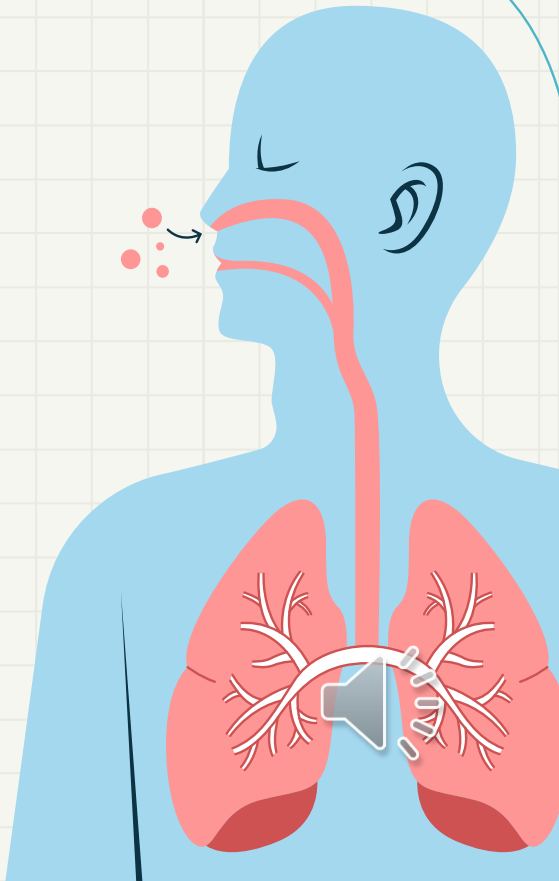
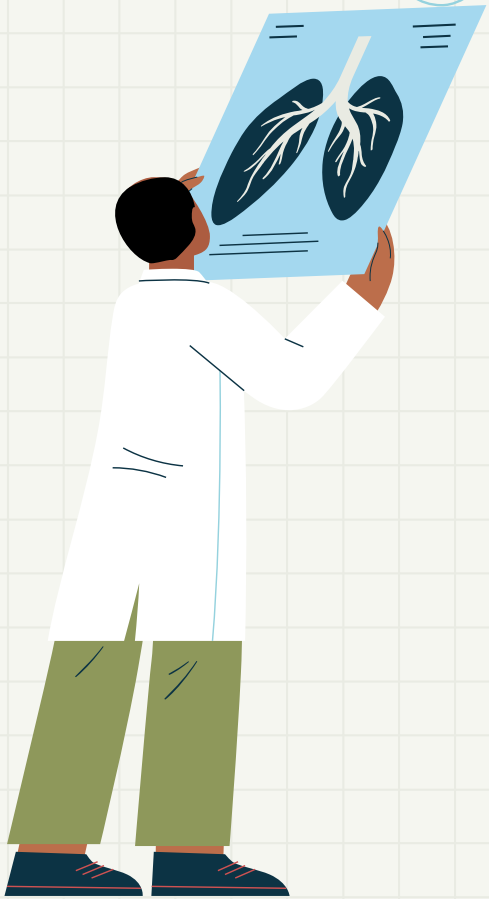
Screening Program for Silicosis

Javier Mancilla Galindo





INTRODUCTION

Silicosis is a pulmonary disease caused by exposure to silica dust, which commonly occurs at the workplace.

Employees at high risk in the Netherlands work in:

- Construction
- Ceramic Tile industry
- Artificial stone benchtop industry

A health surveilance program for silicosis is being developed for these industries. Thus, it is important to evaluate the cost-effectiveness of screening strategies for silicosis.

Alternatives

Diagnostic methods being considered include:

- Diagnostic prediction model
- Individual cumulative exposure
- Chest X-Ray (CXR)
- High-resolution chest computed tomography (HRCT)
- Lung function tests

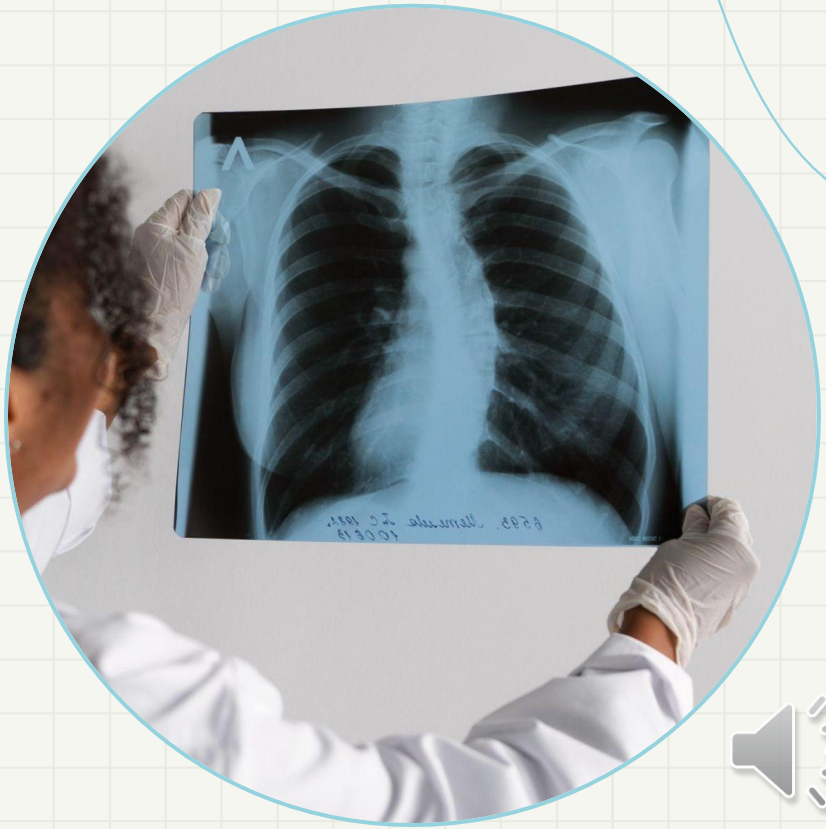
However, no method is perfect and without cons (costs, availability, low participation rates, ratidation).

Objective

To compare the cost-effectiveness of screening strategies for silicosis.

Due to time constrains, not all methods will be compared. The following three have been selected:

- Diagnostic prediction model
- HRCT
- CXR



Diagnostic Prediction Model

Predictor	Value	Score	Beta
Age	greater/equal 40 years	1.0	0.72
Smoking habit	Current smoker	1.0	0.70
Job title	High exposure job title	1.5	1.14
Work duration in construction industry	greater/equal 15 years	1.5	1.00
Self-related health	Feeling unhealthy	1.25	0.84
Standardized residual FEV1	lower/equal -1.0	1.25	0.91

Cost: 92 EUR / worker

Table 4 The diagnostic accuracy across different cut-off points for referral for chest *x* ray investigation

Referral cut-off	Number of workers (%)* per sum score category	Number of workers with chest *x* ray ILO profusion category ⩾1/1 (n = 37) n (%)†	Number of workers without chest *x* ray ILO profusion category ⩾1/1 (n = 1254) n (%)‡	Sensitivity (%)	Specificity (%)	NPV (%)
Sum scores ⩾2	1065 (82.5)	37 (3.5)	1028 (96.5)	100.0	18.0	100.0
Sum scores ⩾3	684 (53.0)	37 (5.4)	647 (94.6)	100.0	48.4	100.0
Sum score ⩾3.75	567 (43.9)	33 (5.8)	534 (94.2)	89.2	57.4	99.4
Sum score ⩾4.0	494 (38.3)	31 (6.3)	463 (93.7)	83.8	63.1	99.2
Sum score ⩾4.25	293 (22.7)	22 (7.5)	271 (92.5)	59.5	78.4	98.5
Sum scores ⩾4.75	270 (20.9)	21 (7.8)	249 (92.2)	56.8	80.1	98.4
Sum scores ⩾5.25	119 (9.2)	13 (10.9)	106 (89.1)	35.1	91.5	98.0

*Proportion of all workers (n = 1291).
†Proportion of workers with positive *x* ray within the sum score category.
‡Proportion of workers with negative *x* ray within the sum score category.

Diagnostic Imaging studies

CXR

Sensitivity: 0.76 (95%CI: 0.63-0.86)

Specificity: 0.89 (95%CI: 0.77-0.95)

Cost: 92 EUR / worker

HRCT

Reference test

Cost: 1600 EUR / worker

Source:

- Sensitivity and specificity from a systematic review of the literature (Durairaj, 2024)
- Costs: Consulted with occupational health referral center

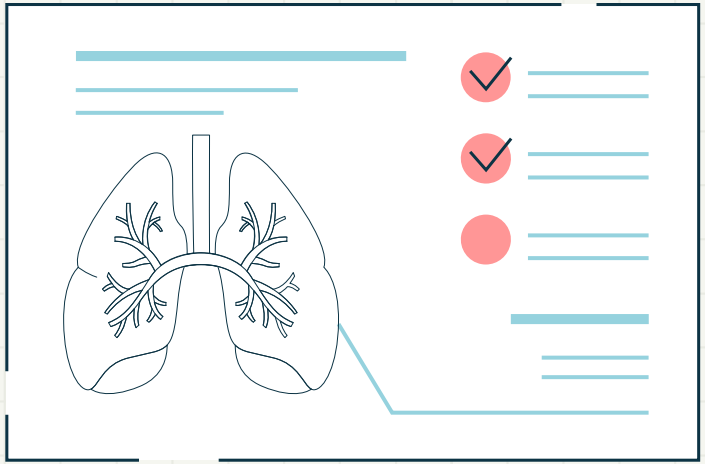
Model

Markov cohort (deterministic) model,

cohort size 1000

Five strategies compared:

- CXR to all workers (baseline)
- HRCT to all workers
- Prediction model stratification followed by HRCT in high-risk participants at 3 cutoffs:
  - 3.75 points
  - 4.25 points
  - 5.25 points



Model

Effectiveness: QALY (utilities are approximates based on own judgement, not literature-based)

Costs: Costs of tests consulted with providers, all other costs assumed.

Probability of death: Own judgement, not based on literature.

WTP: 80,000 EUR per QALY assumed for a high-severity disease in the Netherlands.

Prevalence: Approximately 10%, modeled with beta distribution for low prevalences.

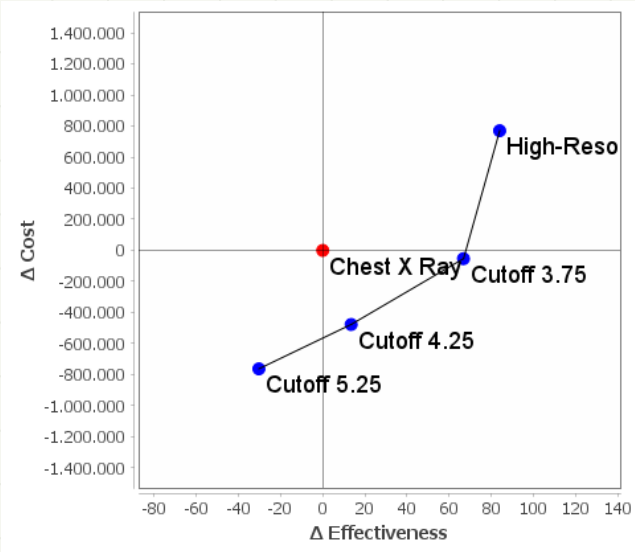
Single screening strategy

Duration: 10 years. It is assumed that transition between stages in follow-up is negligible due to slow progression of silicosis.

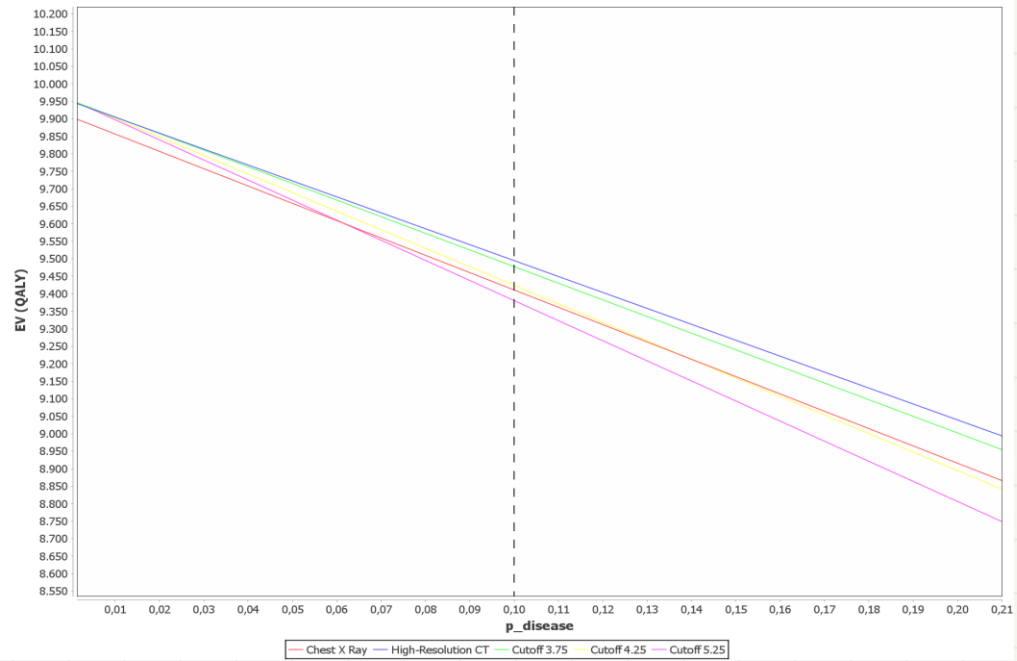
Probabilistic sensitivity analyses

Results

Strategy	Cost (EUR/worker)	Effectiveness (QALY/1000 worker)	ICER	Notes
Cutoff 5.25	1057.13	9.38	---	
Cutoff 4.25	1342.66	9.42	6516.8	Cost Saving
Cutoff 3.75	1766.45	9.48	7946.38	Cost Saving
CXR	1819.63	9.41	---	Strongly Dominated (Baseline)
HRCT	2590.13	9.49	47992.6	

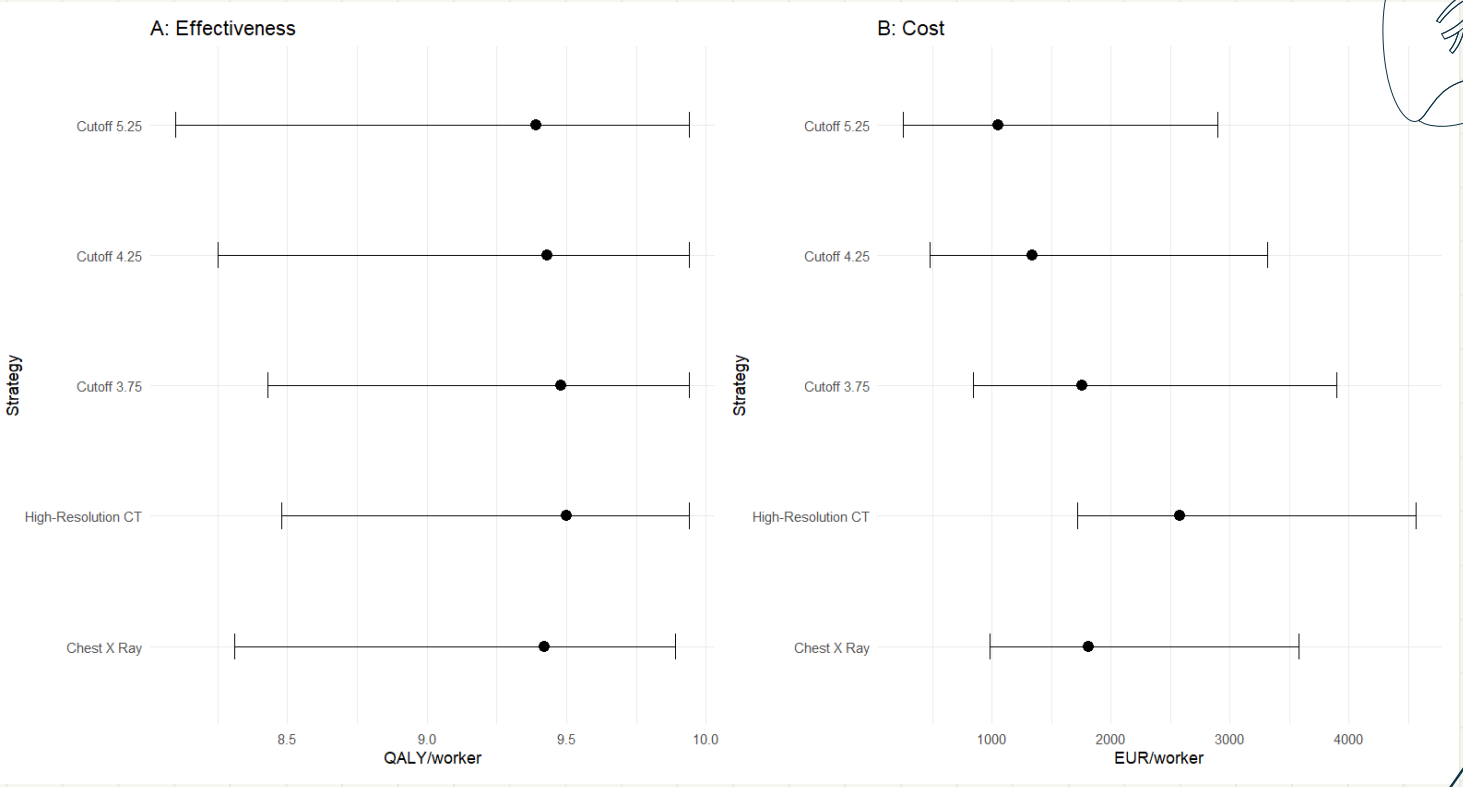


Threshold analysis varying prevalence

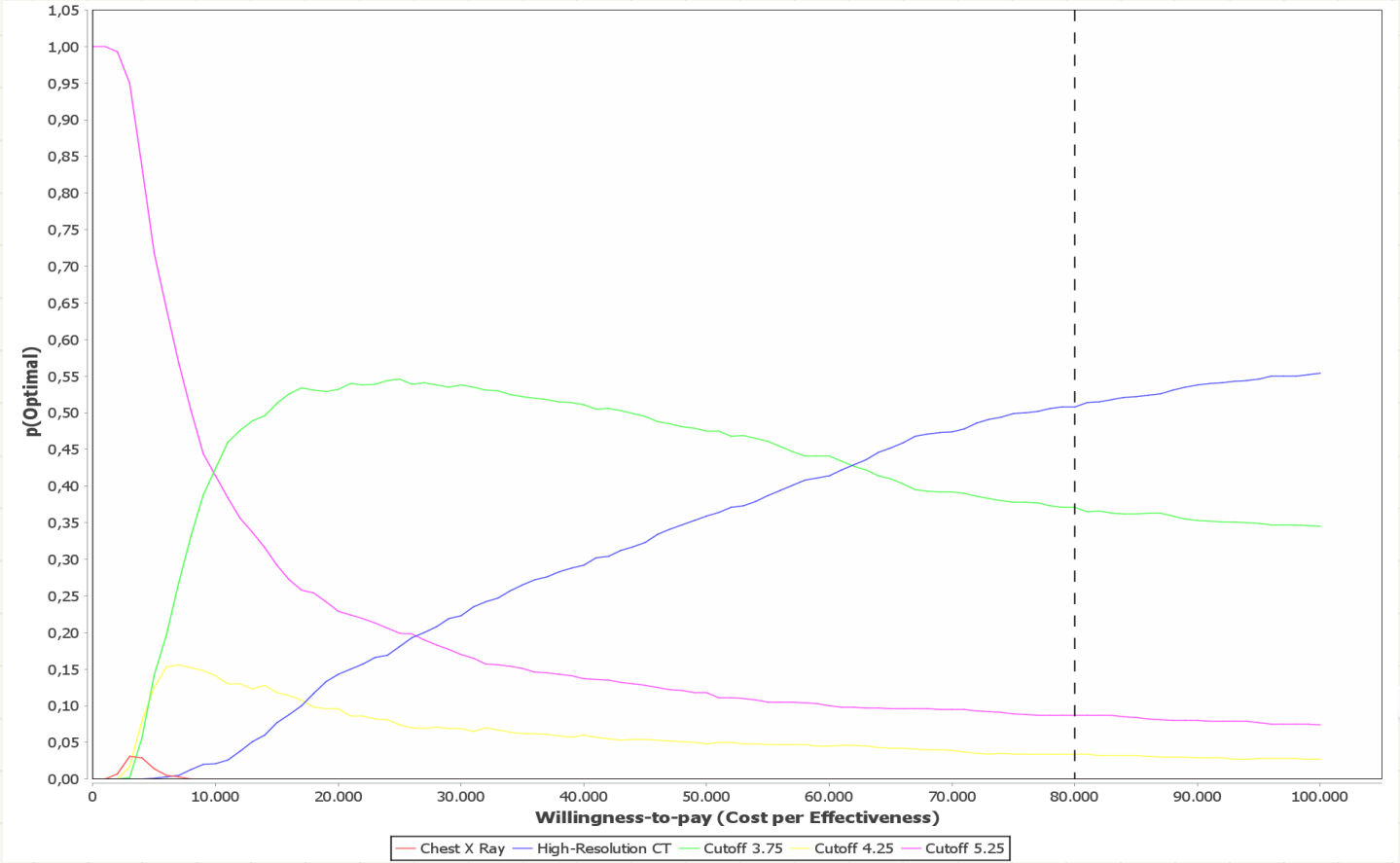


HRCT superior effectiveness above 0,01

Probabilistic Sensitivity Analysis



Probabilistic Sensitivity Analysis



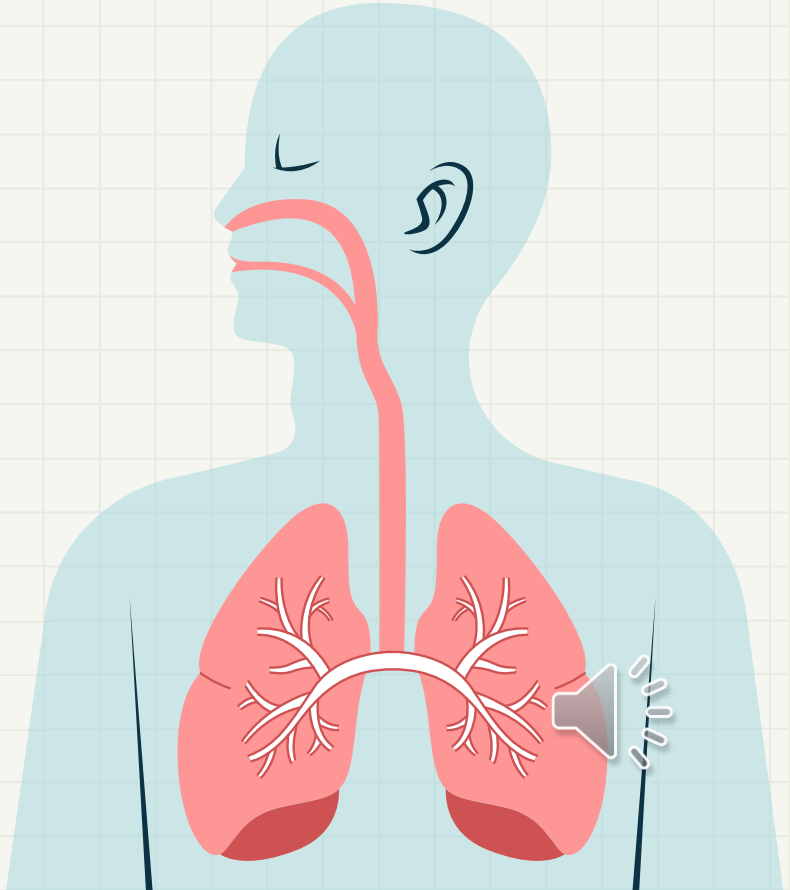
Discussion

- High uncertainty does not allow to conclude which strategy is the best.
- However, HRCT seems to be the most effective strategy and costly.
  - Cost-effectiveness within WTP margin
  - However, screening all workers with HRCT logistically challenging and may have other unintended consecuences (i.e., working time loss, pressure on healthcare system).
- Risk stratification followed by HRCT good alternative under resource constrains.

Discussion

- Reliable sources of data are needed to improve this model.
- Future work:
  - Incorporate individual cumulative exposure in modelling as tunnel states or at the individual level with microsimulation
  - Include other consequences from exposure (i.e., mesothelioma, lung cancer)
  - Model misclassification of prediction model as this was developed with CXR as the reference test.
  - Use better costs estimates for the societal perspective and literature-based survival rates and QoL utilities.

THANKS



CREDITS: This presentation template was created by **Slidesgo**, and includes icons by **Flaticon**, and infographics & images by **Freepik**