

## General Rules for Group Projects

### AY 2024/2025

Each project must include the following sections:

1. Introduction & literature review (4/5 references are ok)
2. Data and Methods (BCEA or Markov model, not very detailed a general description is fine): statistical/economic model
3. Decision analysis (ICER, EIB)
4. PSA with BCEA package (CEAC, EVPI)
5. References (4/5 references are ok).

All the analyses **MUST** be performed using **R**, adopting one of the methods discussed during classes, i.e. Markov Model or Decision tree.

**Grades:** 1 - 4 for group members (no more than 3) involved in writing the code for the empirical analysis

1 - 2 for group members (no more than 3) involved in writing the paper

1 - 3 for group members involved equally in writing the code for the empirical analysis and the paper

The extra points will be added only to the grade obtained on the second part of the course.

The **deadline** to send the final paper (font 12, no more than 10 pages) and the R-scripts used to perform the analysis is the 31-st of December. If you deliver the paper after this date I will decrease the grade of each person in the group by 30%, 60% or 90% if the paper arrives after the 1st, the 9th or the 19th of January, respectively.

*drawing or generating decision tree?*

Title of the publication:

## Cost-effectiveness of screening tools for identifying depression in early pregnancy: a decision tree model

### **Abstract**

**Background:** Although the effectiveness of screening tools for detecting depression in pregnancy has been investigated, there is limited evidence on the cost-effectiveness. This is vital in providing full information to decision makers. This study aimed to explore the cost-effectiveness of different screening tools to identify depression in early pregnancy compared to no screening.

**Methods:** A decision tree was developed to model the identification and treatment pathways of depression from the first antenatal appointment to 3-months postpartum using the Whooley questions, the Edinburgh Postnatal Depression Scale (EPDS) and the Whooley questions followed by the EPDS, compared to no screening. The economic evaluation took an NHS and Personal Social Services perspective. Model parameters were taken from a combination of sources including a cross-sectional survey investigating the diagnostic accuracy of screening tools, and other published literature. Cost-effectiveness was assessed in terms of the incremental cost per quality adjusted life years (QALYs). Cost-effectiveness planes and cost-effectiveness acceptability curves were produced using a net-benefit approach based on Monte Carlo simulations of cost-outcome data.

**Results:** In a 4-way comparison, the Whooley, EPDS and Whooley followed by the EPDS each had a similar probability of being cost-effective at around 30% for willingness to pay values from £20,000–30,000 per QALY compared to around 20% for the no screen option.

**Conclusions:** All three screening approaches tested had a higher probability of being cost-effective than the no-screen option. In the absence of a clear cost-effectiveness advantage for any one of the three screening options, the choice between the screening approaches could be made on other grounds, such as clinical burden of the screening options. Limitations include data availability and short time horizon, thus further research is needed.

**Clinical trials registration:** N/A

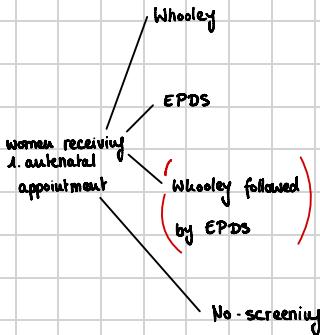
**Keywords:** Cost-effectiveness, Decision analytic model, Depression, Pregnancy, Screening, Whooley, EPDS

↳ Aim: providing evidence on cost-effectiveness of screening tools for detecting depression in pregnancy

↳ Methods: decision tree to show pathway

- NICE guidelines recommend 2 Whooley questions to identify depressive disorders in pregnancy at first antenatal appointment (8-10 weeks) → 86% women attend (p.2)
- the used data for the analysis was taken from different sources (p.3)
- target population: pregnant women aged 16+ attending their first antenatal appointment with midwife in South-East London, who do not have a miscarriage or termination between booking appointment and research interview (p.3)
- included screening strategies:
  1. Whooley only : 2 questions → answering 'yes' to either indicates positive screen
  2. EPDS only: ten-item self-administered tool → a score of <13 indicates positive screen
  - (3. Whooley followed by EPDS → if Whooley was positive)
  4. No - screening
- time horizon: from first antenatal appointment (~8-10 weeks pregnant) to 36 week follow up (3 months post-birth) = total of ~9 months (p.3)

- model structure:

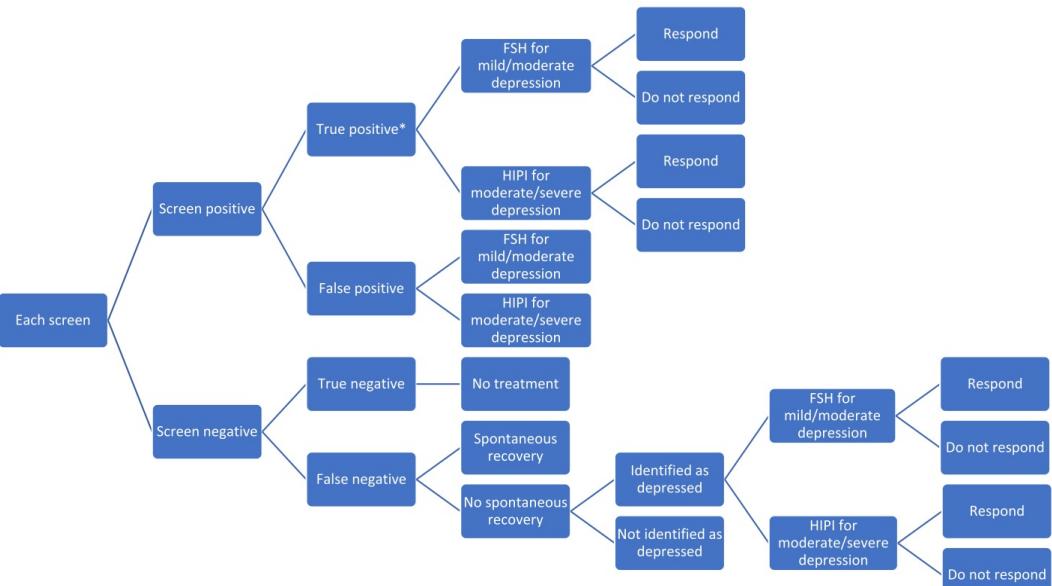


Women who screen positive receive either facilitated self-help (FSH) or high intensity psychological therapy (HIPI)

Women who screen negative receive no treatment

For those depressed women who are wrongly screened as negative (false negative), a proportion achieve spontaneous recovery. Of those who do not achieve spontaneous recovery, a proportion will be identified as depressed at a later point and receive treatment, whilst the remainder continue unidentified and receive no treatment for their depression. Model pathways were identical for all options except the Whooley followed by the EPDS, which required adaptation in order to model the two-stage screening process (see appendix). However, the treatment pathway was the same for all options.

↳ for my project we exclude the Whooley followed by EPDS option!



\*Additional step included here to model the Whooley questions followed by the EPDS questions (see appendix). FSH – facilitated self-help; HIPI – high intensity psychological intervention

**Fig. 1** Detection and treatment model pathway

### - Model parameters:

**Table 1** Model parameters for screening accuracy and treatment pathway

	<i>Base - case probability</i>	<i>Raw data probab.</i>	<i>95% CI</i>	<i>Source</i>	<i>Distribution</i>	<i>Notes</i>
<b>TREATMENT PATHWAY</b>						
<b>Treatment</b>						
Facilitated self help for mild/moderate depression	0.7921	79.21	0.705–0.864	Howard et al, 2018 [15]	Beta	Assuming 50% of women with moderate depression receive this treatment
High intensity psychological therapy for moderate/severe depression	0.2079	20.79	0.136–0.295	Howard et al, 2018 [15]	Beta	Assuming 50% of women with moderate depression receive this treatment
<b>Spontaneous recovery</b>						
Spontaneous recovery	0.3300	33	0.242–0.425	Dennis et al, 2009 [29]	Beta	Midpoint of spontaneous recovery rate (25–40% = 33%).
No spontaneous recovery	0.6700	67	0.575–0.758	Dennis et al, 2009 [29]	Beta	One minus midpoint of spontaneous recovery rate.
<b>Later identification</b>						
Identified as depressed following first antenatal appointment	0.1025	10.25	0.050–0.166	Kessler et al, 2002 [30]	Beta	Based on 41% of misdiagnoses identified over the following 3 years.
Not identified as depressed following first antenatal appointment	0.8975	89.75	0.834–0.950	Kessler et al, 2002 [30]	Beta	One minus rate of identification.
<b>Response to treatment</b>						
Respond to facilitated self help	0.5109	51.09	0.413–0.607	NICE 2014 [17]	Beta	One minus probability of not responding.
No response to facilitated self help	0.4891	48.91	0.393–0.587	NICE 2014 [17]	Beta	Relative risk of no improvement (0.73) reported in NICE (2014) [17] multiplied by absolute risk of no improvement (0.67) reported by Dennis et al. (2009) [29] reported above.
Respond to high intensity psychological therapy	0.6784	67.84	0.586–0.767	NICE 2014 [17]	Beta	One minus probability of not responding.
No response to high intensity psychological therapy	0.3216	32.16	0.233–0.414	NICE 2014 [17]	Beta	Relative risk of no improvement (0.48) reported in NICE (2014) [17] multiplied by absolute risk of no improvement (0.67) reported by Dennis et al. (2009) [29] reported above.

- Outcomes: (p.7)

**Table 2** Model parameters for outcomes – utilities and QALYs

Parameter	Values	Source	Distribution	Standard error	95% CI
<b>Utilities</b>					
Ante-natal depressed	0.678	Littlewood et al, 2018 [25]	Beta	0.04	0.600–0.756
Ante-natal not depressed	0.888	Littlewood et al, 2018 [25]	Beta	0.01	0.868–0.908
Post-natal depressed	0.771	Littlewood et al, 2018 [25]	Beta	0.03	0.712–0.830
Post-natal not depressed	0.907	Littlewood et al, 2018 [25]	Beta	0.01	0.887–0.927
<b>QALYs (9 months)</b>					
Depressed to non-depressed	0.6553		Beta	30%	0.270–1.00
Depressed to depressed	0.5991		Beta	30%	0.247–0.951
Non-depressed to non-depressed	0.7422		Beta	30%	0.306–1.179

**Table 3** Model parameters for the cost of screening, treatment and other health and social care costs

Parameter	Cost (£)	Source	Distribution	Standard error
<b>SCREENING</b>				
Whooley	4.53	Department of Health 2015/6 [42]	Gamma	Assumed to be 30
EPDS	9.38	Department of Health 2015/6 [42]	Gamma	Assumed to be 30
Whooley-EPDS	5.37	Department of Health 2015/6 [42]	Gamma	Assumed to be 30
No-screening	7.95	Department of Health 2015/6 [42]	Gamma	Assumed to be 30
<b>TREATMENT</b>				
Facilitated self-help	759	Radhakrishnan et al., 2013 [43]	Gamma	Assumed to be 30
High-intensity psychological intervention	3114	Radhakrishnan et al., 2013 [43]	Gamma	Assumed to be 30
<b>OTHER HEALTH AND SOCIAL CARE</b>				
True positive who do not respond to treatment	2005	Petrou et al., 2002 [45]	Gamma	Assumed to be 30
<b>Parameter</b>				
True positive who respond to treatment	1680			
True negative	1680			
False negative	2005			
False positive	1680			

- Model outputs: Results are presented in 3 ways: average cost / average QALY gains per person, ICER & cost-effectiveness planes and CEAC (p. 10)
- Sensitivity analysis:

**Table 4** Deterministic sensitivity analysis probabilities and cost parameters

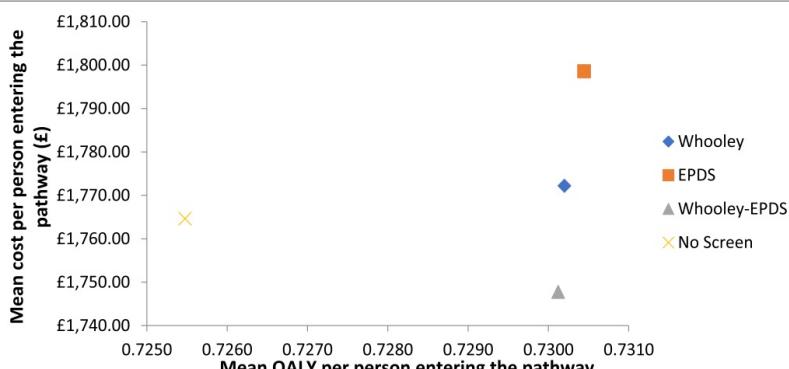
Probabilities	Probability	Source	Data type	95% CI	Distribution	Notes
No-screen positive	0.2500	Mitchell et al, 2009 [31]	Binomial	0.171–0.339	Beta	
No-screen negative	0.7500	Mitchell et al, 2009 [31]	Binomial	0.661–0.829	Beta	
No-screen positive - true positive	0.4000	Mitchell et al, 2009 [31]	Binomial	0.221–0.594	Beta	
No-screen positive - false positive	0.6000	Mitchell et al, 2009 [31]	Binomial	0.406–0.779	Beta	
No-screen negative - true negative	0.8667	Mitchell et al, 2009 [31]	Binomial	0.782–0.933	Beta	
No-screen negative - false negative	0.1333	Mitchell et al, 2009 [31]	Binomial	0.067–0.218	Beta	
Costs	Cost (£)	Source	Data type	95% CI	Standard error	Notes
No-screen	31	Curtis & Burns, 2016 [49]	Assumed fixed	12.77–49.23	Assumed to be 30%	One GP appointment lasting 9.22 minutes, including direct care staff, no qualifications.

→ Monte Carlo sampling (bootstrap) was repeated 5000 times

**Table 5** Mean costs and QALYs for each screening approach

Screening approach	Mean QALYs	Mean Costs (£)	Incremental QALYs compared to no screen	Incremental costs compared to no screen	ICER compared to no screen
EPDS	0.7304	1799	0.0049	34	6939
Whooley	0.7302	1772	0.0047	7	1489
Whooley-EPDS	0.7301	1748	0.0046	-17	-3696

\* No-screen dominated through rules of extended dominance so removed here (Mean QALYs: 0.7255; Mean costs: £1765)



**Fig. 2** Costs and QALYs for each screening approach