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Predicting choice from eye movements

A new Covid variant emerges
Will you take a booster?

Risk of Long Covid after infection	1 in 20 rather than 1 in 10
Risk of hospitalization after infection	1 in 40000 rather than 1 in 5000
Risk of death after infection	1 in 2 million rather than 1 in 500k
Risk of mild side effects	1 in 10
Risk of serious side effects	1 in 1000000

A new Covid variant emerges
Will you take a booster?

Risk of Long Covid after infection	1 in 100 rather than 1 in 10
Risk of hospitalization after infection	1 in 1 million rather than 1 in 5000
Risk of death after infection	1 in 5 million rather than 1 in 500k
Risk of mild side effects	1 in 5
Risk of serious side effects	1 in 100000

Discrete choice experiments

- Used to study people's preference for interventions
- Common in the domain of health economics (how much are people willing to pay to obtain a health benefit?)
- Trade-off between aspects of intervention
- Makes use of "stated preferences" (assumes people will behave as indicated)

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Risk of mild side effects	1 in 10
Risk of serious side effects	1 in 1000000

Design of DCEs

- Typical DCE:
  - 2 or 3 alternatives (with or without 'no change' option)
  - 4-6 attributes (including cost)
- Large number of possible combinations
- Optimal design: Reduced to sets of around 8-18 choices

Table 1 – Definition of attributes and levels.

Attribute	Definition	Levels for screening programs	Levels for the opt-out program
BC mortality	Total number of BC deaths out of 1000 women followed until age 74 y	10, 15, 20, 25	30
False-positive	Number of women undergoing *unnecessary investigations* (e.g., biopsy) because of suspicious findings on the mammograms that do not result in BC diagnosis, out of 1000 women screened until age 74 y	50, 100, 150, 200	0
Overdiagnosis	Number of women undergoing *unnecessary treatments* (e.g., chemotherapy and radiotherapy) because of detection of a noninvasive cancer that would not have become life-threatening, out of 1000 women screened until age 74 y	10, 50, 100, 150	0
Type of screening referral	Invitation to perform a mammogram by 1) the local screening center* or 2) your doctor (GP or gynecologist)	1. "Letter" 2. "Doctor"	–
Travel time	Time spent traveling to the radiology center (min)	10, 30, 60, 90	0
No. of tests	Total number of screening tests until age 74 y	6, 12, 18, 24	0
Out-of-pocket cost	Cost of screening after reimbursement by the public health insurance	€0, €30, €60, €60 (refunded)†	0

BC, breast cancer; GP, general practitioner.
* Standard procedure for inviting women aged 50–74 y eligible to the national BC screening program (organized screening).
† The modality "€60 refunded" means that women had to advance fees, which would be reimbursed later.

Design of the choice scenarios

The 7 attributes and their levels would allow 8192 unique attribute combinations (alternatives) in a full factorial design. A main-effects D-efficient design was generated using the techniques developed by Street and Burgess [32] to reduce this design to a more pragmatic number of 16 choice scenarios, allowing

Traditional DCEs

- Large number of participants (> 200)
- Linear mixed effects or similar method to model effects attribute levels on choices
- Choice tasks in fixed order, attributes in fixed order (often pen and paper)

Table 2 – Description of the sample (N = 812).

Characteristic	n (%)
Age (y)	
40–49	301 (37.1)
50–74	511 (63.9)
Socioprofessional category	
Farmer	7 (0.9)
Craftsman	42 (5.2)
Executive	84 (10.3)

Table 3 – Results of the EC logit model.

Parameters	Moment	MLE
Preferences		
ASC_{Screen}	Mean	9.430*
	SD	7.671*
ASC_{AltA}	Mean	0.274
	SD	0.250*
BC mortality	Mean	−1.048*
False-positive mammography	Mean	−0.022*
Overdiagnosis	Mean	−0.075*
Type of screening referral	Mean	−0.159*
Travel time	Mean	−0.053*
No. of tests	Mean	−0.114†
OOP_€60 (refunded)	Mean	−0.226*
OOP_€30	Mean	−0.748*
OOP_€60	Mean	−0.974*
WTA		
Overdiagnosis	Mean	14.1*
False-positive mammography	Mean	47.8*

Limitations

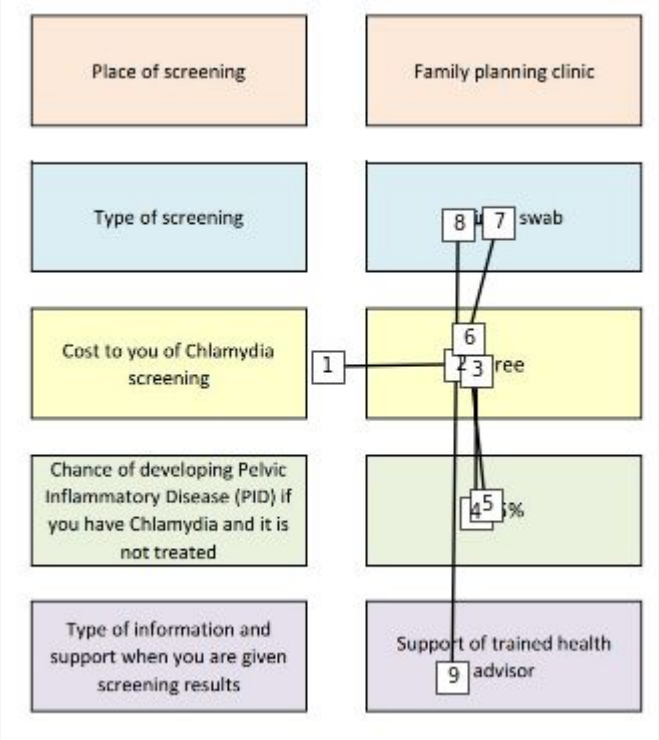
- Analysis restricted to across participant trends
- Process of decision making poorly understood
- Worries that order effects may occur

Risk of Long Covid after infection	1 in 20 rather than 1 in 10
Risk of hospitalization after infection	1 in 40000 rather than 1 in 5000
Risk of death after infectio	1 in 2 million rather
Risk of mild effects	
Risk of serious effects	

Risk of Long Covid after infection	1 in 100 rather than 1 in 10
Risk of hospitalization after infection	1 in 1 million rather than 1 in 5000
Risk of death after infection	1 in 5 million rather than 1 in 500k
Risk of mild side effects	1 in 5
Risk of serious side effects	1 in 100000

Limitations: ANA

- People may not pay attention to all attributes (Attribute Non-Attendance - ANA)
- Statistical models assume all attributes are weighted
- How to measure ANA:
  - Estimate from responses (inferred ANA)
  - Ask participants (stated ANA)
  - Measure attention (visual ANA)



Eye tracking DCEs

- Focus on measuring ANA
- Discussion on what eye movements tell
- Focus on DCEs with two choice alternatives

Using eye-tracking as an aid to design on-screen choice experiments

Emilia Cubero Dudinskaya [a], Simona Naspetti [b], Raffaele Zanoli [a]

Choice certainty in Discrete Choice Experiments: Will eye tracking provide useful measures?

Kennet Uggeldahl [a], Catrine Jacobsen [a], Thomas Hedemark Lundhede [a, b], Søren Bøye Olsen [a]

Using eye-tracking to model attribute non-attendance in choice experiments

Daniel Chavez, Marco Palma & Alba Collart

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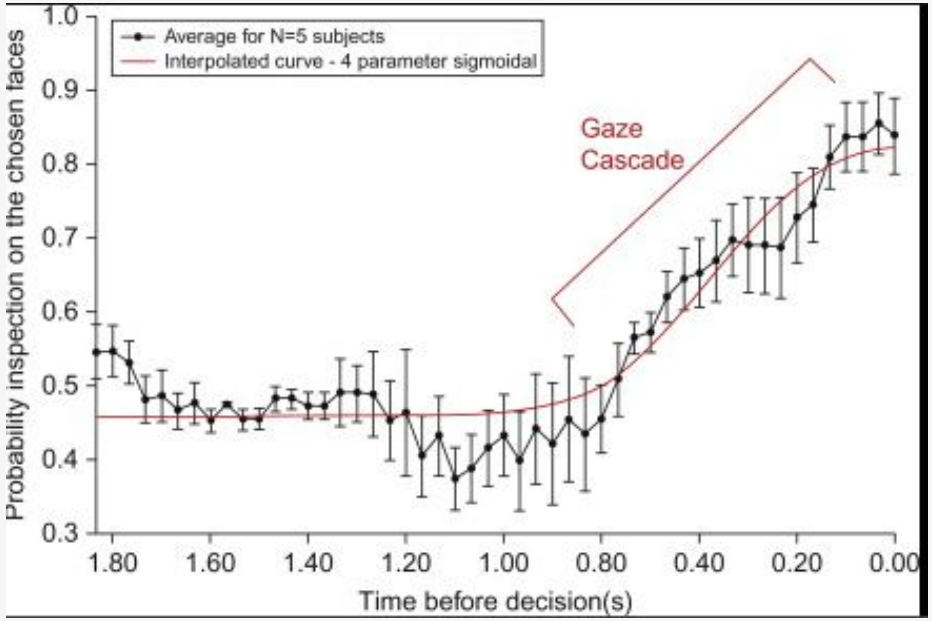
Two-alternative DCEs

- Most DCEs involve choice between two or more alternatives
- Gaze cascade effect occurs
- Choice can often be predicted from gaze patterns



Single alternative DCEs

- Decisions often involve one option and the choice to accept or reject
  - Screening: yes or no?
  - Vaccination: yes or no?
- RQ: What do eye movements tell about such decisions?

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Risk of serio effects	

Risk of Long Covid after infection	1 in 100 rather than 1 in 10
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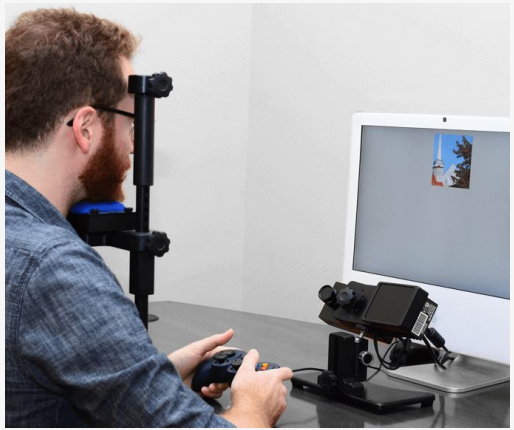
Our study

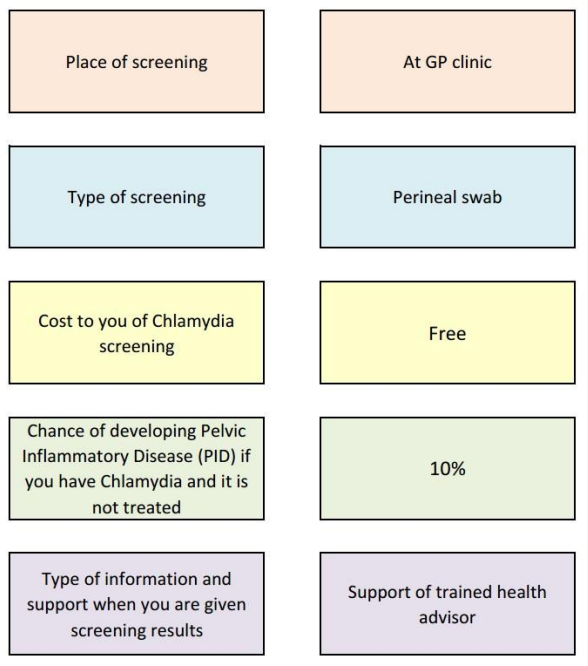
- Existing DCE on chlamydia screening
- 30 female participants, individually tested
- 5 attributes
- Eye tracking with Eyelink 1000 system



Place of screening	At GP clinic
Type of screening	Perineal swab
Cost to you of Chlamydia screening	Free
Chance of developing Pelvic Inflammatory Disease (PID) if you have Chlamydia and it is not treated	10%
Type of information and support when you are given screening results	Support of trained health advisor

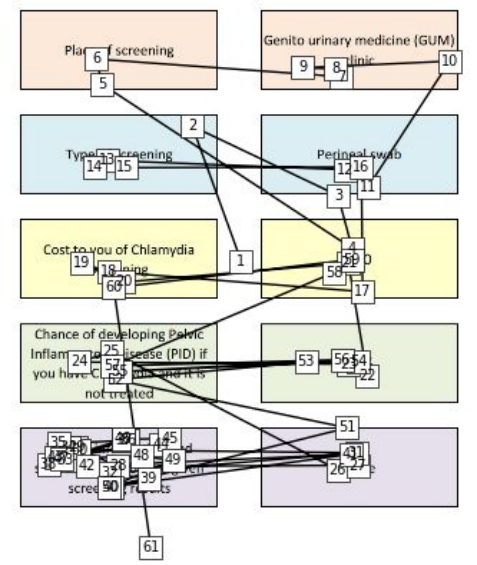
Design

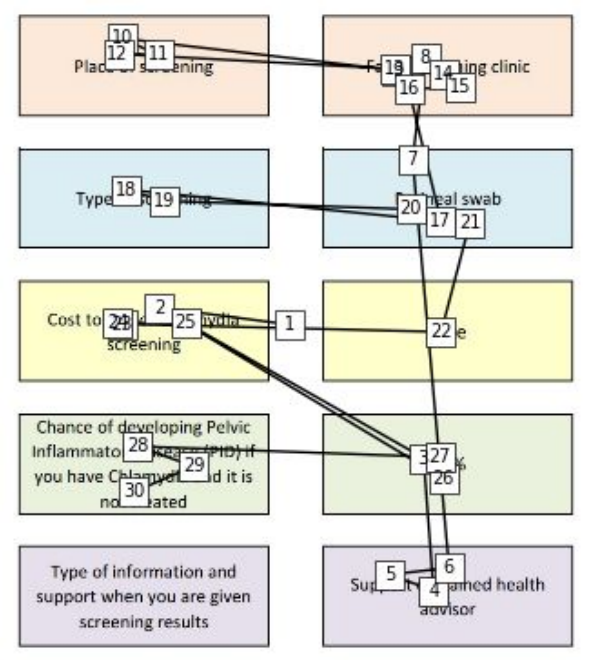
Scenario	Place	Type	Cost	PID risk	Support
Practice 1	GUM clinic	Urine test	£5	10%	None
Practice 2	At home	Perineal swab	£1	25%	None
Practice 3	At GP clinic	Urine test	Free	15%	Health advisor
Main 1	Family planning clinic	Full pelvic	£5	10%	None
Main 2	Family planning clinic	Perineal swab	£10	1%	None
Main 3	GUM clinic	Urine test	£10	10%	Health advisor
Main 4	At home	Perineal swab	£5	5%	Health advisor
Main 5	At home	Urine test	Free	1%	None
Main 6	At GP clinic	Full pelvic	£20	1%	Health advisor
Main 7	Family planning clinic	Urine test	£20	5%	Health advisor
Main 8	GUM clinic	Urine test	£5	5%	Health advisor
Main 9	GUM clinic	Full pelvic	Free	5%	None
Main 10	At home	Urine test	£20	10%	None
Main 11	At GP clinic	Perineal swab	Free	10%	Health advisor
Main 12	Family planning clinic	Perineal swab	Free	25%	Health advisor
Main 13	GUM clinic	Perineal swab	£20	25%	None
Main 14	At home	Full pelvic	£10	25%	Health advisor
Main 15	At GP clinic	Perineal swab	Free	10%	Health advisor
Main 16	At GP clinic	Urine test	£5	25%	None
Catch 1	At home	Urine test	Free	50%	Health advisor
Catch 2	GUM clinic	Full pelvic	£40	1%	None



Data pre-processing

- Detection of fixations / saccades
- Assigning fixations to regions of interest (ROI)



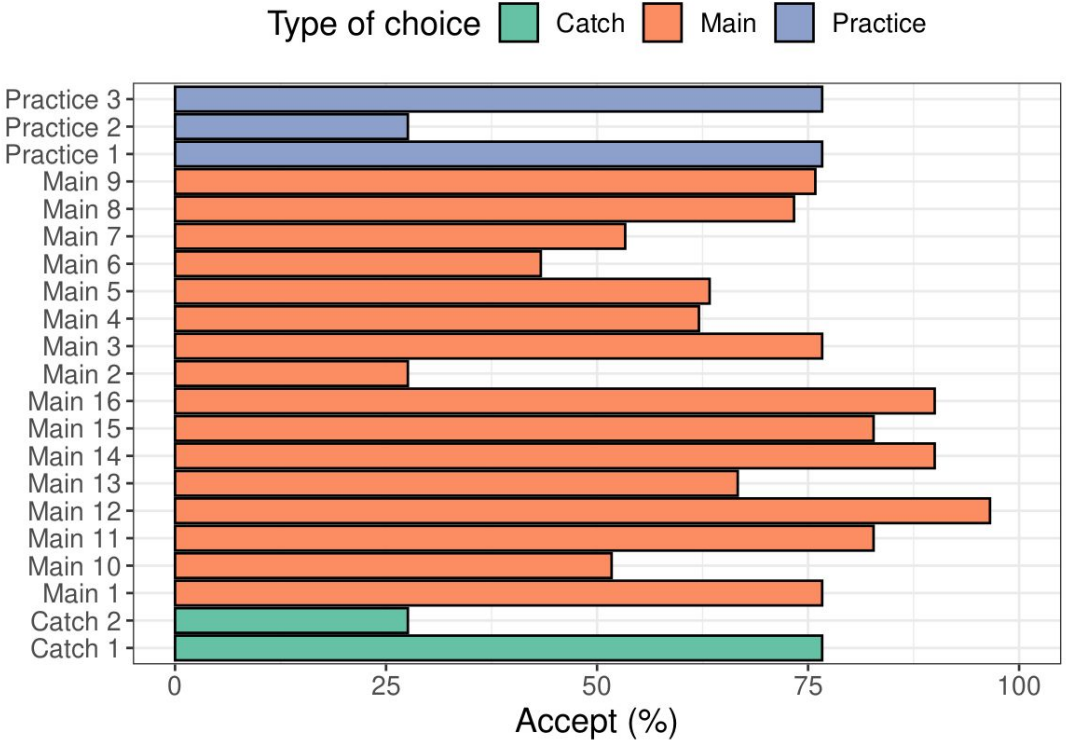


Data

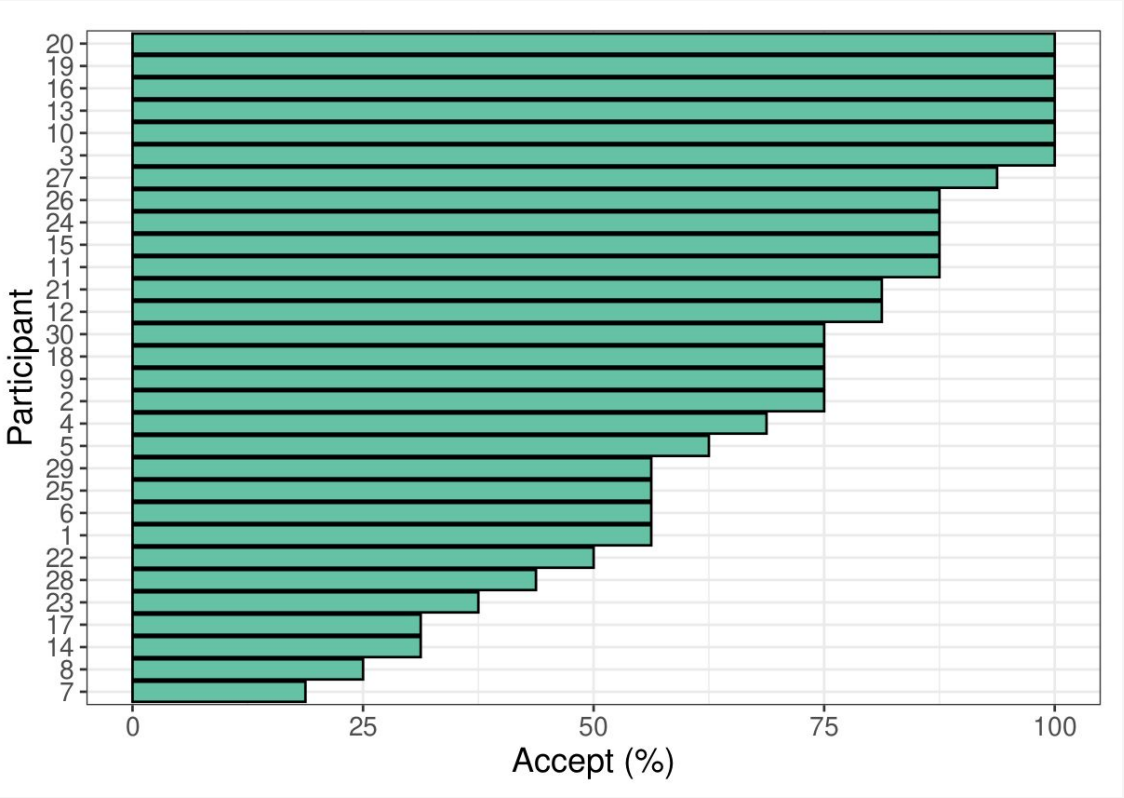
```
## [1] "Total number of fixations: 19692"
## [1] "Total number of choices: 630"
## [1] "Number of participants: 30"
```

	Participant	FixationDuration	XlocFix	YlocFix	ROI	TypeOfTrial	ChoiceNumber	Choice
1	1	254	632.4	493.7	Elsewhere	Practice	1	Accept
2	1	107	436.3	368.8	Type_Label	Practice	1	Accept
3	1	412	393.7	158.7	Place_Label	Practice	1	Accept
4	1	285	451.1	166.2	Place_Label	Practice	1	Accept
5	1	156	742.6	162.0	Place_Value	Practice	1	Accept
6	1	169	697.8	159.2	Place_Value	Practice	1	Accept
7	1	235	463.3	172.0	Place_Label	Practice	1	Accept
8	1	134	427.1	176.3	Place_Label	Practice	1	Accept
9	1	110	426.8	299.6	Type_Label	Practice	1	Accept
10	1	157	725.7	153.7	Place_Value	Practice	1	Accept
11	1	385	696.9	160.5	Place_Value	Practice	1	Accept
12	1	284	746.4	155.1	Place_Value	Practice	1	Accept
13	1	208	766.1	156.6	Place_Value	Practice	1	Accept
14	1	426	846.5	159.1	Place_Value	Practice	1	Accept
15	1	305	929.4	153.1	Place_Value	Practice	1	Accept
16	1	268	798.2	186.8	Place_Value	Practice	1	Accept
17	1	209	819.6	176.3	Place_Value	Practice	1	Accept
18	1	197	818.6	335.7	Type_Value	Practice	1	Accept

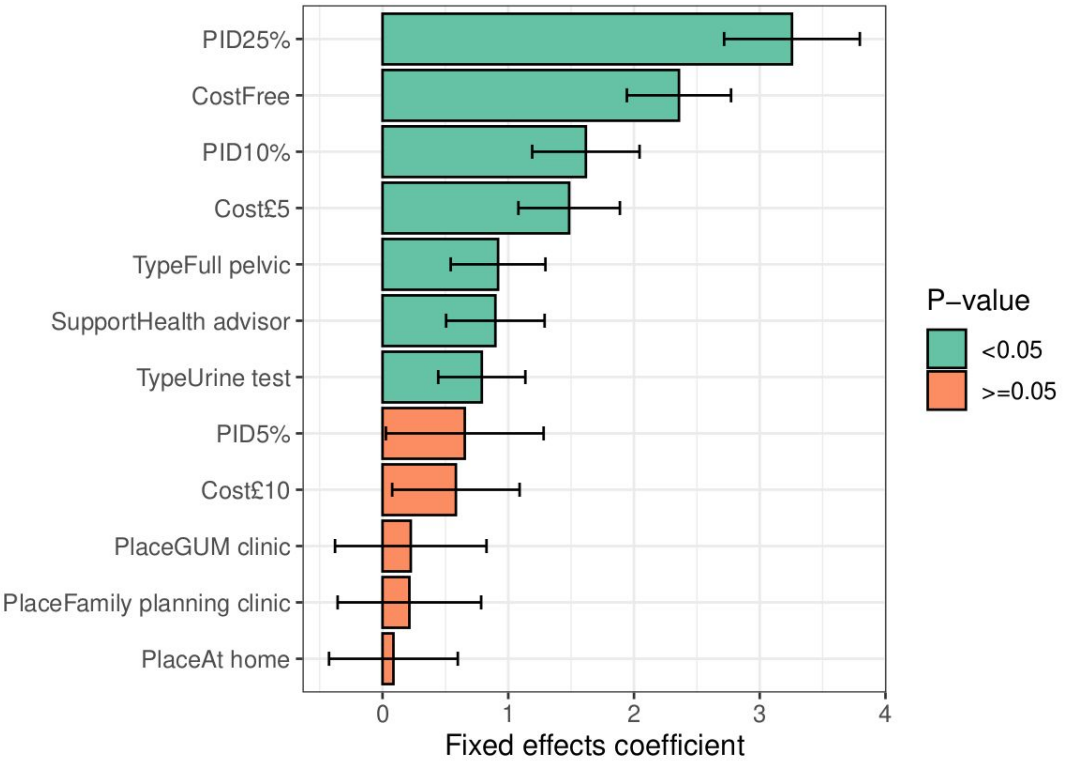
Data exploration: % accept



Data exploration: individual differences

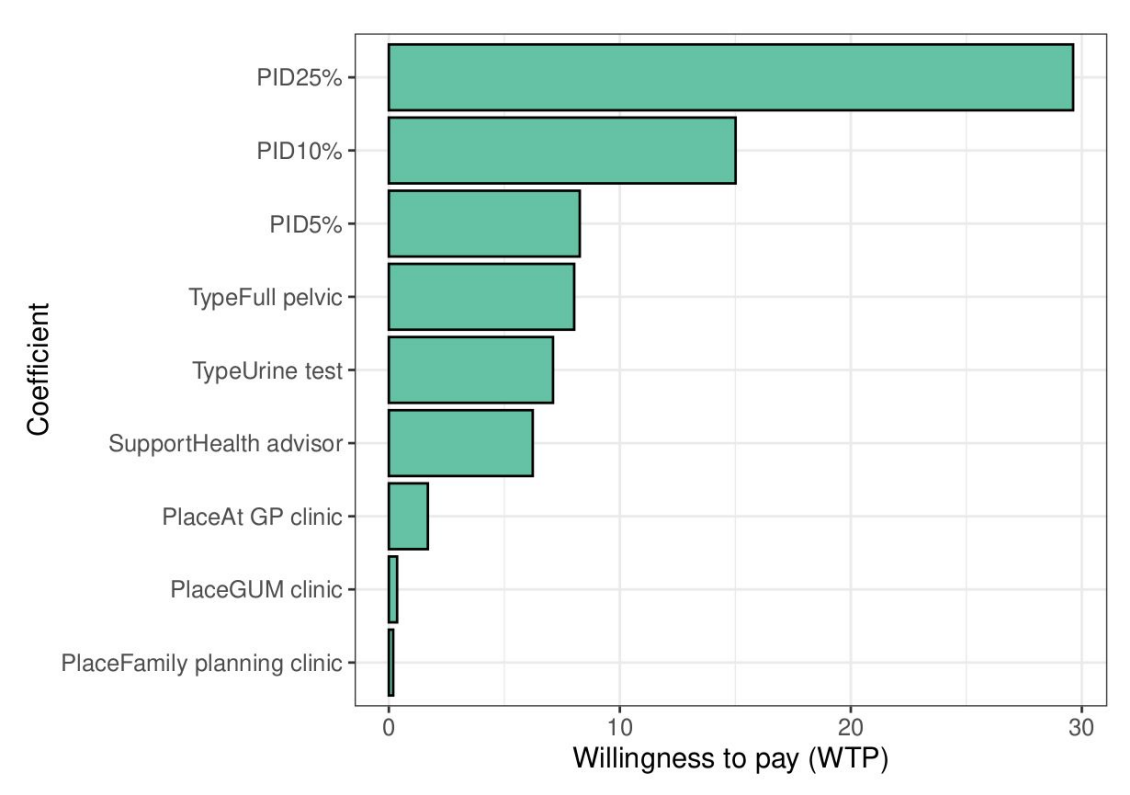


Data exploration: traditional analysis



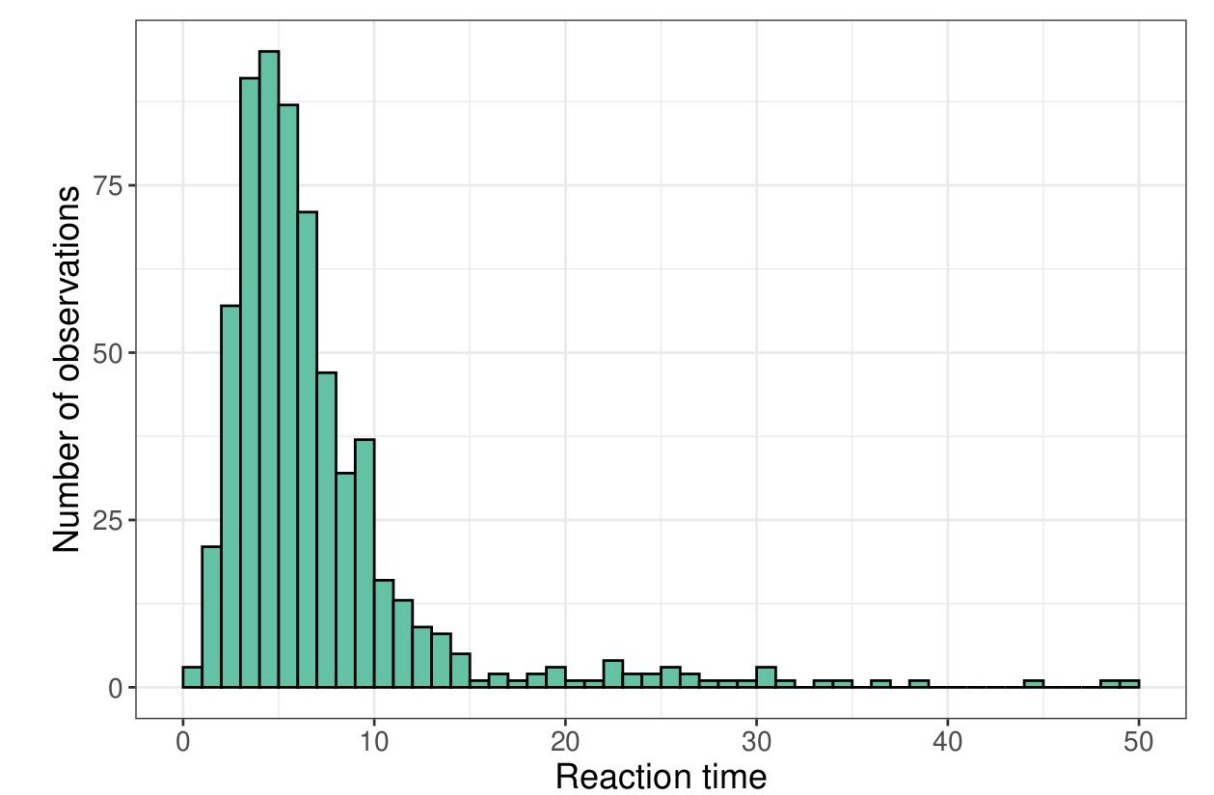
PID reference = 1%
Cost reference = £20
Place reference = GP Clinic
Type reference = swab

Data exploration: willingness to pay

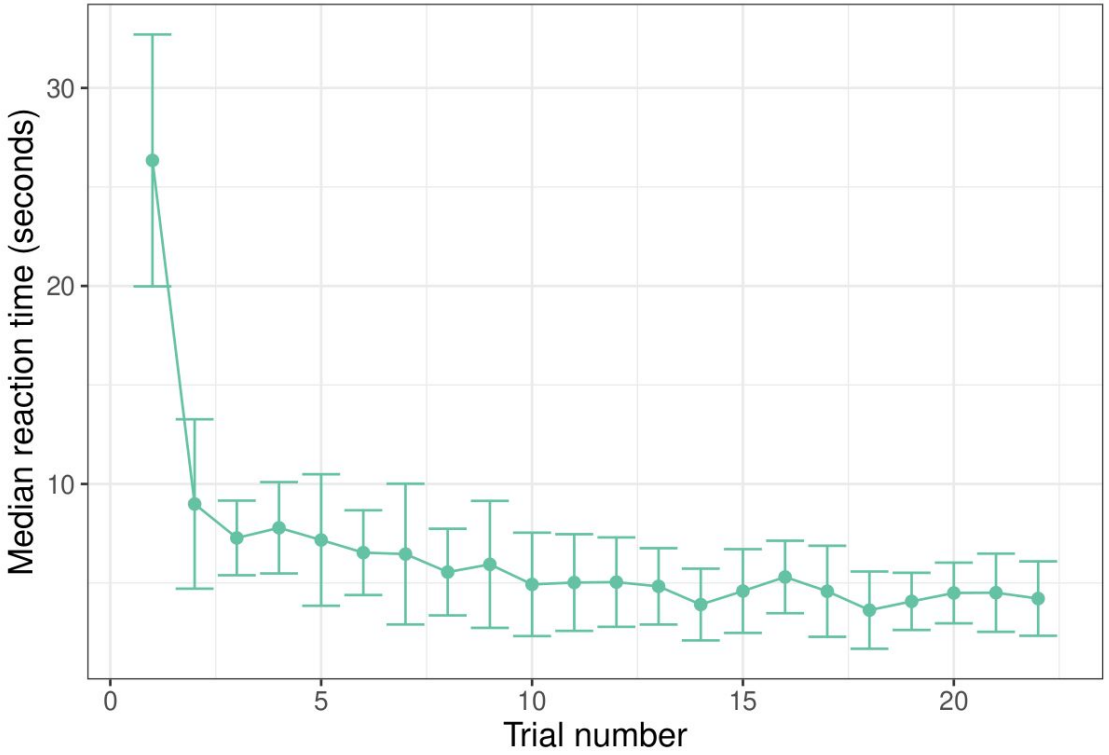


PID reference = 1%
Place reference = GP Clinic
Type reference = swab

Data exploration: decision times

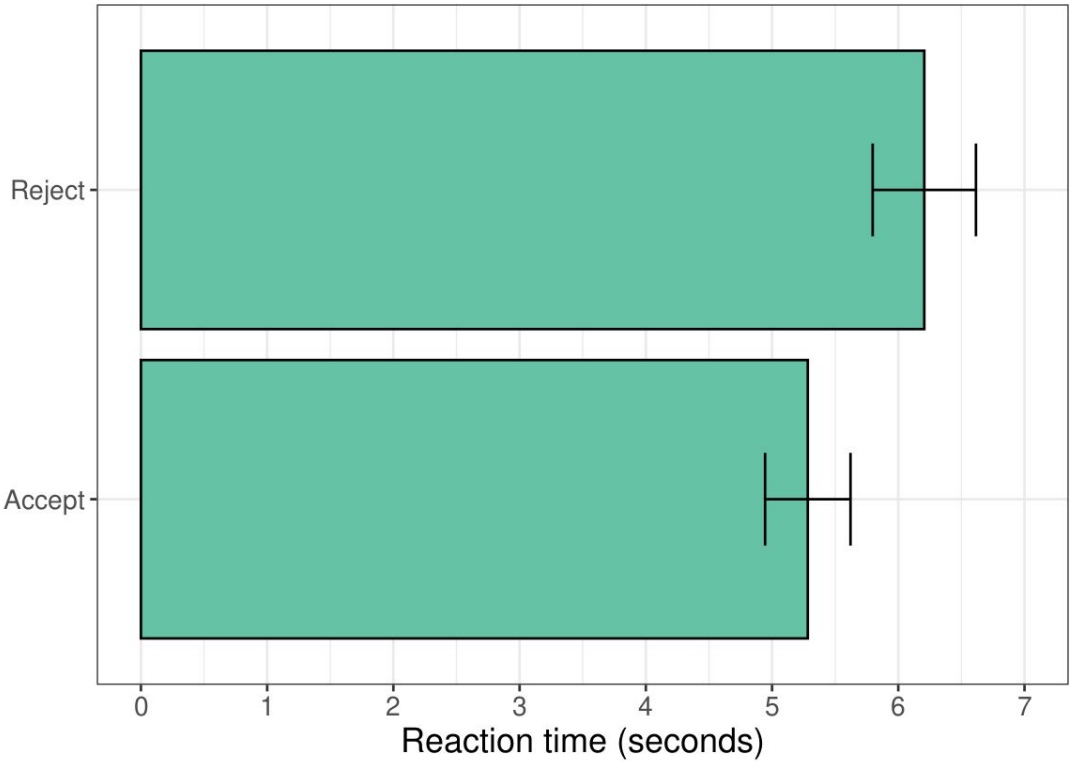


Data exploration: decision times



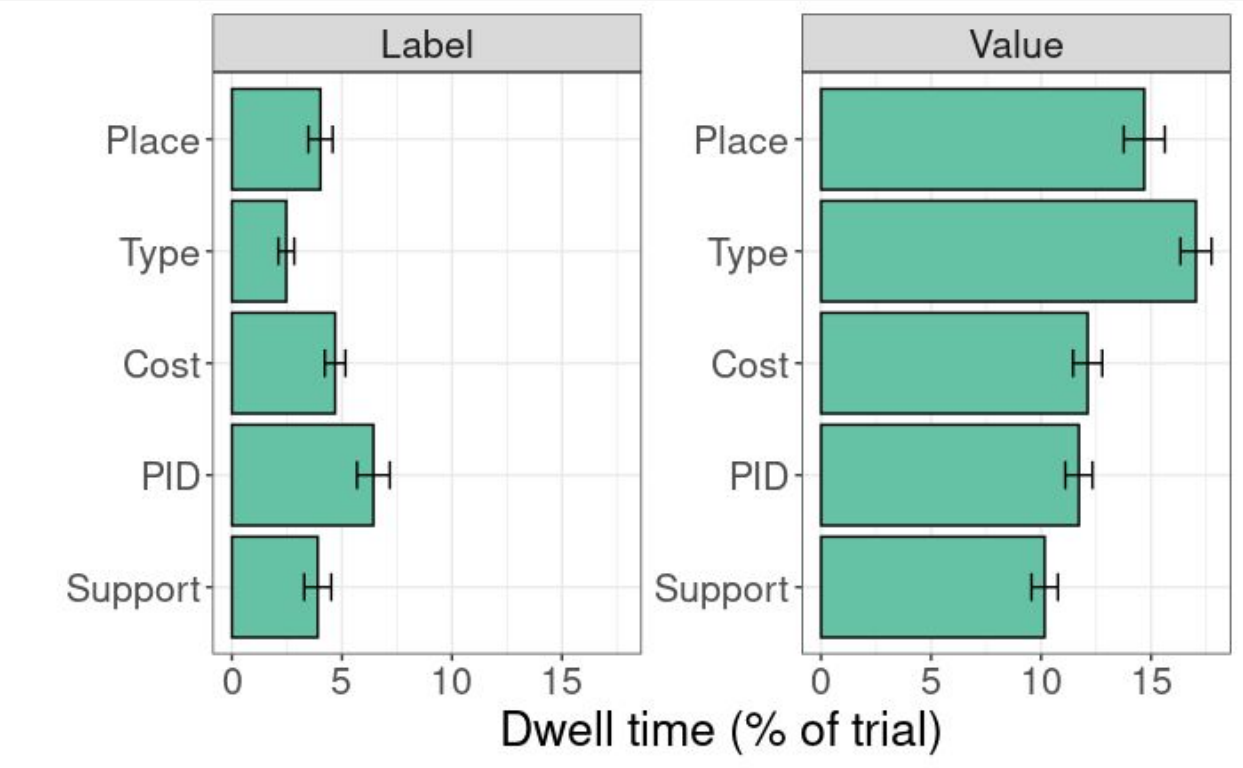
At least one 'warm-up' trial needed

Data exploration: accept faster?



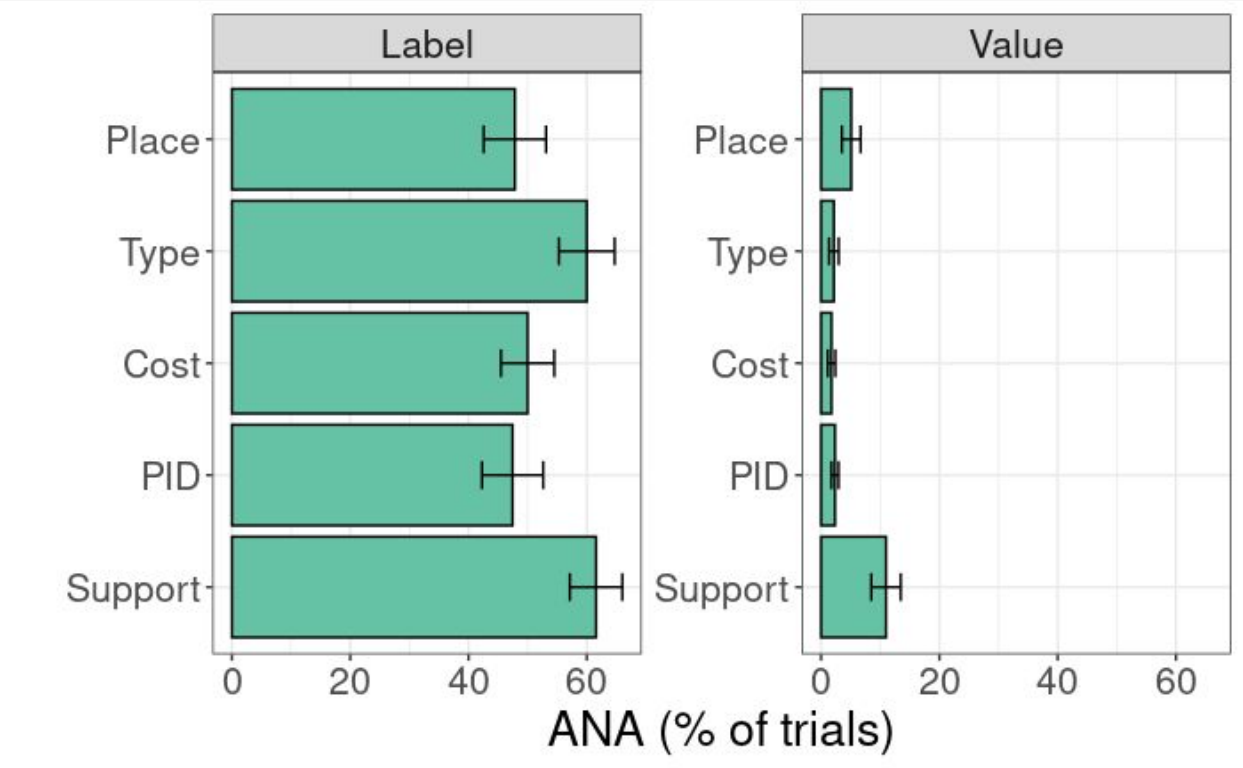
p = 0.40 (n.s.)

Where do people look?



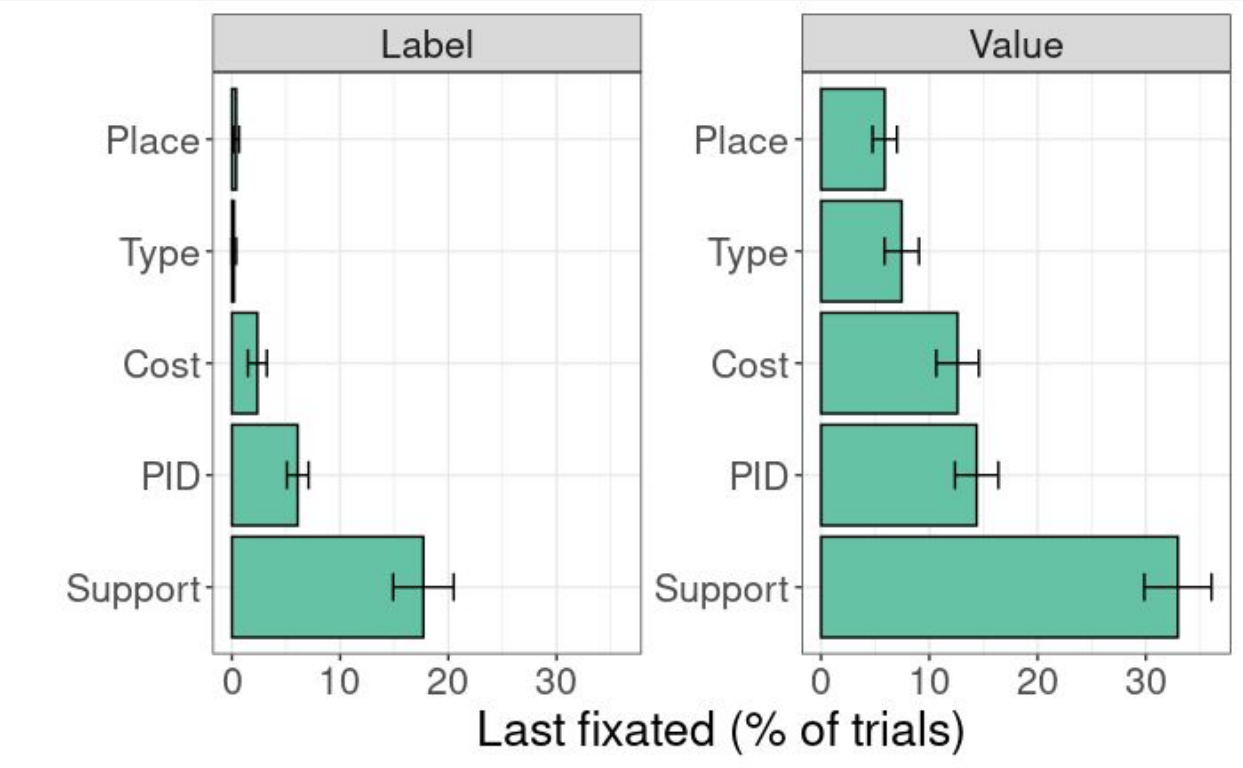
Place of screening	At GP clinic
Type of screening	Perineal swab
Cost to you of Chlamydia screening	Free
Chance of developing Pelvic Inflammatory Disease (PID) if you have Chlamydia and it is not treated	10%
Type of information and support when you are given screening results	Support of trained health advisor

What do people skip?



Place of screening	At GP clinic
Type of screening	Perineal swab
Cost to you of Chlamydia screening	Free
Chance of developing Pelvic Inflammatory Disease (PID) if you have Chlamydia and it is not treated	10%
Type of information and support when you are given screening results	Support of trained health advisor

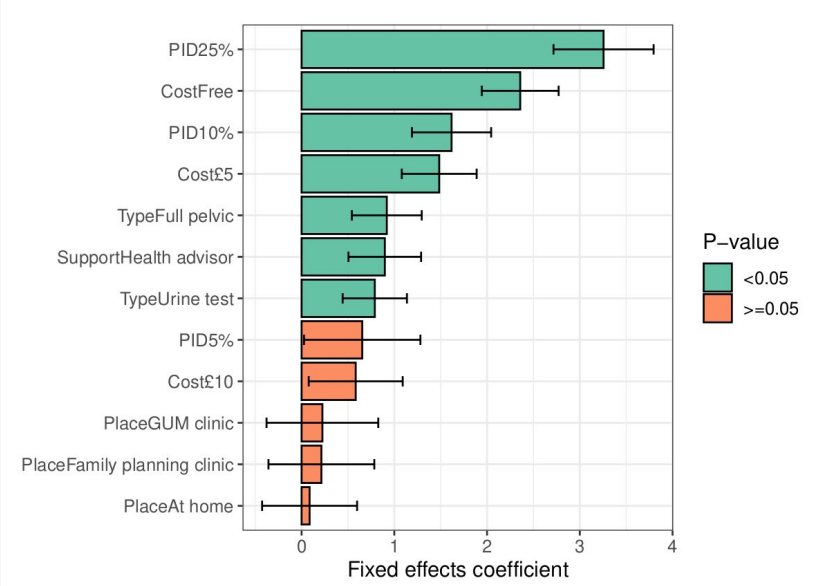
What do people look at last?



Place of screening	At GP clinic
Type of screening	Perineal swab
Cost to you of Chlamydia screening	Free
Chance of developing Pelvic Inflammatory Disease (PID) if you have Chlamydia and it is not treated	10%
Type of information and support when you are given screening results	Support of trained health advisor

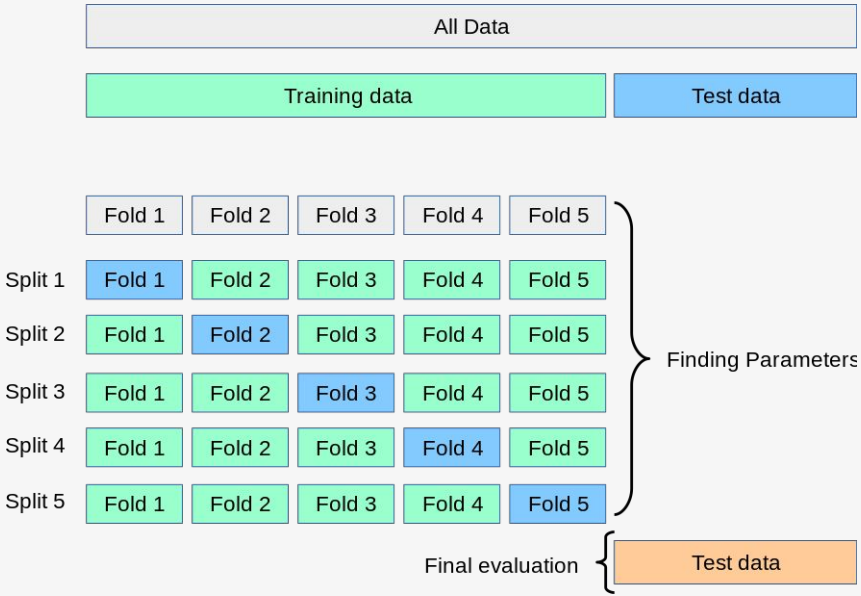
Predicting choice: Traditional approach

- Mixed effects models:
  - Takes into account differences between participants and trials
  - Linear model (weighted sum of dummy variables)
  - Relative importance factors
  - Difficult to assess predictive performance



Predicting choice: machine learning approach

- Treats trials from different participants the same as within participants
- Focuses on assessing predictive performance
- Large selection of classification models (not just linear)



Workflow: Create dummy variables

Participant	ChoiceNumber	...	Place	Support
1	1	...	Familyplanningclinic	None
1	2	...	Familyplanningclinic	None
1	3	...	GUMclinic	Healthadvisor
1	4	...	Athome	Healthadvisor
1	5	...	Athome	None

PID_1	PID_10	...	Support_Healthadvisor	Support_None
0	1	...	0	1
1	0	...	0	1
0	1	...	1	0
0	0	...	1	0
1	0	...	0	1

Workflow: Convert dependent variable

Workflow: Split into training and test

Training

	PID_1	PID_10	...	Support_Healthadvisor	Support_None
314	0	1	...	1	0
227	0	0	...	1	0
145	1	0	...	0	1
320	0	1	...	0	1
217	0	1	...	0	1
..	...	...	...	...	...
291	0	0	...	1	0
330	0	1	...	1	0
472	0	0	...	0	1
111	0	0	...	0	1
4	1	0	...	0	1

[384 rows x 17 columns]

Test

	PID_1	PID_10	...	Support_Healthadvisor	Support_None
271	0	0	...	0	1
74	0	1	...	1	0
315	0	0	...	1	0
20	1	0	...	0	1
134	0	0	...	1	0
..	...	...	...	...	...
289	1	0	...	0	1
139	0	0	...	1	0
332	0	0	...	0	1
454	0	0	...	1	0
347	0	0	...	1	0

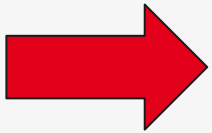
[96 rows x 17 columns]

Workflow: Use cross-validation (CV) on training to find optimal parameters for classifier

Search space

```
param_grid = {
    'bootstrap': [True],
    'max_depth': [80, 90, 100, 110],
    'max_features': [2, 3],
    'min_samples_leaf': [3, 4, 5],
    'min_samples_split': [8, 10, 12],
    'n_estimators': [100, 200, 300, 1000]
}
```

Use CV to determine accuracy per combination



Best parameters

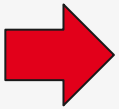
```
{'n_estimators': 200,
 'min_samples_split': 12,
 'min_samples_leaf': 3,
 'max_features': 3,
 'max_depth': 80,
 'bootstrap': True}
```

Workflow: Predict

- Fit model with these parameters
- Compute class probabilities for each sample in test set

	PID_1	PID_10	...	Support_Healthadvisor	Support_None
271	0	0	...	0	1
74	0	1	...	1	0
315	0	0	...	1	0
20	1	0	...	0	1
134	0	0	...	1	0
..	...	...	...	...	...
289	1	0	...	0	1
139	0	0	...	1	0
332	0	0	...	0	1
454	0	0	...	1	0
347	0	0	...	1	0

[96 rows x 17 columns]



```
[0.07653206, 0.92346794]
[0.2050691 , 0.7949309 ]
[0.07720942, 0.92279058]
[0.27489649, 0.72510351]
[0.43464067, 0.56535933]
[0.1273329 , 0.8726671 ]
[0.27563762, 0.72436238]
[0.27489649, 0.72510351]
[0.27107976, 0.72892024]
[0.77328743, 0.22671257]
[0.2050691 , 0.7949309 ]
[0.21824037, 0.78175963]
[0.27563762, 0.72436238]
```

Predicted category

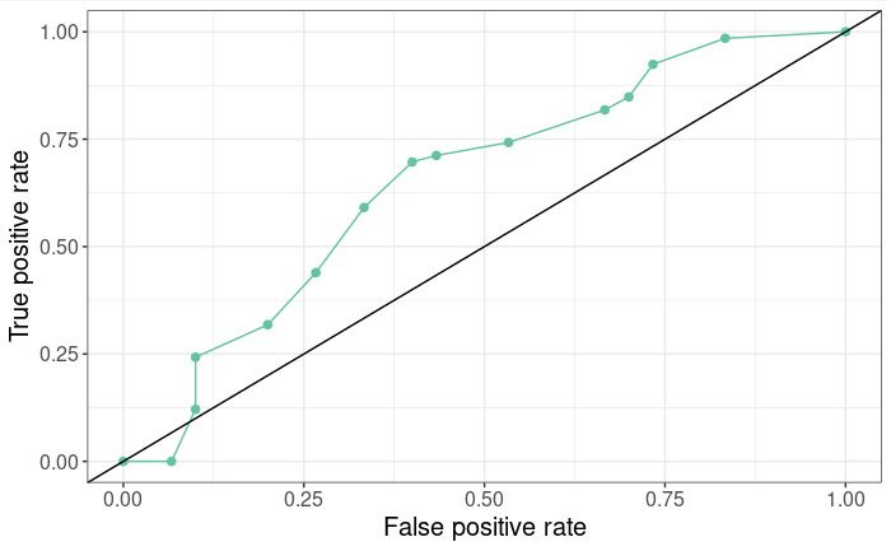
```
1
1
1
1
1
..
0
1
1
1
1
```

Original category

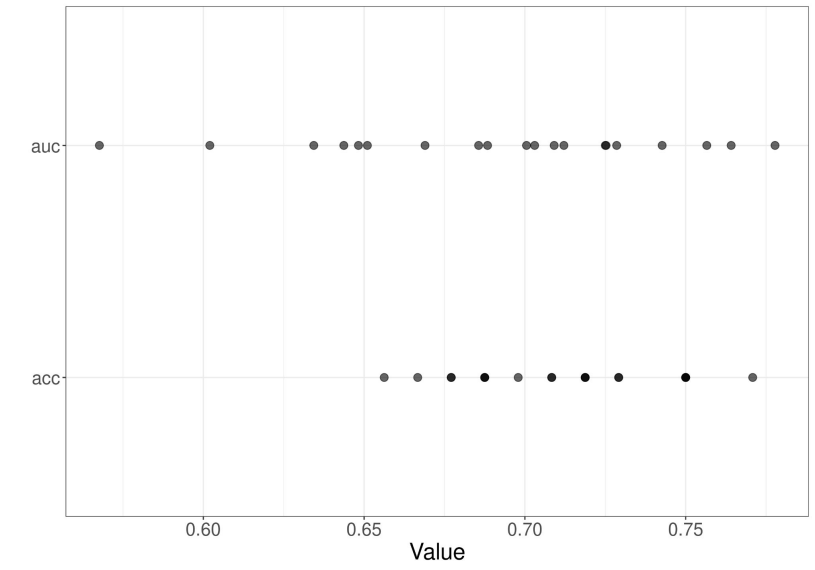
```
1
0
0
0
1
..
1
1
0
1
1
```

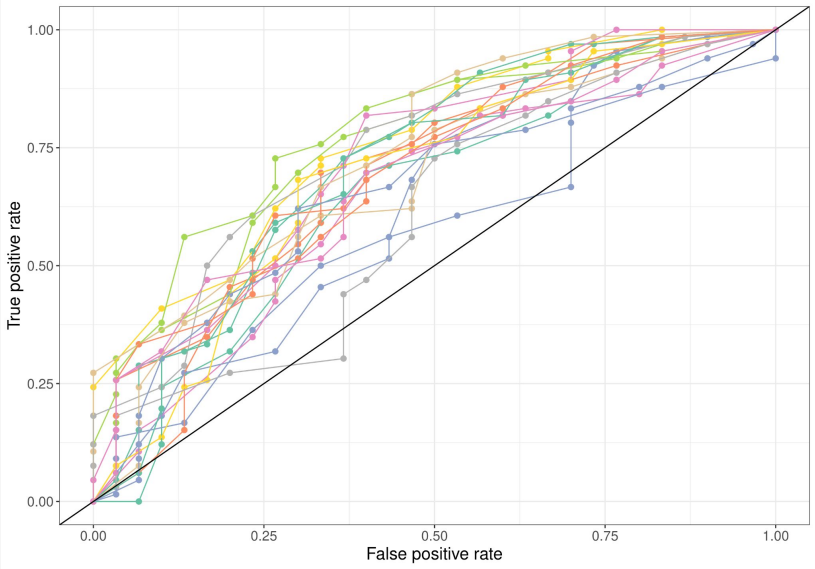
Workflow: Access performance

Accuracy = 0.6770833
AUC = 0.6510101



Multiple splits in training / test needed

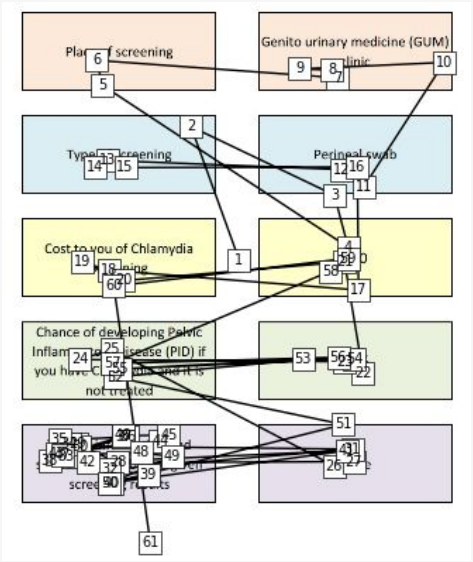




Types of predictions

- Input features
  - Coding information on screen
  - Coding eye movements
    - No sequence information (bag of words without n-grams; shuffle order in LSTM)
  - Sequence information (bag of words with n-grams; original order in LSTM)
  - Coding of location
  - Coding of information fixated
- Classifier / method
  - Random forest / KNN/ LR / decision tree…
  - LSTM (DL)

Example input for standard ML




```
['Participant', 'ChoiceNumber', '0/1', '0/2', '0/3', '0/4', '0/5', '1/0',
 '1/2', '1/3', '1/4', '1/5', '2/0', '2/1', '2/3', '2/4', '2/5', '3/0',
 '3/1', '3/2', '3/4', '3/5', '4/0', '4/1', '4/2', '4/3', '4/5', '5/0',
 '5/1', '5/2', '5/3', '5/4', 'n0', 'n1', 'n2', 'n3', 'n4', 'n5', 'first',
 'last', 'n', 'n_unique', 'choice_bin', 'Choice'],
```

Participant	ChoiceNumber	0/1	0/2	...	n	n_unique	choice_bin
1	1	2	1	...	15	6	1.0
1	2	3	1	...	18	6	0.0
1	3	2	0	...	19	6	0.0
1	4	1	1	...	22	6	0.0
1	5	3	0	...	15	6	1.0

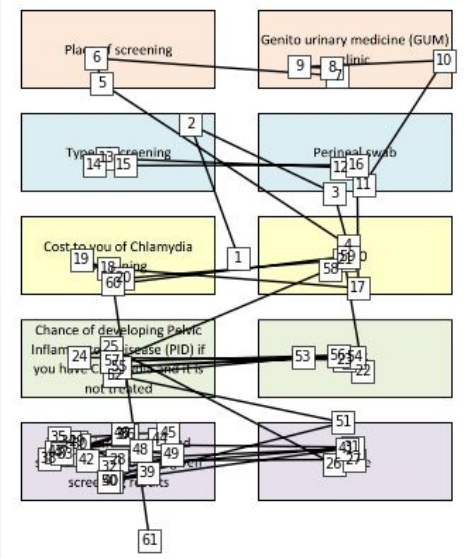
Example input for LSTM

Row information only

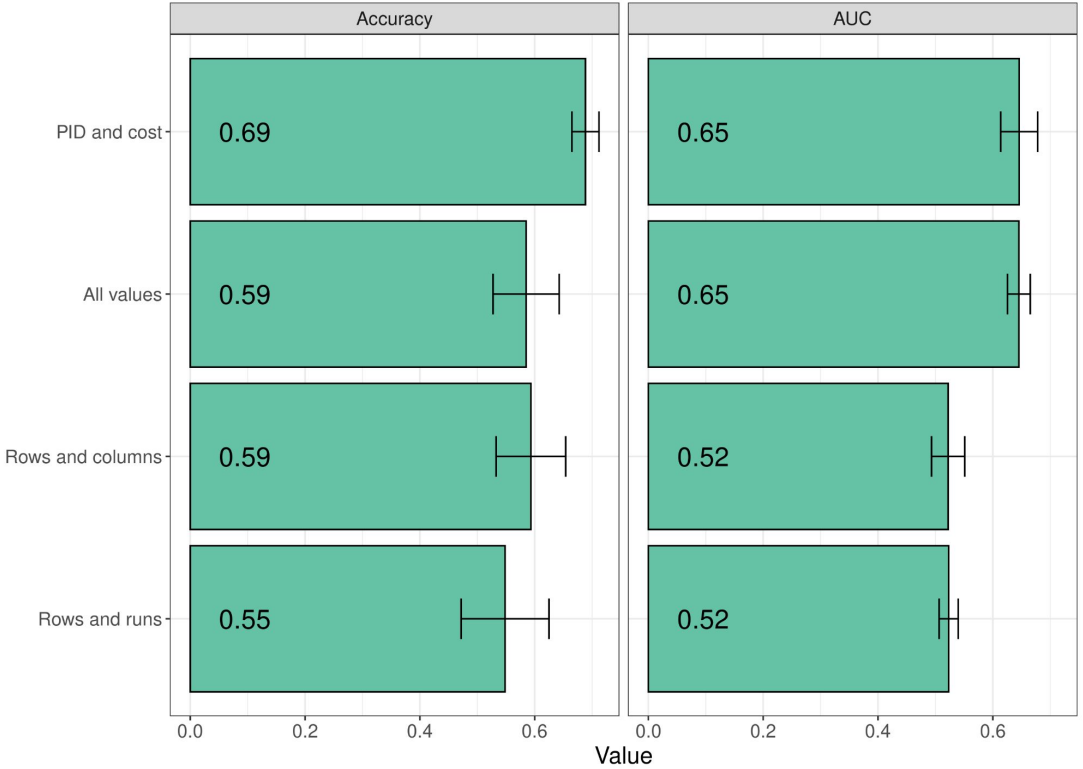
row_seq	Choice
0/1/0/1/2/0/2/3/4/5/2/3/4/1/2	Accept
0/2/0/1/0/1/0/1/2/1/2/3/4/5/4/5/4/3	Reject
0/3/2/3/2/0/1/0/3/4/5/4/3/2/1/0/1/5/3	Reject
0/2/1/0/1/2/3/4/3/2/1/2/3/0/5/4/3/2/1/3/4/3	Reject
0/1/0/1/0/1/2/3/0/4/3/2/1/2/5	Accept

Information fixated

row_seq	Choice
00/11/00/00/00/Family planning clinic/Family p...	Accept
00/12/00/Family planning clinic/00/11/00/00/00...	Reject
00/£10/Urine test/Urine test/£10/Urine test/Ur...	Reject
00/12/12/At home/At home/00/00/00/00/00/At hom...	Reject
00/At home/At home/00/11/11/At home/11/00/00/0...	Accept
00/Full pelvic/At GP clinic/At GP clinic/00/At...	Reject
00/£20/Family planning clinic/Family planning ...	Reject
00/00/12/GUM clinic/00/GUM clinic/11/11/11/GUM...	Reject
00/Free/GUM clinic/GUM clinic/GUM clinic/11/GU...	Accept
00/12/£20/£20/10%/At home/00/11/00/At home/At ...	Reject



Results LSTM



	row_seq	Choice
00/11/00/00/00/21/21/21/22/22/22/22/00/12/13/1...		Accept
00/12/00/21/00/11/00/00/00/21/21/21/22/22/21/2...		Reject
00/£10/22/22/£10/22/22/22/00/00/11/00/00/00/£1...		Reject
00/12/12/21/21/00/00/00/00/00/21/21/22/22/22/2...		Reject
00/21/21/00/11/11/21/11/00/00/00/21/21/21/21/2...		Accept
00/22/21/21/00/21/00/22/22/22/22/22/22/22/21/£...		Reject
00/£20/21/21/21/21/00/22/22/22/21/22/22/22/£20...		Reject
00/00/12/21/00/21/11/11/11/21/00/21/21/00/00/2...		Reject
00/Free/21/21/21/11/21/21/21/21/00/00/21/21/21...		Accept
00/12/£20/£20/10%/21/00/11/00/21/21/21/21/22/2...		Reject

Bag of words + random forest

- Create a corpus
- Count number of times each "word" occurs

```
['00 11 00 00 00 Family_planning_clinic Family_planning_clinic Family_planning_clinic
Full_pelvic Full_pelvic Full_pelvic Full_pelvic 00 12 13 13 13 13 13 13 £5 10% 14 14
None None Full_pelvic Full_pelvic £5 10% Family_planning_clinic Family_planning_clinic
Family_planning_clinic Family_planning_clinic Family_planning_clinic
Family_planning_clinic Full_pelvic Full_pelvic Full_pelvic Full_pelvic Full_pelvic
Full_pelvic',
 '00 12 00 Family_planning_clinic 00 11 00 00 00 Family_planning_clinic
Family_planning_clinic Family_planning_clinic Perineal_swab Perineal_swab
Family_planning_clinic Family_planning_clinic Family_planning_clinic Perineal_swab
Perineal_swab 12 Perineal_swab Perineal_swab Perineal_swab £10 1% None 1% 14 14 14 14
14 14 14 14 14 14 14 14 14 14 14 14 14 None None 15 15 1% £10 £10',
 '00 £10 Urine_test Urine_test £10 Urine_test Urine_test Urine_test 00 00 11 00 00 00
£10 10% 14 14 Health_advisor Health_advisor Health_advisor 10% 10% 10% 14 £10
Urine_test Urine_test Urine_test Urine_test Urine_test GUM_clinic GUM_clinic 0
11 GUM_clinic Health_advisor £10']
```

```
[ 5,  2,  1,  1,  6,  2,  0,  0,  0,  0,  9,  0, 12,  0,  0,  2,
  0,  0],
[ 6,  3,  1,  2,  0, 19,  2,  0,  0,  0,  7,  0,  0,  0,  0,  3,
  7,  0],
[ 8,  9,  3,  0,  0,  3,  0,  0,  0,  0,  0,  0,  0,  3,  4,  0,
  0, 10]])
```

Including N-grams

```
['00 11 00 00 00 Family_planning_clinic Family_planning_clinic Family_planning_clinic
Full_pelvic Full_pelvic Full_pelvic Full_pelvic 00 12 13 13 13 13 13 13 £5 10% 14 14
None None Full_pelvic Full_pelvic £5 10% Family_planning_clinic Family_planning_clinic
Family_planning_clinic Family_planning_clinic Family_planning_clinic
Family_planning_clinic Full_pelvic Full_pelvic Full_pelvic Full_pelvic Full_pelvic
Full_pelvic',
 '00 12 00 Family_planning_clinic 00 11 00 00 00 Family_planning_clinic
Family_planning_clinic Family_planning_clinic Perineal_swab Perineal_swab
Family_planning_clinic Family_planning_clinic Family_planning_clinic Perineal_swab
Perineal_swab 12 Perineal_swab Perineal_swab Perineal_swab £10 1% None 1% 14 14 14 14
14 14 14 14 14 14 14 14 14 14 14 14 14 14 None None 15 15 1% £10 £10',
 '00 £10 Urine_test Urine_test £10 Urine_test Urine_test Urine_test 00 00 11 00 00 00
£10 10% 14 14 Health_advisor Health_advisor Health_advisor 10% 10% 10% 14 £10
Urine_test Urine_test Urine_test Urine_test Urine_test GUM_clinic GUM_clinic 00 00 11
11 GUM_clinic Health_advisor £10']
```

Including bi-gram counts

```
[ 5,  2,  0,  1,  1,  0,  0,  0,  0,  0,  0,  1,  0,  0,  0,  0,
  0,  0,  0,  2,  0,  0,  0,  0,  1,  0,  0,  0,  1,  0,  0,  0,
  0,  0,  0,  0,  1,  1,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,
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  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,
  0,  0,  0,  0,  0,  0,  0,  0,  0],
```
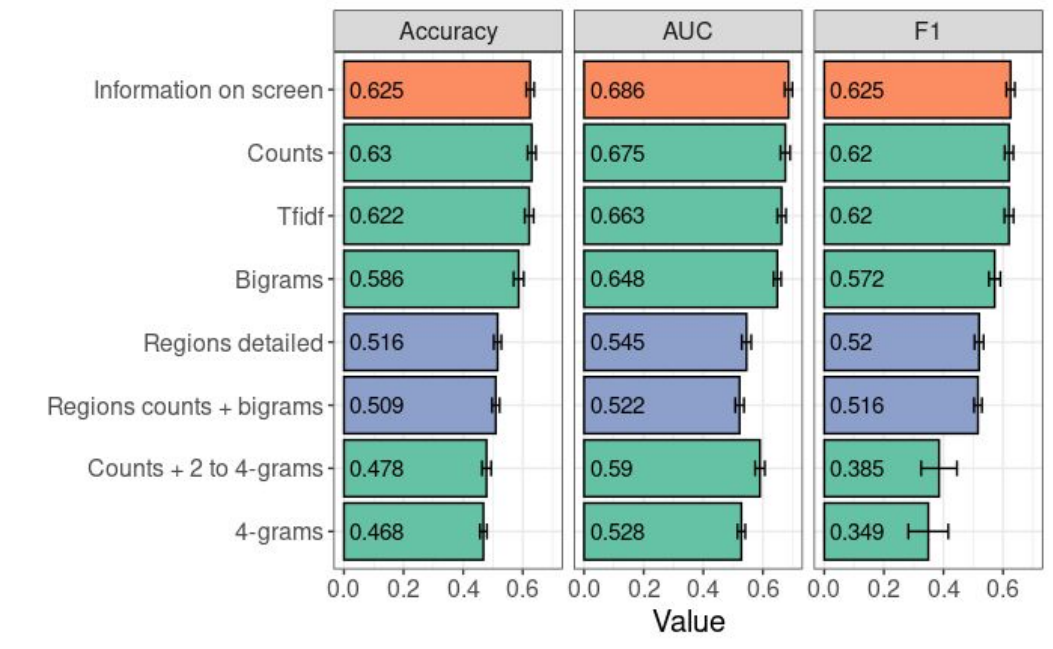
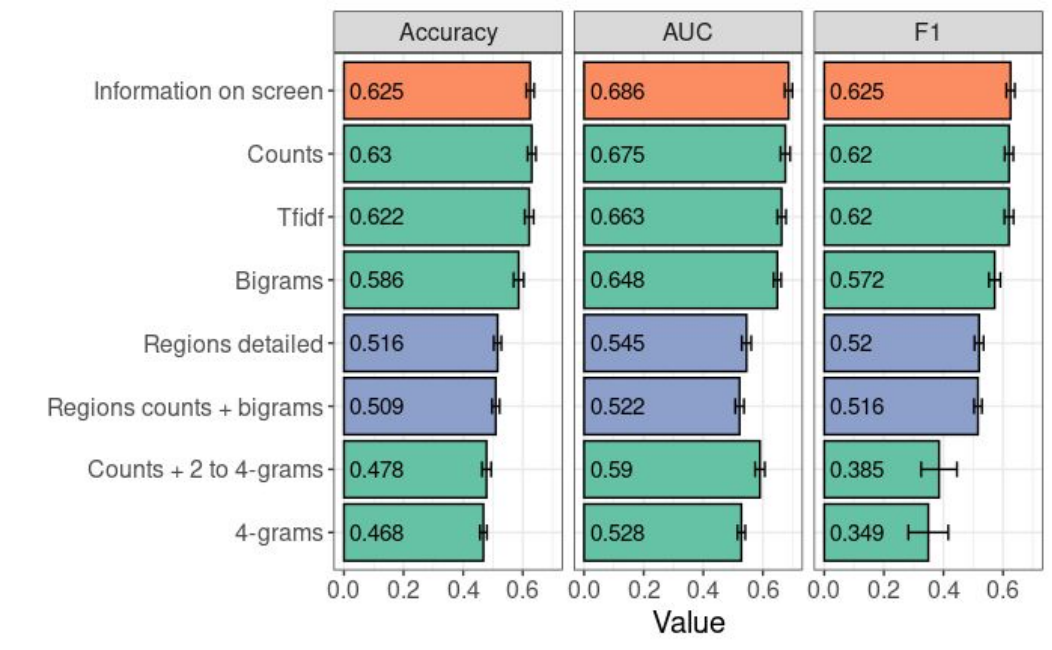

Results Bag of words




```
['00 11 00 00 00 Family_planning_clinic Family_planning_clinic Family_planning_clinic
Full_pelvic Full_pelvic Full_pelvic Full_pelvic 00 12 13 13 13 13 13 13 £5 10% 14 14
None None Full_pelvic Full_pelvic £5 10% Family_planning_clinic Family_planning_clinic
Family_planning_clinic Family_planning_clinic Family_planning_clinic
Family_planning_clinic Full_pelvic Full_pelvic Full_pelvic Full_pelvic Full_pelvic
Full_pelvic',
 '00 12 00 Family_planning_clinic 00 11 00 00 00 Family_planning_clinic
Family_planning_clinic Family_planning_clinic Perineal_swab Perineal_swab
Family_planning_clinic Family_planning_clinic Family_planning_clinic Perineal_swab
Perineal_swab 12 Perineal_swab Perineal_swab Perineal_swab £10 1% None 1% 14 14 14 14
14 14 14 14 14 14 14 14 14 14 14 14 14 14 None None 15 15 1% £10 £10',
 '00 £10 Urine_test Urine_test £10 Urine_test Urine_test Urine_test 00 00 11 00 00 00
£10 10% 14 14 Health_advisor Health_advisor Health_advisor 10% 10% 10% 14 £10
Urine_test Urine_test Urine_test Urine_test GUM_clinic GUM_clinic 00 00 11
11 GUM_clinic Health_advisor £10']
```

Summary

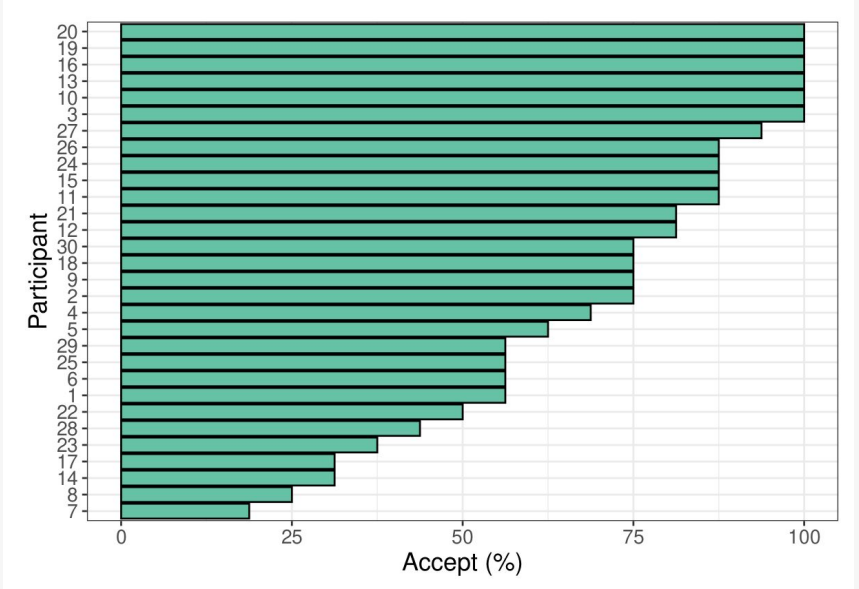
- Eye movements reveal:
  - attention,
  - ANA,
  - sequence effects,
  - individual differences
- Accuracy models no better than majority class (66.7%)
- AUC suggests some predictive power



Future directions: Individual differences

- Machine learning for "nested" data (individual differences)
- Train models on one set of participants, test on another
- Adjust threshold for baseline accept rates

Risk of Long Covid after infection	1 in 20 rather than 1 in 10
Risk of hospitalization after infection	1 in 40000 rather than 1 in 5000
Risk of death after infection	1 in 2 million rather than 1 in 500k
Risk of mild side effects	1 in 10
Risk of serious side effects	1 in 1000000



Discussion

- When is the time to publish results?
  - Only when a "working model" has been obtained?
- How much effort to put in finding a "working model"?
  - "Publish or perish"
  - Better pay off for studies where you quickly find a "working model"?
  - Overlap with "file drawer" effect