	18.4%	13.7%

Beyond preference elicitation

DCEs as Decision Aid Tools

Luis Enrique Loría

DCEs as Decision Aid Tools

Decision Aid Tools are used to inform people about their condition and available treatments, presenting estimates of benefits and risks of each.

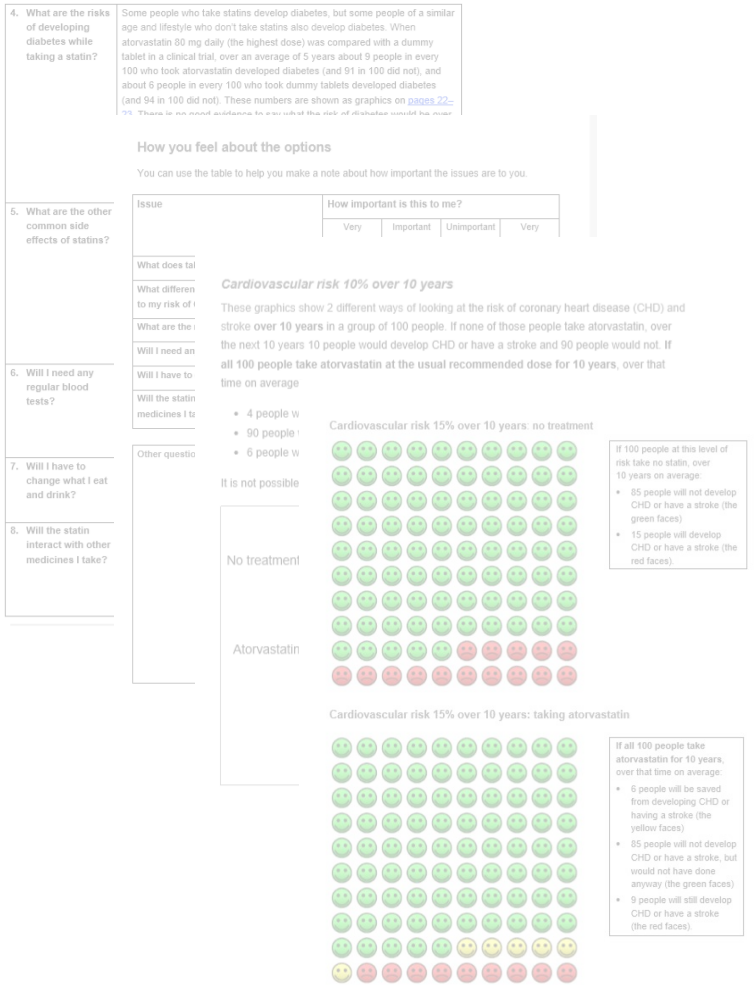
They intend to help people **make informed choices that take into account their preferences**.

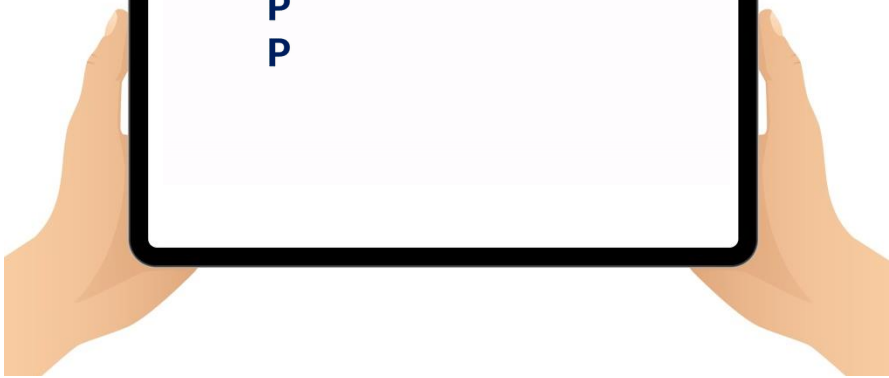
They are meant to **supplement or support the interaction** between the person and healthcare professional.

Deciding

Learn by ~~**DOING**~~.

The Food Court Analogy™


4. What are the risks of developing diabetes while taking a statin?
Some people who take statins develop diabetes, but some people of a similar age and lifestyle who don't take statins also develop diabetes. When atorvastatin 80 mg daily (the highest dose) was compared with a dummy tablet in a clinical trial, over an average of 5 years about 9 people in every 100 who took atorvastatin developed diabetes (and 91 in 100 did not), and about 6 people in every 100 who took dummy tablets developed diabetes (and 94 in 100 did not). These numbers are shown as graphics on pages 22–
How you feel about the options
You can use the table to help you make a note about how important the issues are to you.
Issue
How important is this to me?
Very
Important
Unimportant
Very
5. What are the other common side effects of statins?
6. Will I need any regular blood tests?
7. Will I have to change what I eat and drink?
8. Will the statin interact with other medicines I take?
Cardiovascular risk 10% over 10 years
These graphics show 2 different ways of looking at the risk of coronary heart disease (CHD) and stroke over 10 years in a group of 100 people. If none of those people take atorvastatin, over the next 10 years 10 people would develop CHD or have a stroke and 90 people would not. If all 100 people take atorvastatin at the usual recommended dose for 10 years, over that time on average
Cardiovascular risk 15% over 10 years: no treatment
If 100 people at this level of risk take no statin, over 10 years on average:
85 people will not develop CHD or have a stroke (the green faces)
15 people will develop CHD or have a stroke (the red faces).
No treatment
Atorvastatin
Cardiovascular risk 15% over 10 years: taking atorvastatin
If all 100 people take atorvastatin for 10 years, over that time on average:
6 people will be saved from developing CHD or having a stroke (the yellow faces)
85 people will not develop CHD or have a stroke, but would not have done anyway (the green faces)
9 people will still develop CHD or have a stroke (the red faces)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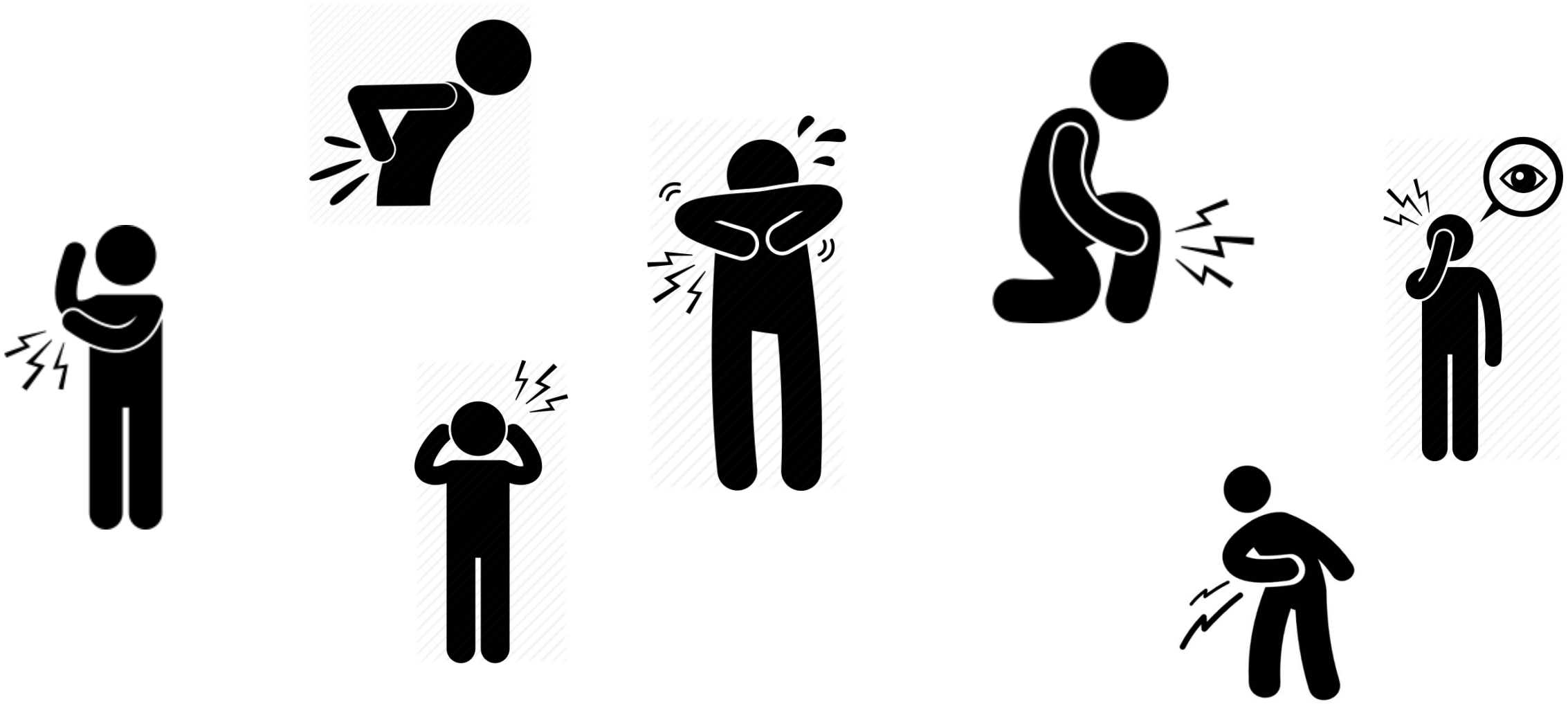
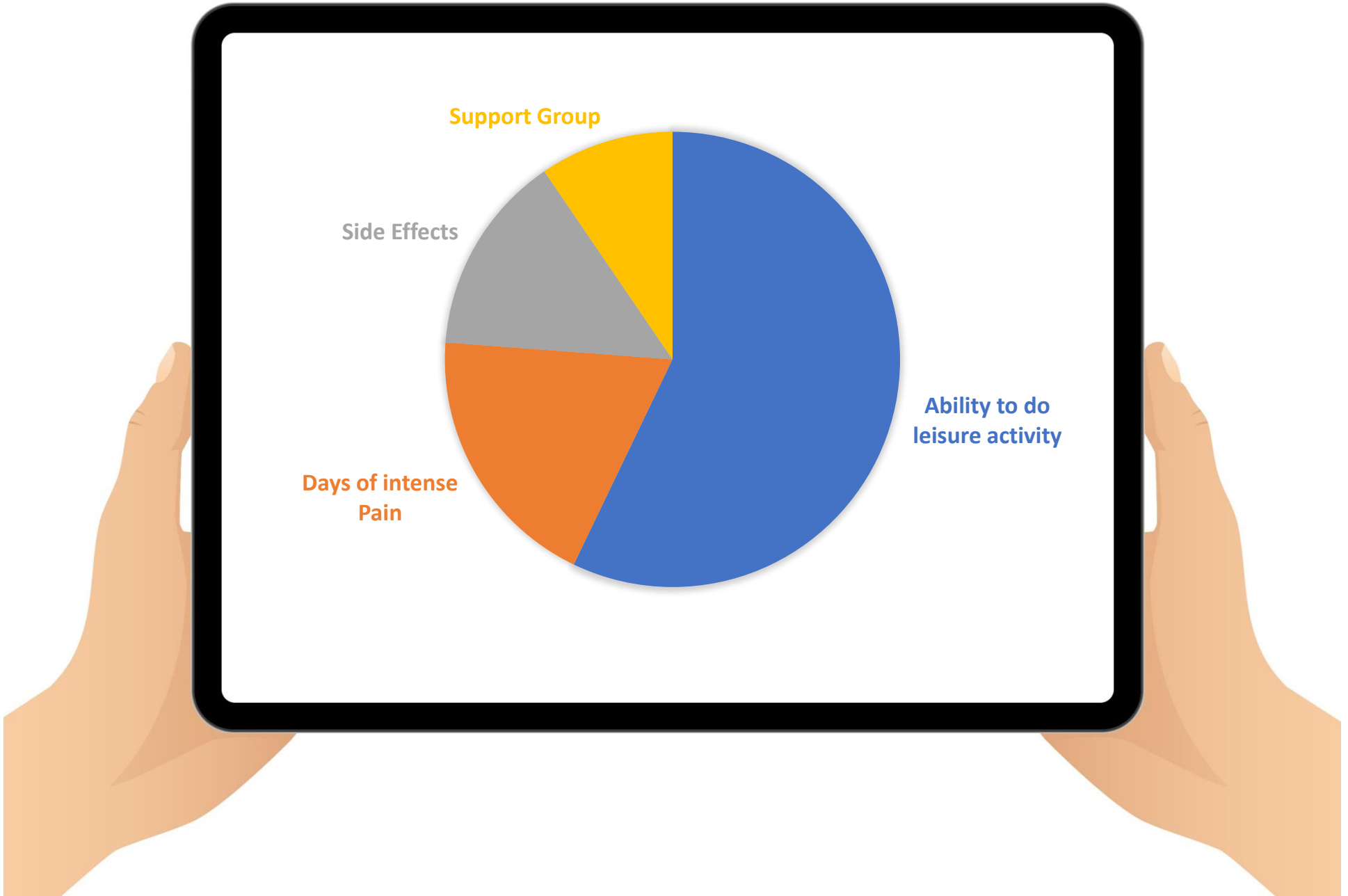
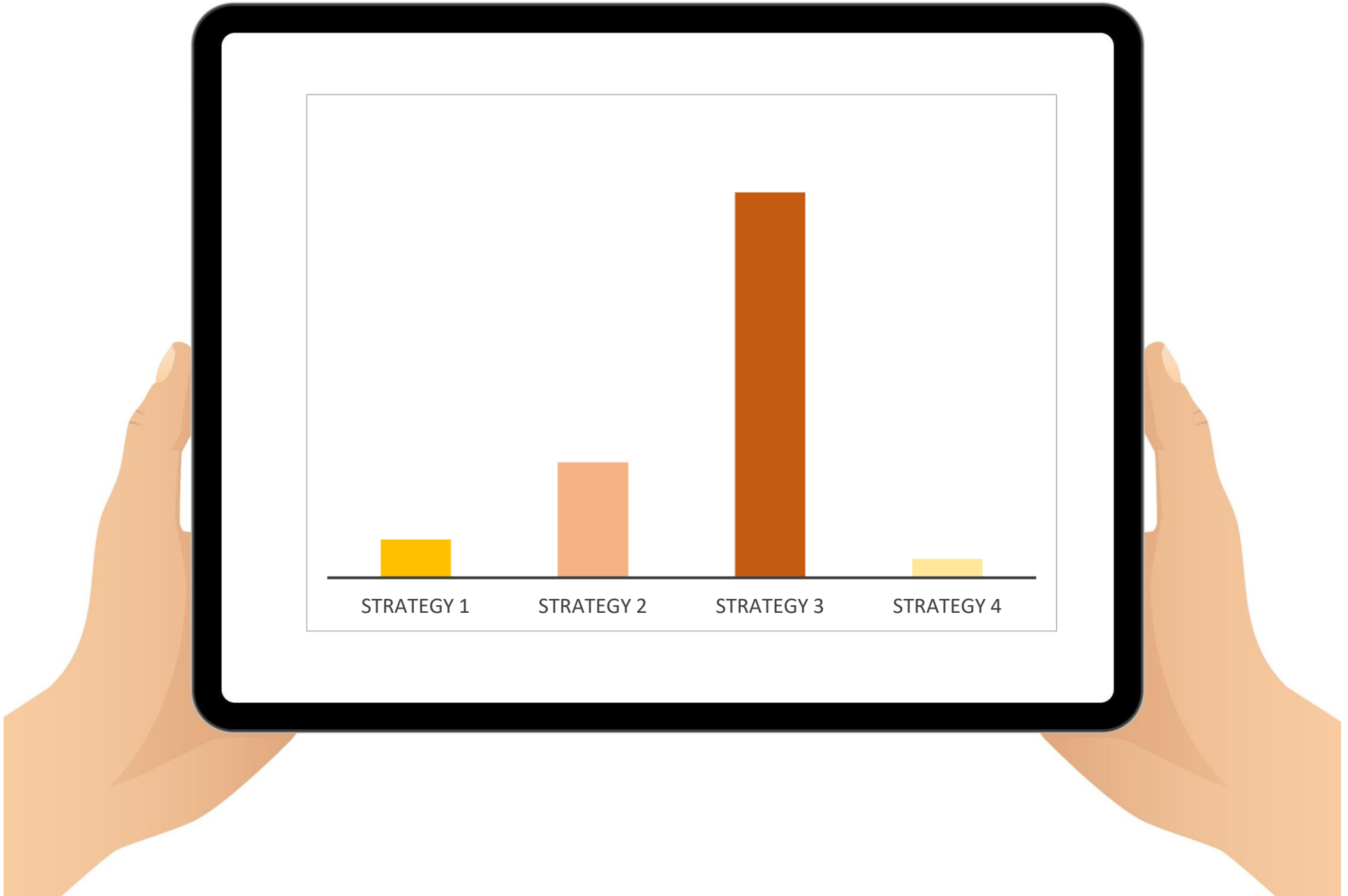
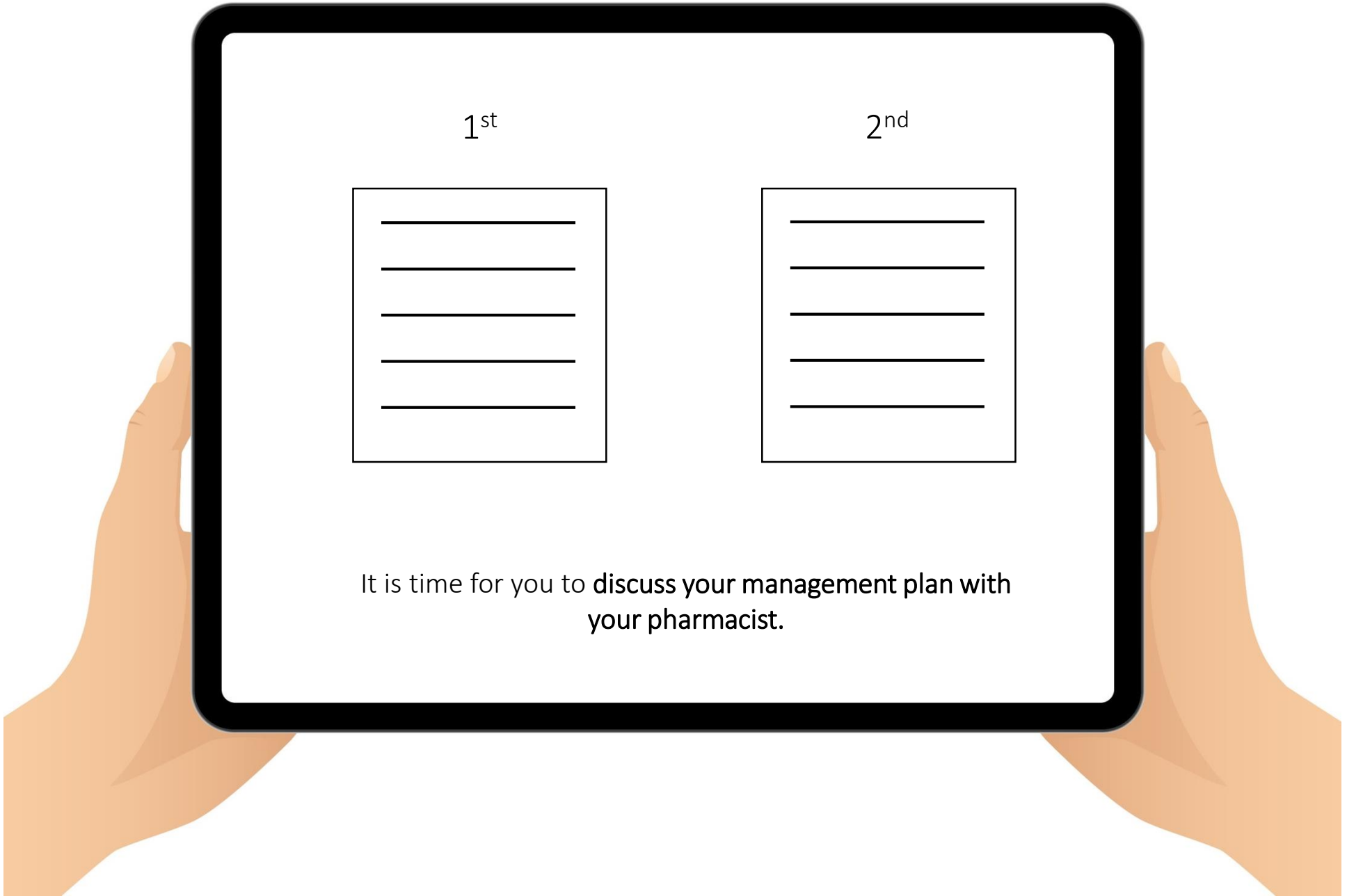


Pain is different for everyone!

Management	Management A	Management B
Day-to-day feeling	Over the counter medicine	Supervised Exercise
Ability to do leisure activity of choice	Same feeling as now	Less discomfort than now
Days a week of intense pain	Same ability as now	More likely to be able to do leisure activities
Side Effects	Less days a week of intense pain	Less days a week of intense pain
Access to social support group	No side effects.	No Side Effects
	No access to social support group	Invited to a social support group


Support Group
Side Effects
Ability to do leisure activity
Days of intense Pain


STRATEGY 1
STRATEGY 2
STRATEGY 3
STRATEGY 4


1st
2nd
It is time for you to discuss your management plan with your pharmacist.

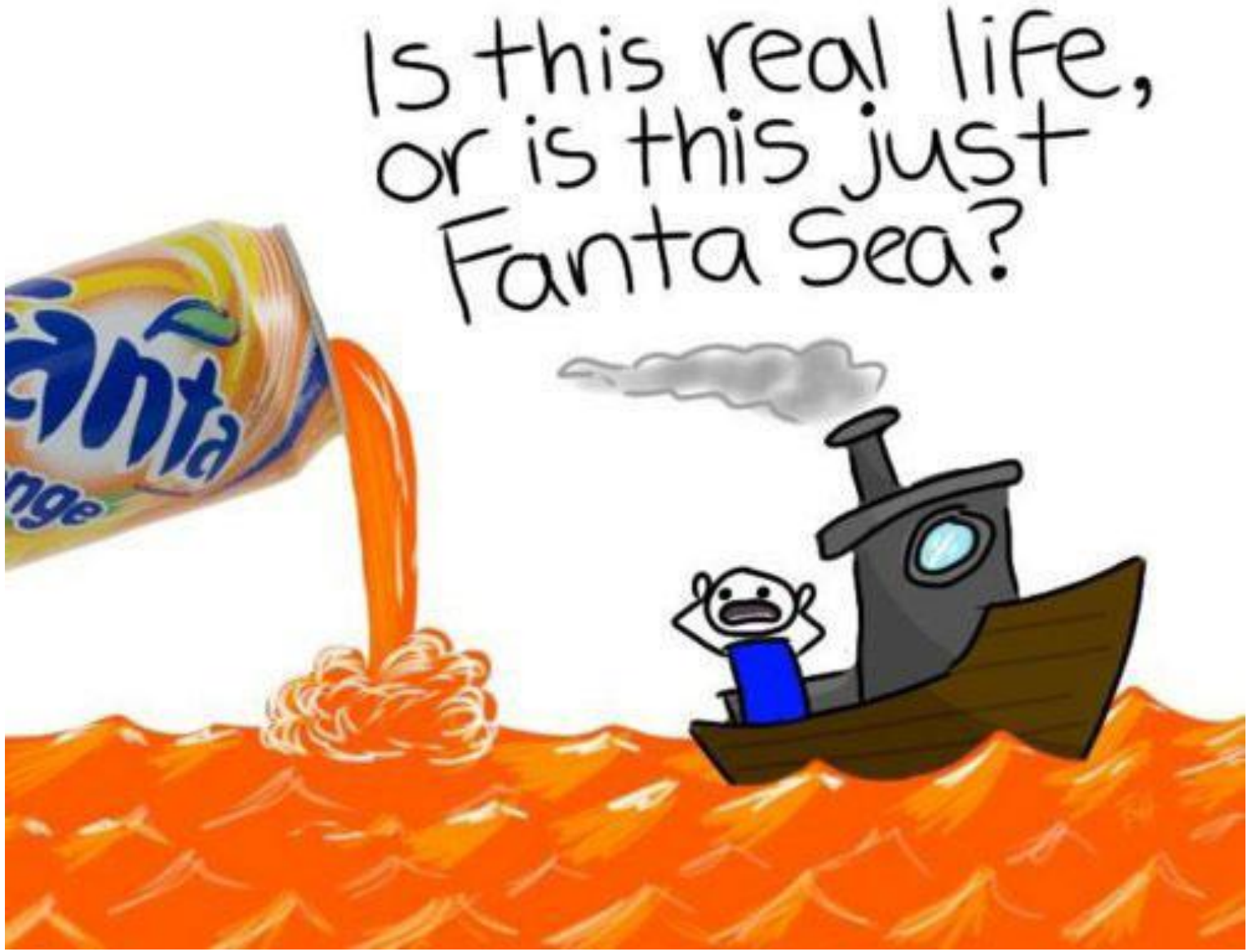
DCEs as Decision Aid Tools

DCEs can facilitate preference saliency in unfamiliar topics and decisions.

Help people understand the necessary trade-offs that they would make when making a treatment decision.

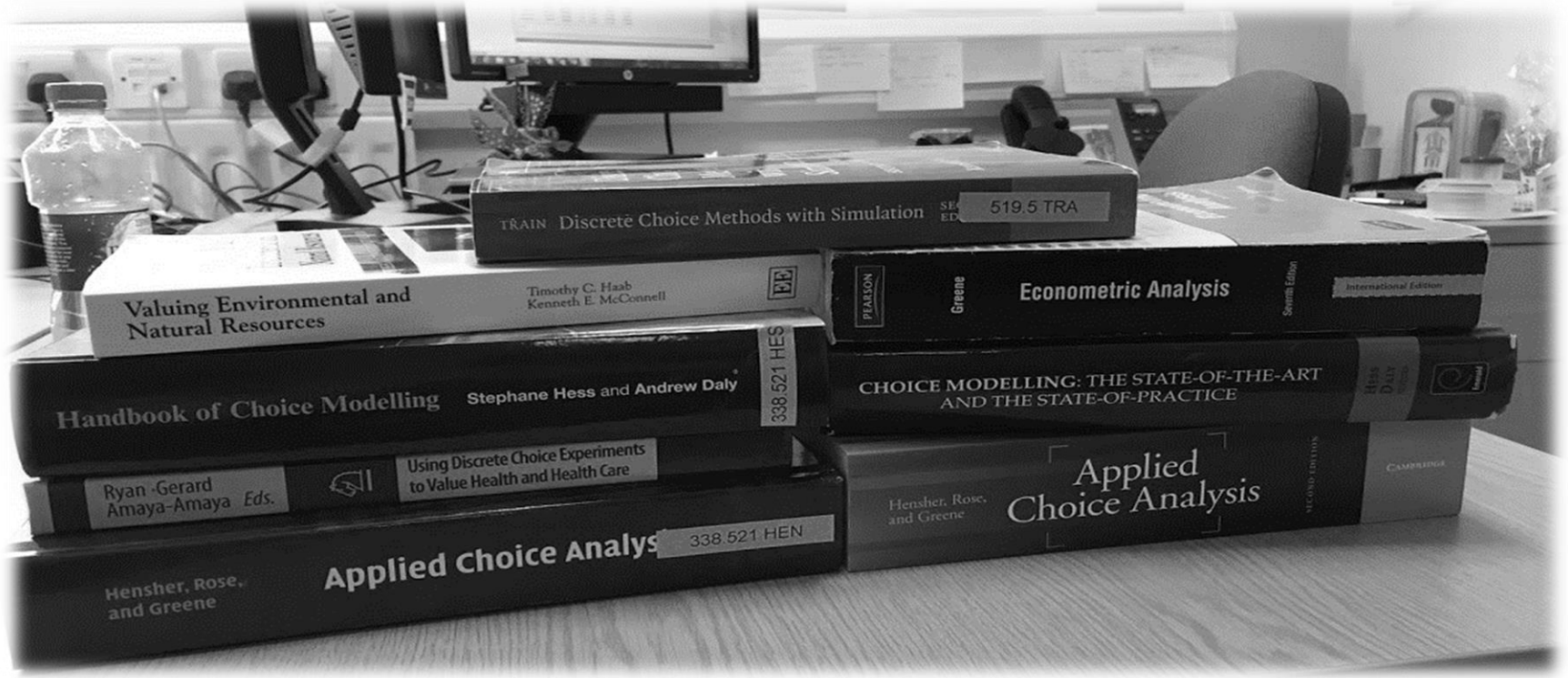
Empower the patient to take active part in the decision making process.

Make it more likely to arrive at treatment decisions that align best with the person's values and preferences.



Mandy Ryan

Testing underlying axioms and Internal Validity



Results good! Axiom of CONTINUITY attracted attention

Think Aloud

***Monotonicity* – 'failure' can be explained**

***Continuity?* - Individuals value attributes highly, not simple heuristics!**

Ryan M. Watson V. and Entwistle V. Rationalising the 'irrational': A think aloud study of discrete choice experiment responses. *Health Economics.* 2009; 18: 321-336.

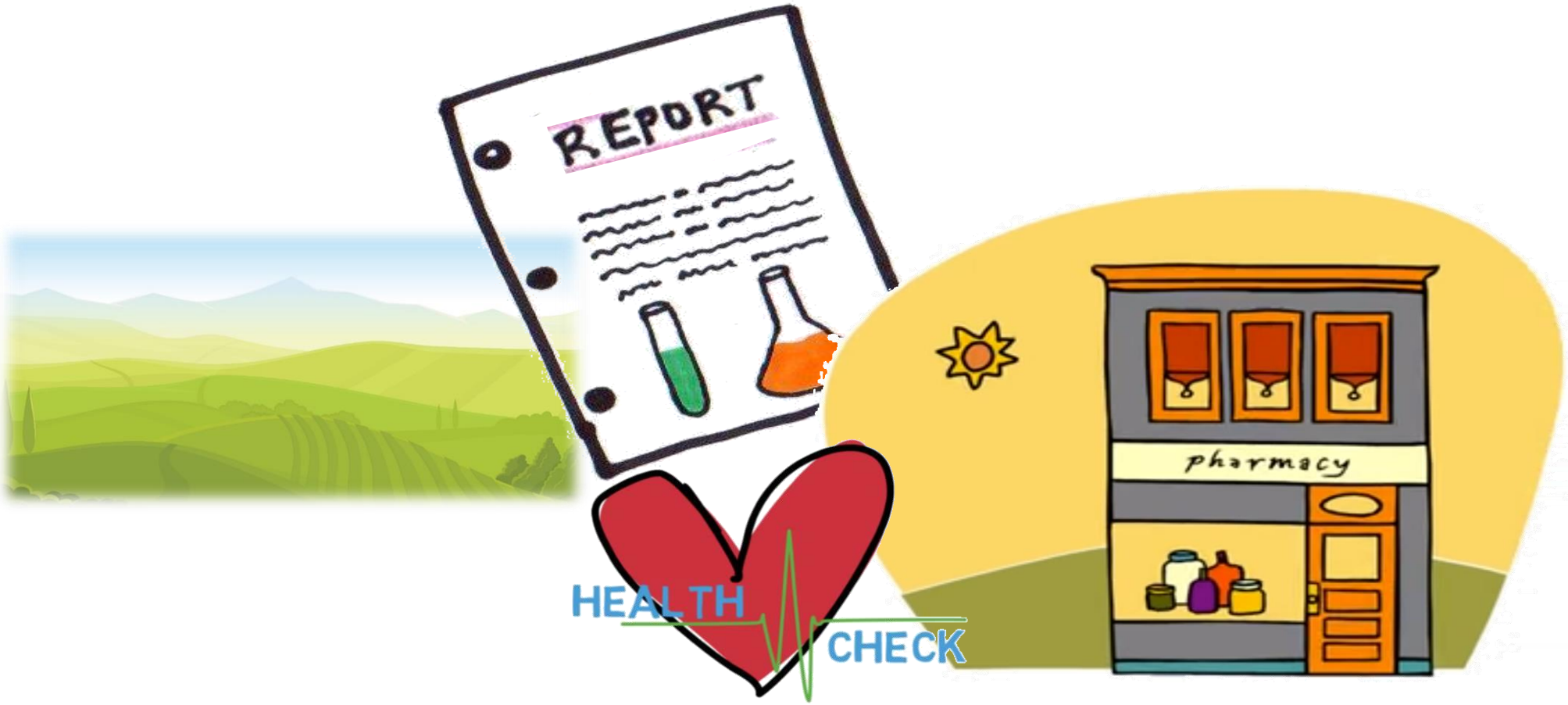
Eye-Tracking

Ordering effects

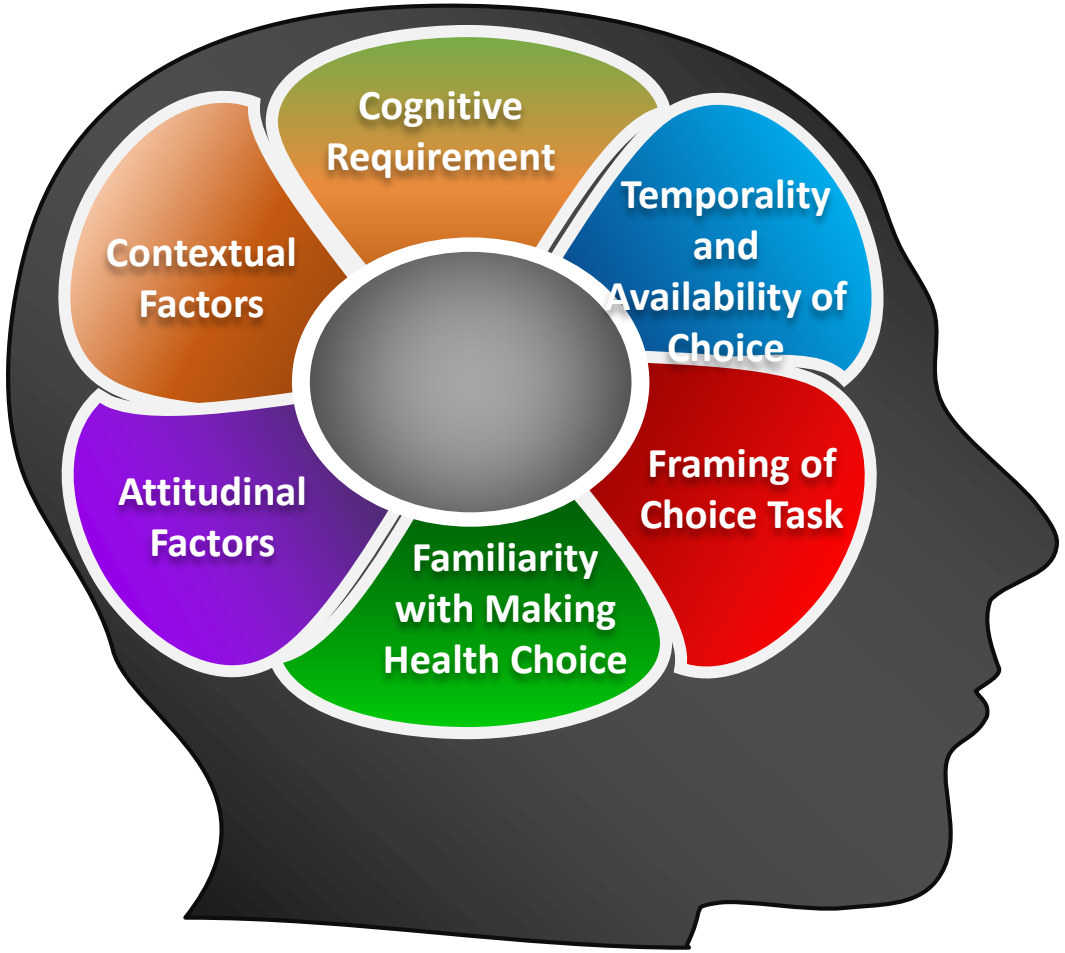
- randomise task order across individuals
- randomised alternatives across tasks + individual
- randomise attributes? Probably not

Ryan M. Krucien N. Hermens F. (2018) 'The eyes have it: using eye tracking to inform information processing in multi-attributes choices', *Health Economics,* 27(4), 709-721.

Assessing external validity using a field experiment in pharmacy



Why don’t participants do as they say? –Qualitative Insight



“I'm really interested but what put me off is that it is in Aberdeen and I lived in Alford. I definitely would go for it if it's nearer to where I live.”
(ID: 70, Female, Yes-No)