Sensorveiledning/Guidelines for the evaluation of HEVAL5120 – 2019

The evaluation of HEVAL5120 – 2019 consists of three excel files with solutions of the tasks that the students had to do during the exam.

Comments to the questions are addressed during the exam text below.

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English

Written exam 6th of June 2018, 09:00-13:00

HEVAL5120 – Modeling in economic evaluation I

Results will be made available **within three weeks**. The results will be posted on Studentweb.

The Exam consists of 7 pages (including the front page)

READ all information carefully

The exam MUST be submitted as a combination of excel_files and a word document.

Only <u>CANDIDATE NUMBERS ON THE FILES</u>:

Q1_candidateNO, such as Q1_101 (NO NAMES)

The word-file MUST have ONLY CANDIDATE NO.

1. **MAKE A COPY OF THE FILES ON DESKTOP**
2. **Remember to eject the USB correctly**
3. **DURING THE EXAM, WORK ON DESKTOP**
4. **WHEN YOU ARE FINISHED WITH THE EXAM, COPY THE FINAL FILES BACK TO THE USB-STICK**
5. **Remember to eject the USB correctly**
6. **KEEP A COPY OF THE FINAL FILES ON DESKTOP FOR BACKUP!!!**

One exam question could have several files attached. Then save the solutions as Q1_a_101 etc.

THE BEST OF LUCK!

Question 1: Treatment for cancer patient (40%)

Use the excel file **Q1_Cancer_template**

You are asked by the government to evaluate a new treatment option for patient with cancer, who are currently progression free. The Markov model contains of four health states, progression free, progression, terminal and death, see the Model structure in the excel sheet. The current treatment option is best supportive care (BSC). BSC contains medications, pain relief and follow up at the hospital.

The transition between health states for BSC are given by:

Counts of state transitions for BSC					
	Progression Free	**Progression**	**Terminal**	**Death**	**Total**
Progression free	2200	900	300	100	3500
Progression	0	800	600	100	1500
Terminal	0	0	1400	700	2100
Death	0	0	0	1	1

A new treatment option has entered the market, radiation therapy in combination with BSC. The new treatment is only given in the health state progression free and has shown to reduce the probability of moving from progression free to progression. The relative risk is reported in the parameter sheet.

The health outcome is measured in life years.

The cost of BSC is given by £1300 per cycle

The cost of BSC is provided in all cycles and health states (except death) – added during exam to clarify.

The treatment regime for radiation in progression free is as follows:

Radiation therapy is given for two month, then there is one month without radiation treatment (only BSC).

Radiation therapy is given as long as the patient is in the health state progression free. -– added during exam to clarify.

One month treatment of radiation therapy consists of

10 radiation treatments

Cost per radiation treatment £70

2 follow up controls at the GP (general practitioner) every month (also in the month without radiation therapy)

The cost per GP visit £40

Both life years and costs should be discounted by 4%

The threshold value for a life years gained is £50 000.

a) Calculate the cost-effectiveness of radiation therapy combined with BSC compared to BSC alone in a 2 year perspective. Describe and interpret the results.

Undiscounted and half-cycle corrected results

Strategy	Cost	LifeYears
BSC	£7 990	0,512
Radiation therapy and BSC	£10 837	0,573
Increment	**£2 848**	**0,061**

	Incremental cost/Life years gained
ICER	£46 781

Discounted and half-cycle corrected results

Strategy	Cost	LifeYears
BSC	£6 844	0,505
Radiation therapy and BSC	£9 203	0,564
Increment	**£2 359**	**0,059**

	Incremental cost/Life years gained
ICER	£40 034

Based on the given threshold, radiation should be recommended in combination with best supportive care. In this task it was monthly cycles, needs to be accounted for.

b) Conduct a one way sensitivity analysis of the effect of cost of Radiation therapy (vary the cost per cycle from £450 to £1000) on the ICER. Create a figure and interpret the results.
Remember to reset the parameters

When the cost of increases the ICER increases, as radiation is only provided to the intervention group

c) Conduct a one way sensitivity analysis of the effect of cost of best supportive care (range £700 to £2100) on the ICER. Create a figure, describe and interpret the results. **Remember to reset the parameters**

When the cost of best supportive care increase, the cost in both arms increases, as both treatment groups are receiving best supportive care. The increase in ICER stems from the fact that patient with radiation therapy, survive longer and therefore receive BSC for more cycles.

d) Conduct a two-way sensitivity analysis of the effect of relative risk of progression rrPD (range 0,35 to 0,9) and cost of best supportive care (range £700 to £2100) on the ICER. Mark with yellow the ICER from the basecase analysis. Describe and interpret the results.

The ICER increases both with increased RR and cost of BSC. The effect is greatest for the relative risk, as this is only influencing the intervention arm. Higher RR, implies less effective radiation treatment.

e) If the time horizon was reduced to 1 year, what would be your recommendation. Describe and interpret the results.

Undiscounted and half-cycle corrected results

Strategy	Cost	LifeYears
BSC	£7 763	0,498
Radiation therapy and BSC	£10 331	0,543
Increment	**£2 568**	**0,045**

	Incremental cost/Life years gained
ICER	£56 861

Discounted and half-cycle corrected results

Strategy	Cost	LifeYears
BSC	£6 718	0,491
Radiation therapy and BSC	£8 927	0,535
Increment	**£2 208**	**0,044**

	Incremental cost/Life years gained
ICER	£50 169

In a one year perspective, the ICER increases. The reason for the increase is that not all benefits due to improved treatment has been accounted for.

Question 2: Screening for sleep apnea (45%)

The government is considering introducing screening to the population above 20 years old. Sleep apnea is a condition where individuals have problems with sleeping, as the sleep is interrupted by breathing during sleep.

Finish the probabilistic model, by solving the decision tree in **the Excel file Q2_DecisionTree**. All necessary information is included in the excel sheets.

In the decision tree model you are comparing screening for sleep apnea versus do nothing.

There are two age groups 20-50 years and over 50 Years (50+), both comparator and new treatment are in each of these two excel sheets.

The prevalence depend on age, see the parameter sheet.

Screening response is assumed to be 100%.

Some relevant formulas:

*Test positive: pSens*pPrev+(1-pSpec)*(1-pPrev)

*Positive predicted value (test positive and sleep apnea):

pPrev*pSens)/((pPrev*pSens)+(1-pPrev)*(1-pSpec))

*Probability of having sleep apnea given a negative test:

(pPrev*(1-pSens))/(pPrev*(1-pSens)+(1-pPrev)*pSpec)

a) Based on the **deterministic results**, and a threshold of £20 000, answer the following questions and provide an explanation based on the results of your analysis:
   I. What is the ICER of the main analysis? Interpret the finding. Would you recommend screening?
   II. What is the ICER if only those in the age group 20-50 were screened, and what is the ICER if only those in the age group 50+ were screened? Would you alter the recommendation from I.?

In order to solve a) ii), you need to condition on either 20-50 or 50+. This could easily be done in the parameter sheet by putting the p20_50 to 1 and 0 respectively.

Results for the general population:

Results		
Strategy	**Cost**	**QALY**
Do nothing	£ -	0,799
Screening for sleep apnea	£ 1 194	0,854
Increment	**£ 1 194**	**0,055**
		Incremental cost/QALY
ICER		£ 21 636

For 20 to 50 years:

Results		
Strategy	**Cost**	**QALY**
Do nothing	£ -	0,834
Screening for sleep apnea	£ 946	0,870
Increment	**£ 946**	**0,036**
		Incremental cost/QALY
ICER		£ 26 590

For 50+

Results		
Strategy	**Cost**	**QALY**
Do nothing	£ -	0,780
Screening for sleep apnea	£ 1 327	0,846
Increment	**£ 1 327**	**0,066**
		Incremental cost/QALY
ICER		£ 20 194

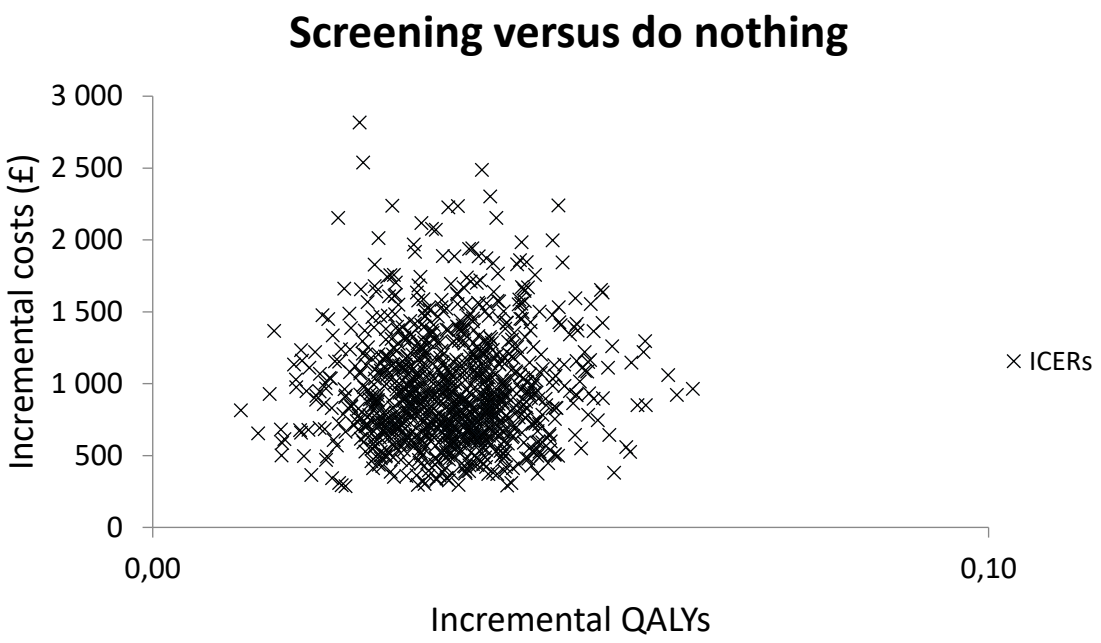
Given a threshold of £20000, screening is not cost-effective for the general population or for each of the groups separately.

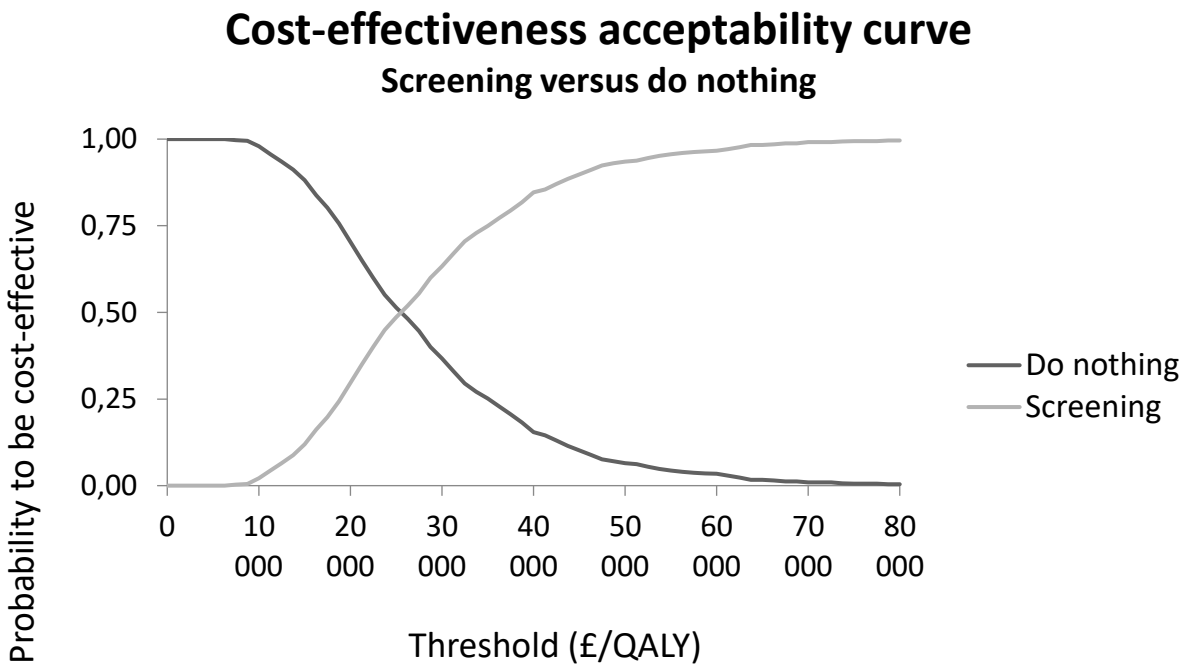
b) **Run a probabilistic sensitivity analysis** and create a cost-effectiveness scatterplot, CEAC and CEAF. Remember to assign the appropriate distribution to the different parameters. *If you are not able to run the PSA, simulated results for sub-question 1 is provided in the excel sheet PSA_extra.*

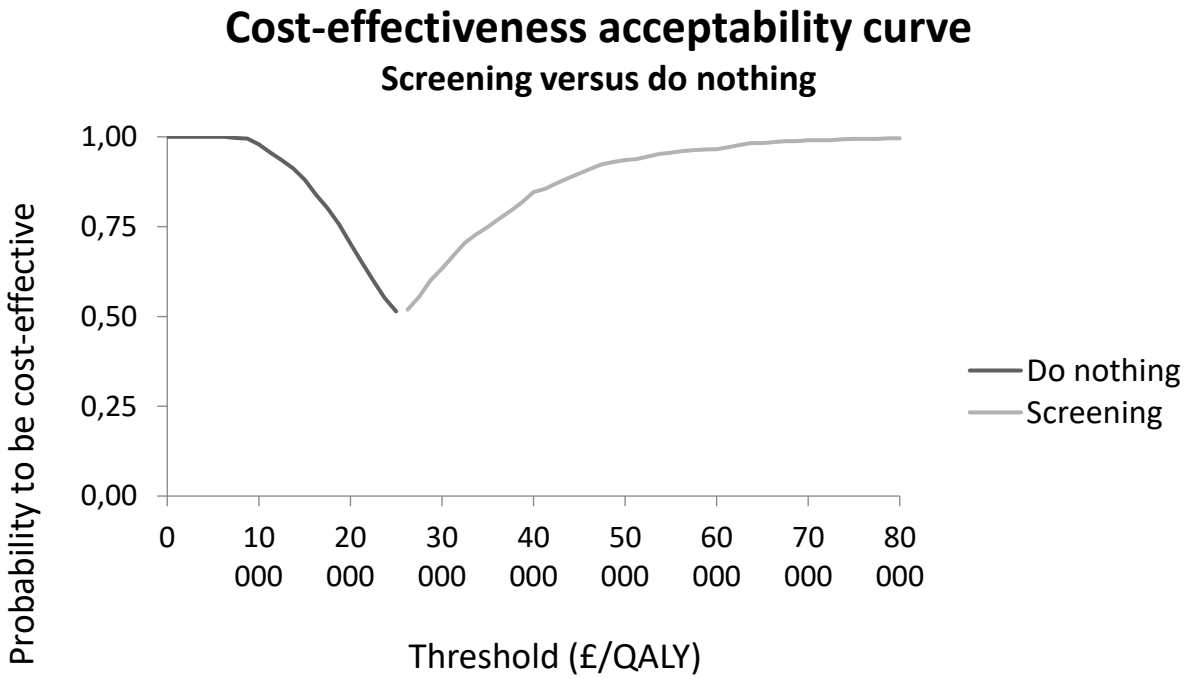
I. In what quadrants of the cost-effectiveness scatterplot are the simulated ICERs, and what is your interpretation?

II. Given a threshold of £20 000 per QALY gained, what is the probability that screening is cost-effective compared to do nothing?

III. Would you recommend screening as an alternative strategy to do nothing?





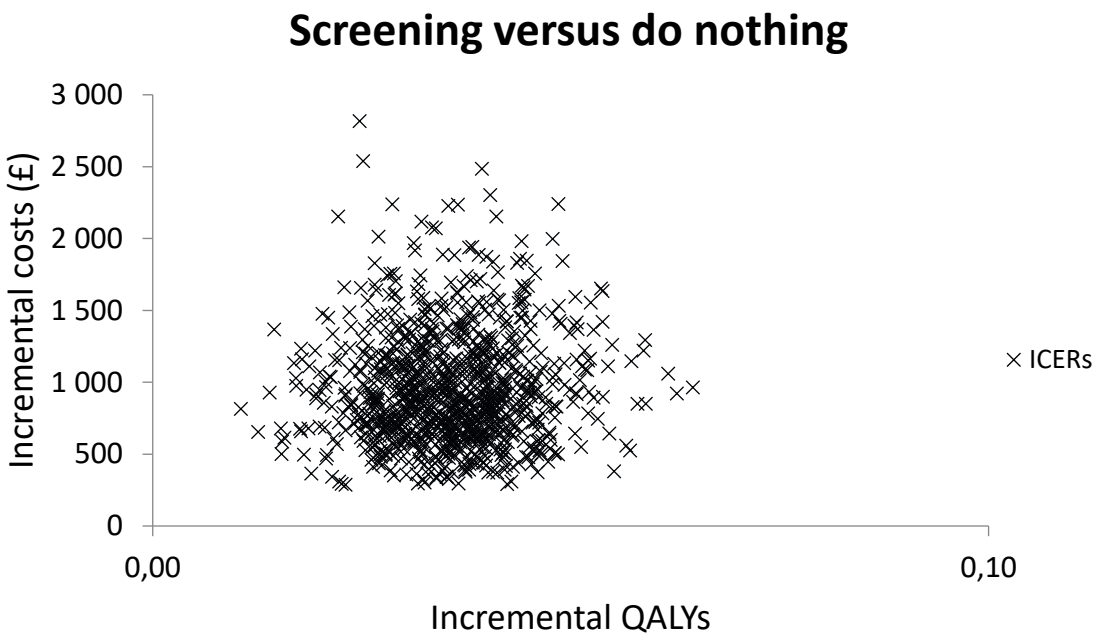


All simulations are located in the NE quadrant, indicating higher incremental costs and incremental effect. The decision depend on the threshold value and the likelihood of screening to be cost-effective. Screening has a likelihood of around 47%. A good solution describe the cost-effectiveness plane and define CEAC and CEAF.

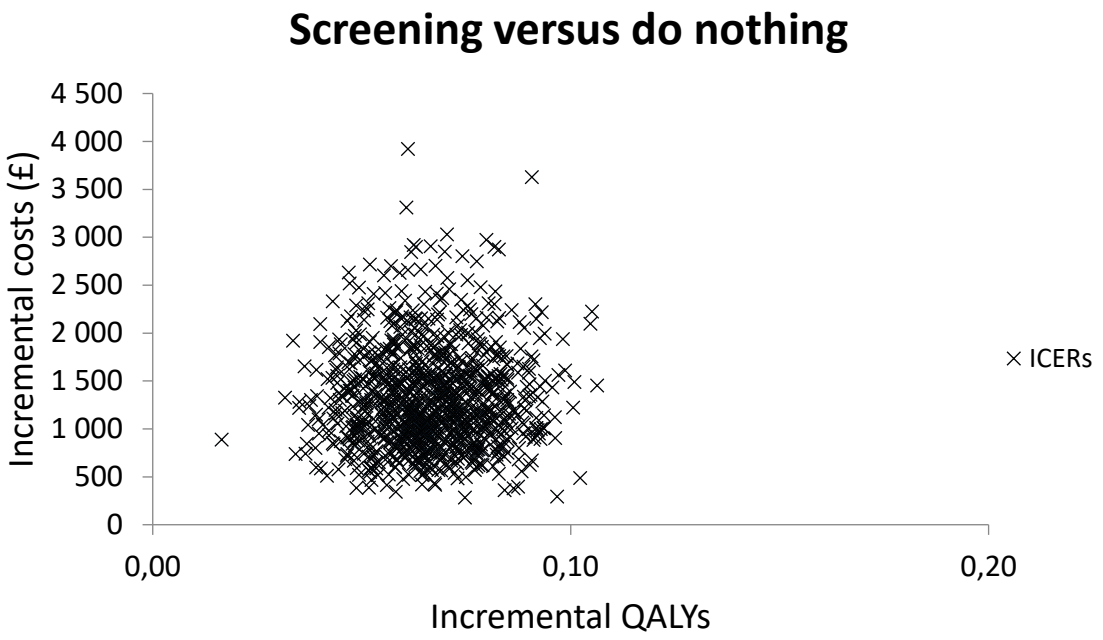
IV. Run the simulation for as if only 20-50 year old were invited to screening or if only those 50+ were invited. What is your recommendation based on the PSA results for the two age groups separately?

Similar to above, just need to run new macros given 1 and 0 for the p20-50 respectively. Here are the scatterplots as an illustration:

20-50 years



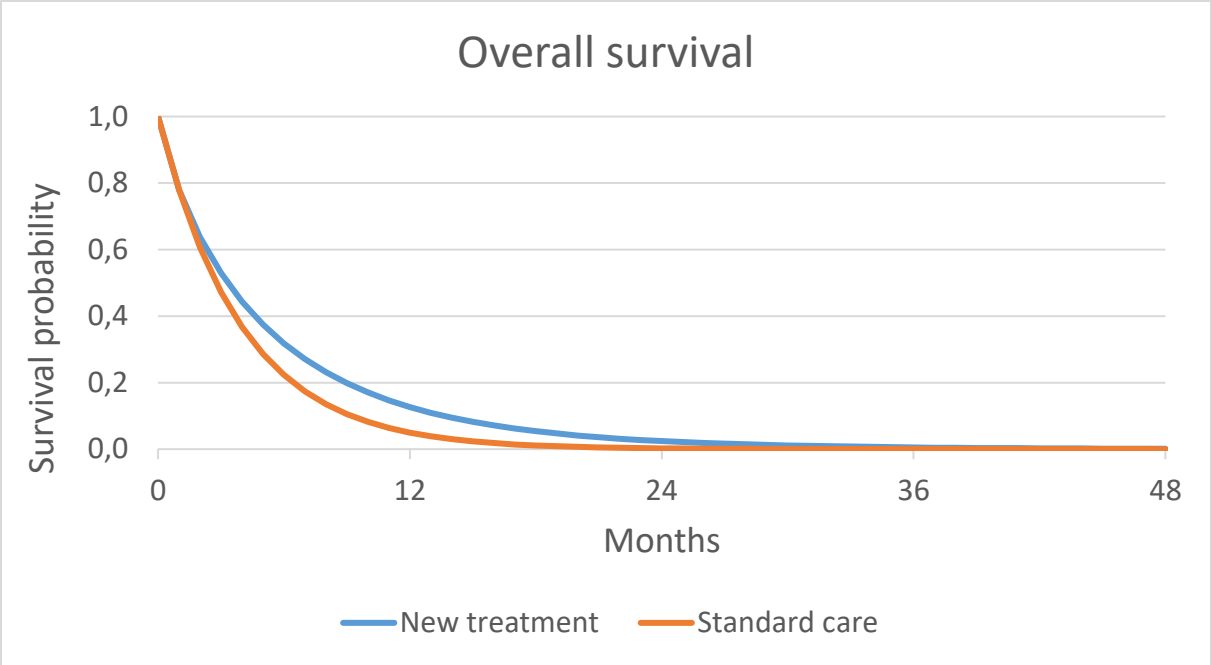
50+



Question 3: Survival and probability of dying (15%)

Use the excel file **Q3_survival_template**

a. Create a figure illustrating the survival curve for *standard care* and *new treatment*. Each curve represent survival from month 0 (everybody alive – indicated by 1) to month 48 (4 years). Almost everybody is dead after four years



b. If the cost per patient per month is €200 for *standard care* and €1 500 per month per patient for the *new treatment*, would you recommend the new treatment given a willingness-to-pay of € 50 000 for one additional life year, and why? **You do not have to consider discounting or half-cycle correction.**

Inc effect	0,130
Inc cost	8209
Icer	63361

BONUS

c. Consider the survival data for *standard care* and *new treatment*. Explain whether the probability of death is increasing, decreasing, or stays constant over time for *standard care*. What about the *new treatment*?

New treatment has declining probability of dying, while standard care has constant probability of dying.

d. For a patient who is still alive after received the *new treatment* for 12 months, what is the conditional probability that the patient will survive another 12 months (until 24 month) with the *new treatment*?

Condition on surviving until 12 month, the probability of surviving until 24 month is 19%