CAN LABORATORY PARTICIPATE IN HOSPITAL COST REDUCTION?

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Clinical/Medical Laboratories

- The most widely used part of the health system
- Play a key role in clinical decision
- 60% to 70% of diagnoses are based on the results of laboratory tests
- Demand for laboratory services has dramatically increased in last few decades
- An increase of laboratory costs

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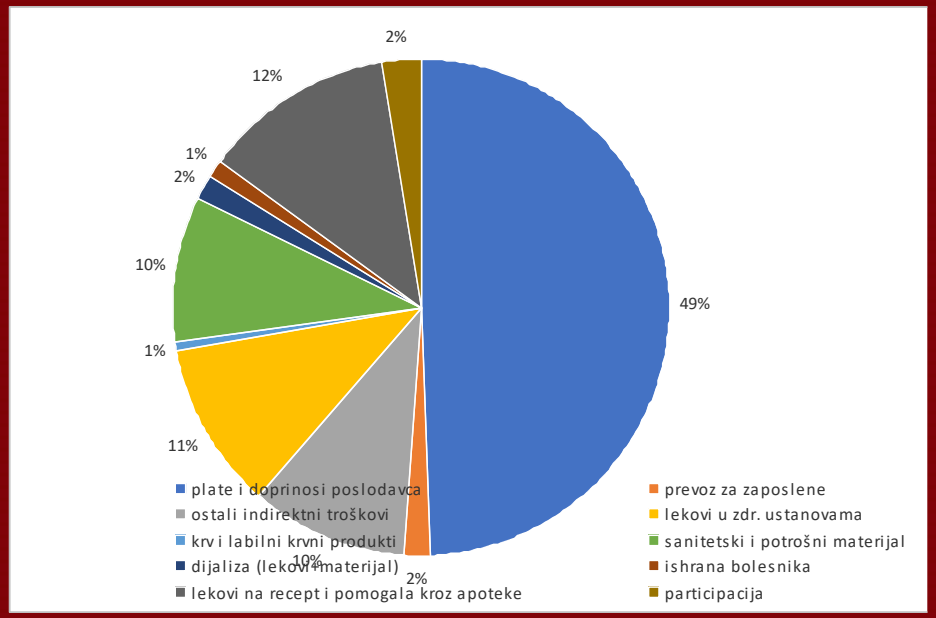
Laboratory Costs In Total Health Costs

- Laboratory testing accounts for only a 3–5% of healthcare spending
- Laboratory services account for around 10% of total health costs in Serbia



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Laboratory Costs In Total Hospital Cost

- **In developing countries**
- The cost of consumable goods
  - 22%
- Laboratory costs
  - 49% of the total hospital costs

- **In Serbia**
- IVD, consumables and medical supplies
  - 28% of hospital costs

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Responsibility For Excessive Laboratory Use And Costs Increase

The unit cost of many routine tests has decreased

Test utilization has increased

Physicians, laboratory professionals and hospital management

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Contribution To Increased Laboratory Testing

- **Overutilization (when irrelevant or repeat laboratory testing is ordered) can result in**:
  - unnecessary blood draws and other sample-collection procedures
  - Increases the likelihood of false-positive results
  - incorrect diagnoses,
  - increases adverse outcomes due to unwarranted additional intervention
  - **Increase costs**

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Contribution To Increased Laboratory Testing

- **Underutilization (when relevant laboratory tests are not ordered) can result in**:
  - morbidity due to delayed or missed diagnoses
  - downstream overutilization

- **Over and underutilization** can both lead to longer hospital stays and contribute to legal liability

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Contribution To Increased Laboratory Testing by Physicians

- Laboratories have little control over testing requested
- Physicians are the most important factor in the expansion of laboratory test utilization,
- Physicians control up to 80% of health care costs

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Contribution To Increased Laboratory Testing By Laboratory Professionals

Improve accuracy and efficiency of testing
Reduction of TAT, duplicate tests, errors

↓

Better medical decision-making

↓

Healthcare resource saving

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Costs associated with testing

- Laboratory testing is often the principal basis for more costly downstream care
- **Economic models of how testing influences these activities**

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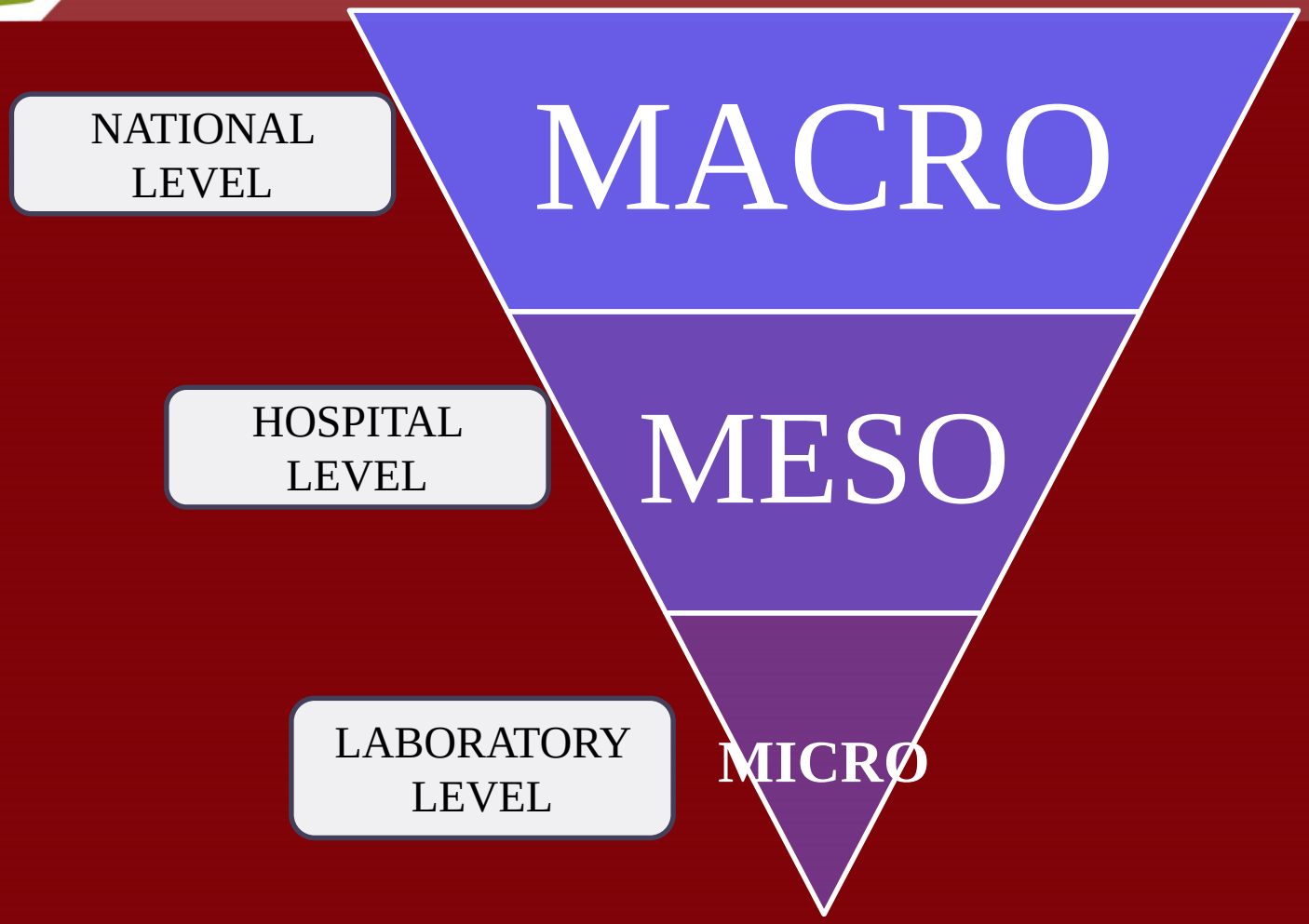
Decision Making Levels



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Cost – Effectiveness Analyse

- This study was aimed to investigate the cost and effectiveness of the different methods for prediction of length of stay (LOS) in hospital after the cardiac surgery.

- For prediction we used traditional statistics method **C-statistic** and newly predictive technique **artificial neural network**

- The both classification systems included pre and post-operative risk factors (six different time points)

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Patient group

- 108 coronary artery disease patients operated by coronary artery bypass graft surgery

- Patients were divided in two groups:
  - who stayed in hospital equal or more than 10 days – **long LOS in hospital**
  - Patients who stayed in hospital less than 10 days – **short LOS in hospital**

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Predictive variables

- Six selected parameters were:
- CK-MB-t2 measured immediately after the surgery ending,
- Protein concentration – t3 measured after 6h
- Creatinine measured 24 and 48 h after the operation (creatinine –t4 and t5, respectively).
- Total intubation time in hours (IT)
- Required transfusion volume (TV)

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Train Group For Model Building

- Train group (with three quarters of subjects)
  - Train group was used for predictive models building by LR and ANN

$$\log(p/(1-p)) = b_0 + b_1 x_1 + \ldots + b_n x_n$$

- Log (p/(1-p) = 0.853 + 0.015 Cr-t4 + 0.015 Cr-t5 + 0,006 CK-MB-t2 + 0.003 IT - 0.101 protein-t3 + 0,002 TV

$$\hat{y} = f_2\left\{\sum_{i=1}^{h} w_i f_1\left[\sum_{j=1}^{n} w_{ij} x_j + b_{i0}\right] + b_0\right\}$$

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Test Group For Model Validation

- Test group with remaining subjects
  - test group was used for models validation

Models	Test group			
	Se (95% CI)	Sp (95% CI)	CC (%)	AUC (95% CI)
Logistic model	78.57 (49.2 - 95.3)	71.43 (47.8 - 88.7)	74.3	0.816 (0.649 - 0.926)
ANN model	85.71 (57.2 - 98.2)	85.71 (63.7 - 97.0)	85.7	0.846 (0.685 - 0.946)

CC- Correctly classified subjects; AUC- area under the curve, CI – confidence interval; Se-sensitivity; Sp-specificity

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Probabilities Calculation

	LOS	Probability	Results	robabilitie
			True negative	0.7143
	Short	0.6		
			False positive	0.2857
LR				
			False negative	0.2143
	Long	0.4		
			True positive	0.7857

	LOS	Probability	Results	robabilitie
			True negative	0.8571
	Short	0.6		
			False positive	0.1429
ANN				
			False negative	0.1429
	Long	0.4		
			True positive	0.8571

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Cost Calculation

- ICU wards,
- Ordinary wards,
- Examinations,
- Radiology,
- Disposals,
- Operation,
- Anesthesia,
- Specific medical materials for operations,
- Blood transfusion
- Laboratory analyses
- Medication

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Costs

- Cost for short LOS –1914 euro
- Cost for long LOS – 2102 euro
- Additional cost for patients monitoring if thay have high probability for long LOS – 43 euro

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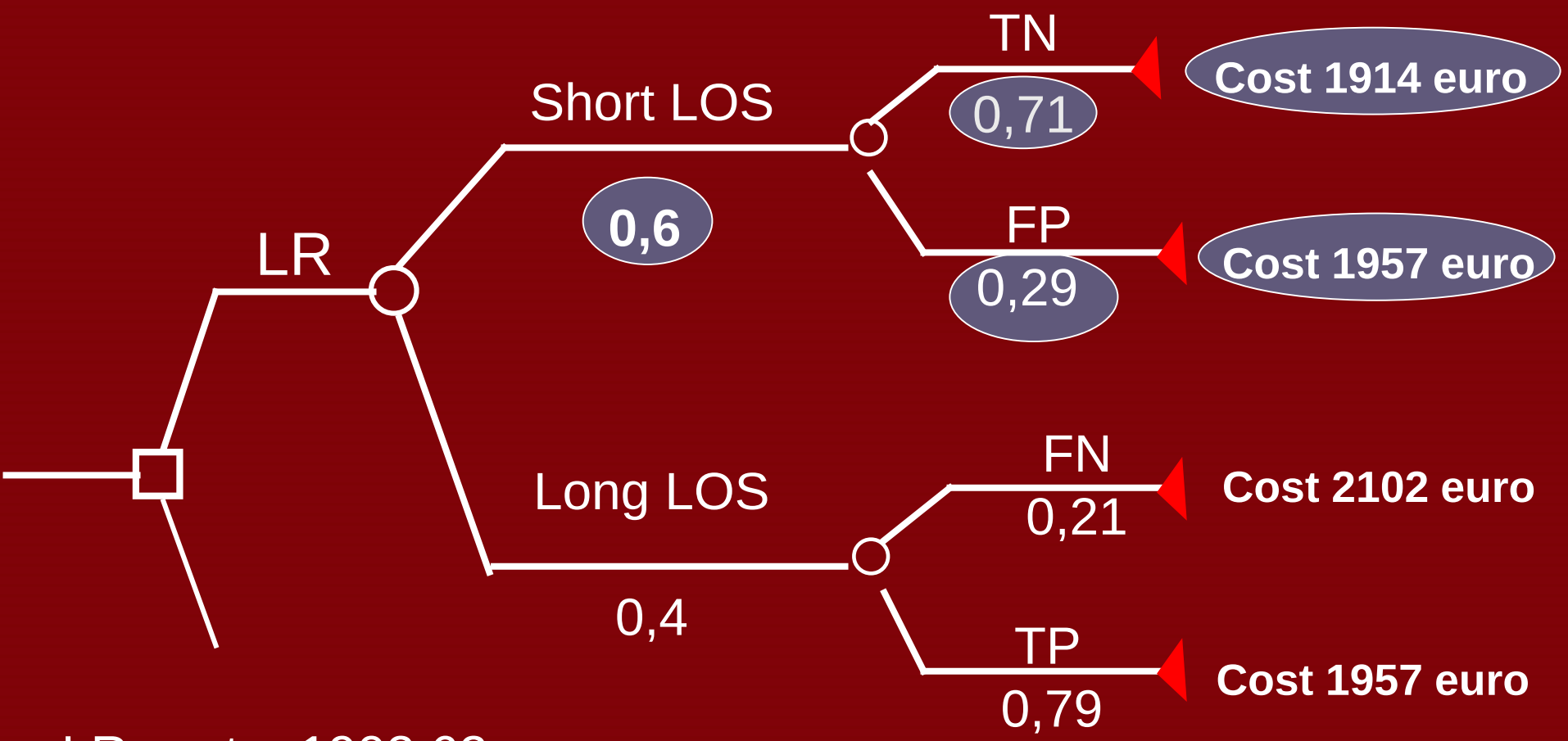
Cost Calculation In Decision Tree



LR cost = 1902.62 euro

ANN cost = 1895.00 euro

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ICER analysis

Cost for patients without application of calculators was 1940.00 euro

Strategies	Effectiveness	Cost	△E	△Cost	ICER
LR	74%	1902,9			
ANN	86%	1895,0	12%	-8 euro	Dominated

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Conclusion

- Increase in laboratory use – decrease hospital costs

- Both calculators improved patient's outcomes and reduced costs in comparison to strategy without LOS probability calculation.

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