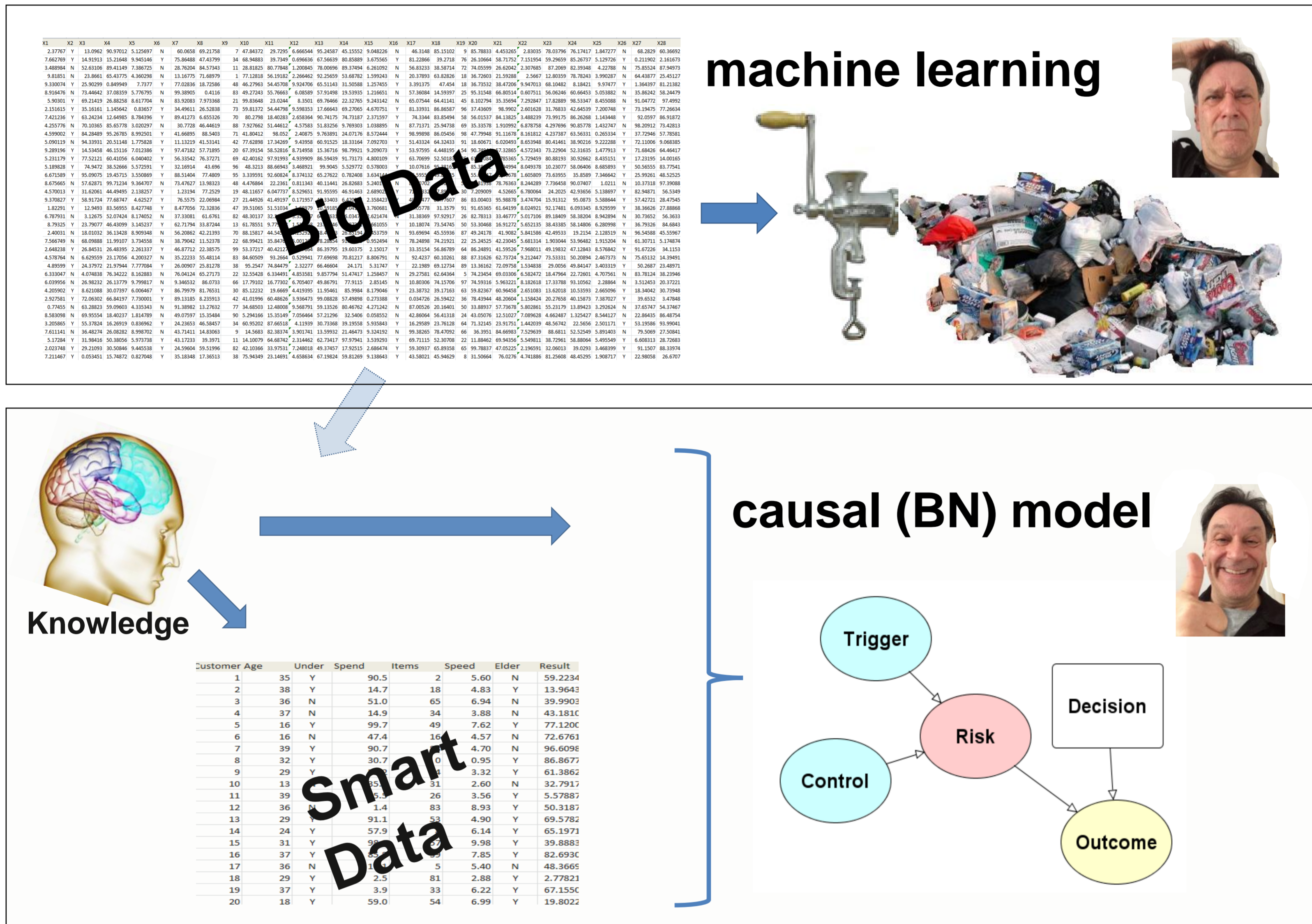


- BAYES-KNOWLEDGE is providing evidence-based decision-making in areas such as medicine, law, forensics, and transport. What makes it radical is that it does this in situations where there is little data, and hence where traditional statistics cannot be used.
- We bring together data, expert opinion, risk and uncertainty into a visual probabilistic framework, allowing decision-makers to see their choices clearly.
- Instead of using confusing spreadsheets to model all the interactions between factors we use Bayesian networks (BNs) and we are developing novel strategies and new algorithms to extend and refine the use of BNs in decision-making.

## Big Data ... or Smart Data?



## What is a Bayesian Network?

A graphical model for representing causal or influential relationships between variables.

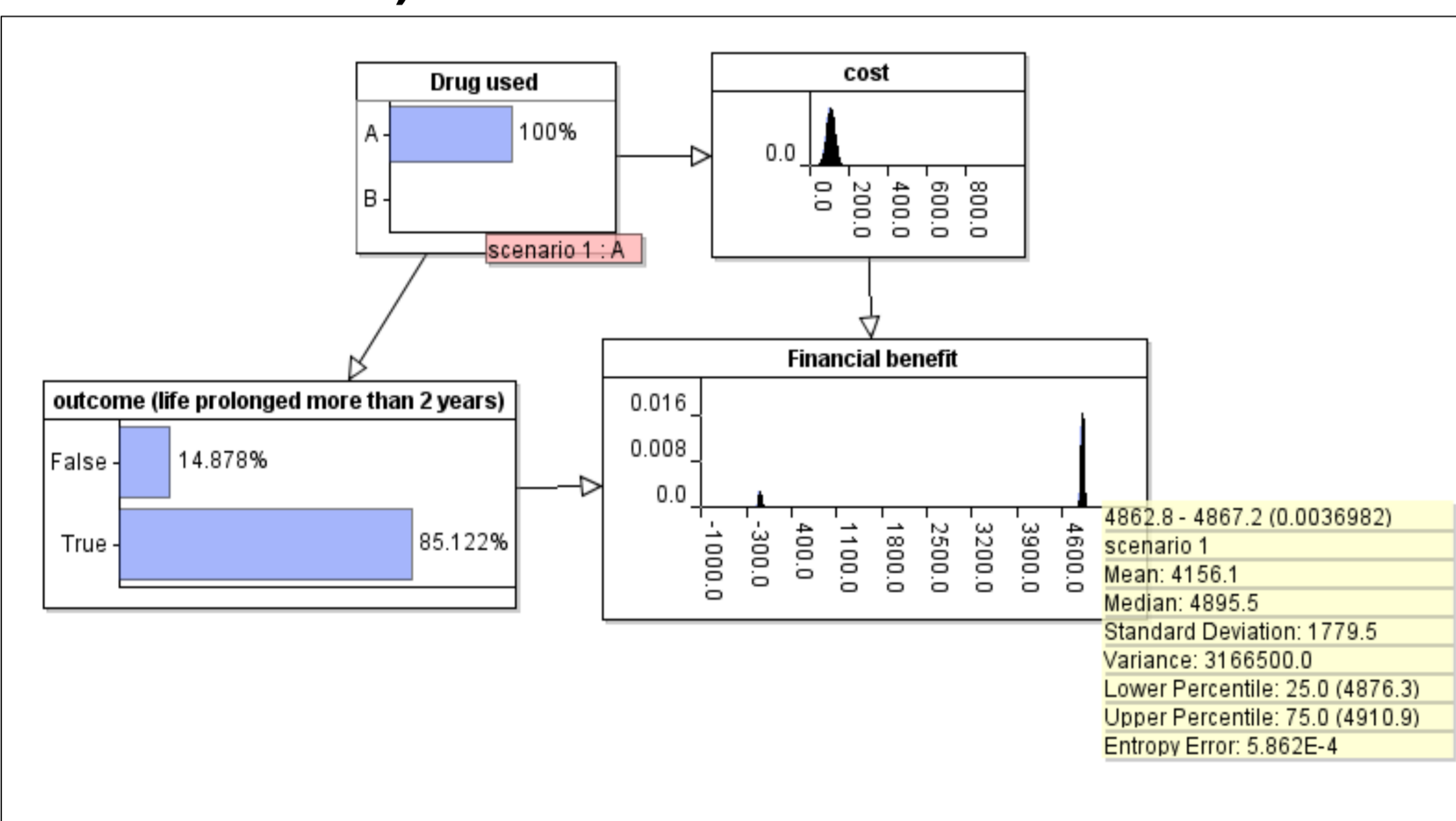
Some of our Bayesian network applications:

- More accurate and informative results of impact of forensic evidence like DNA [1, 3]
- Determine whether a prisoner is suitable for release based on the risk of serious re-offence [2]
- Beating the bookies with more accurate predictions of Premier League football matches [4]



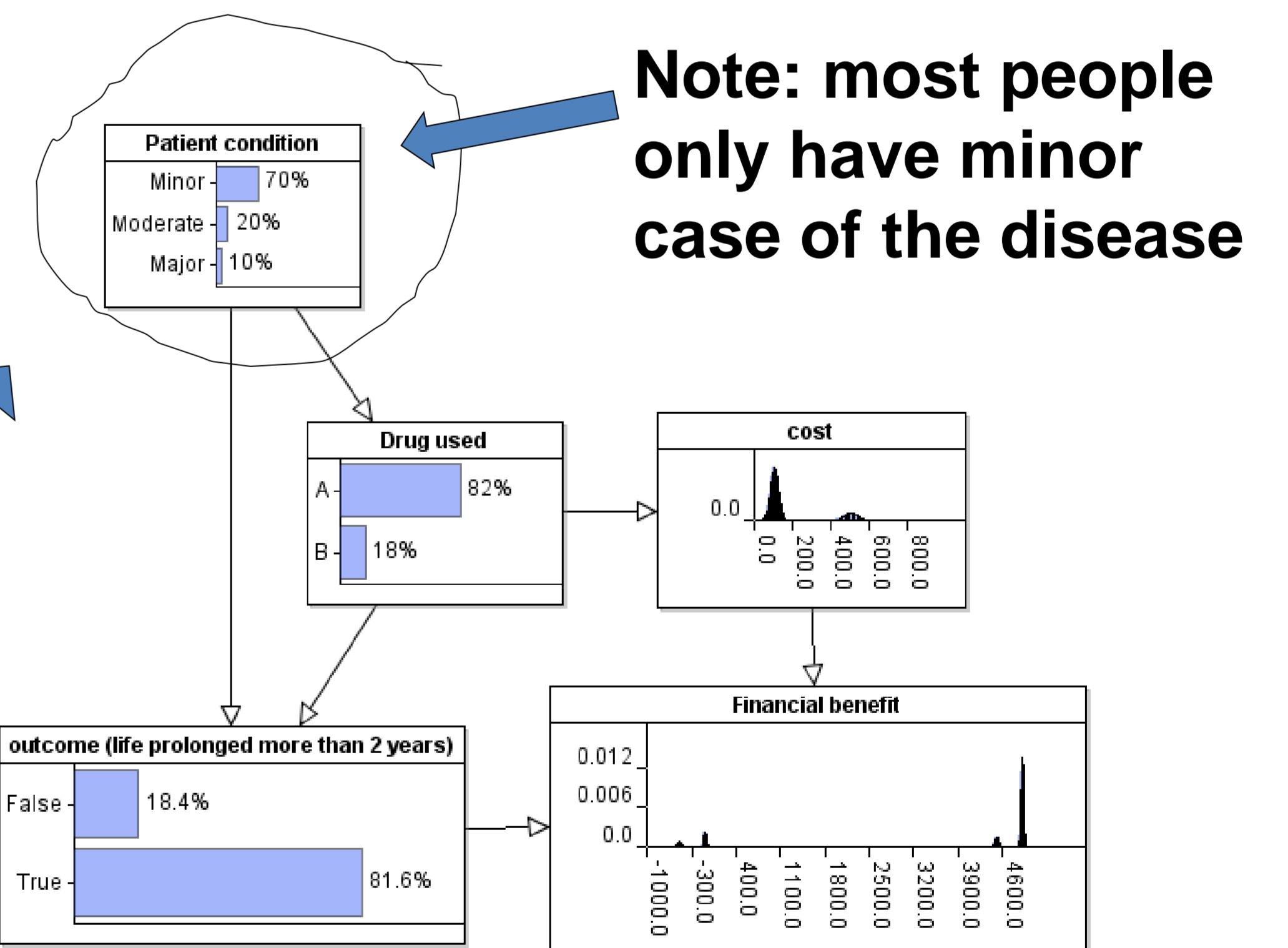
## Bayesian Network Example: Which drug to recommend for particular disease?

**Drug A: cheap and effective (mean financial benefit \$4156)**

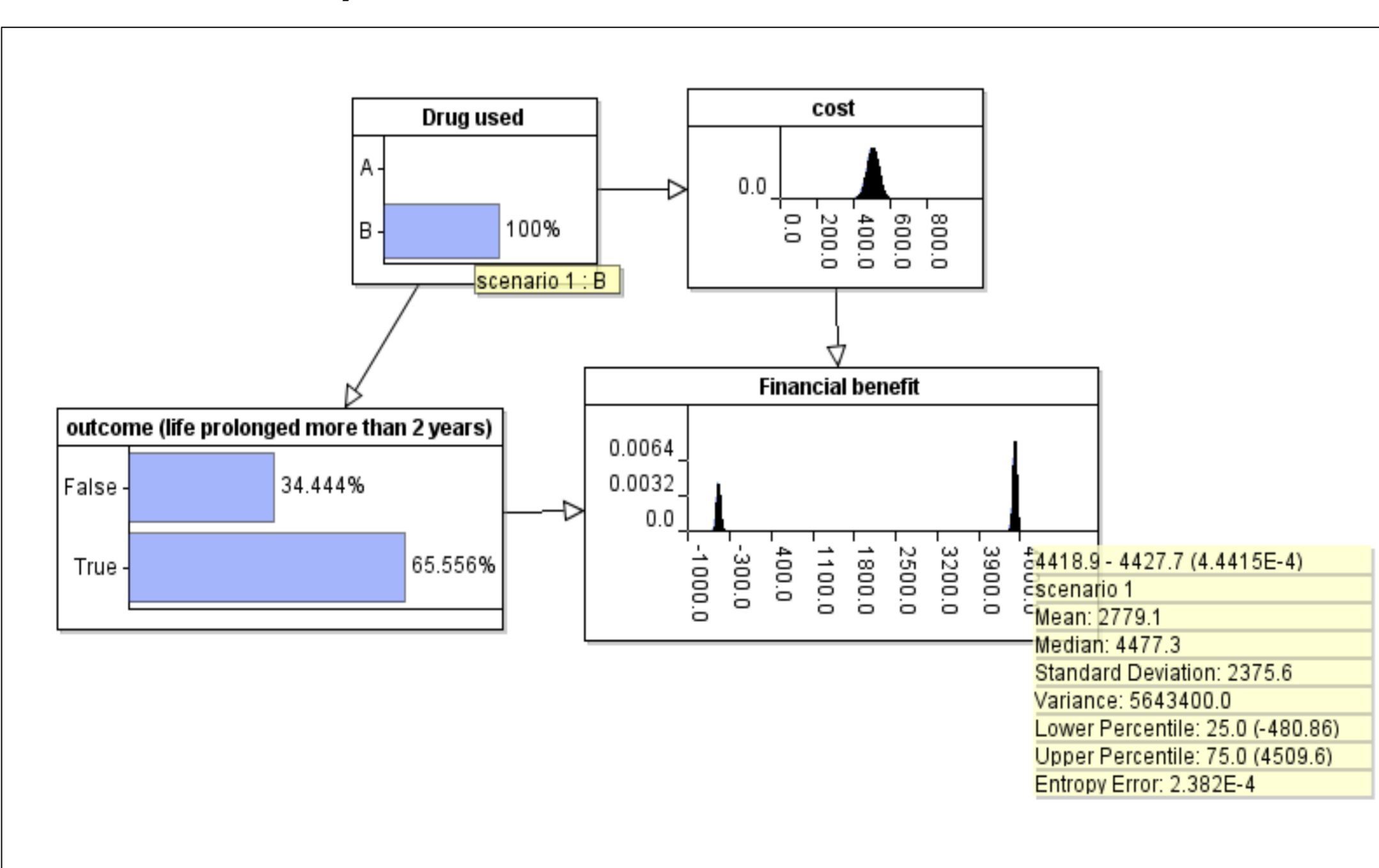


So obviously stop using Drug B?

No! Need to include hidden variable *Patient condition* – i.e. seriousness of the disease.

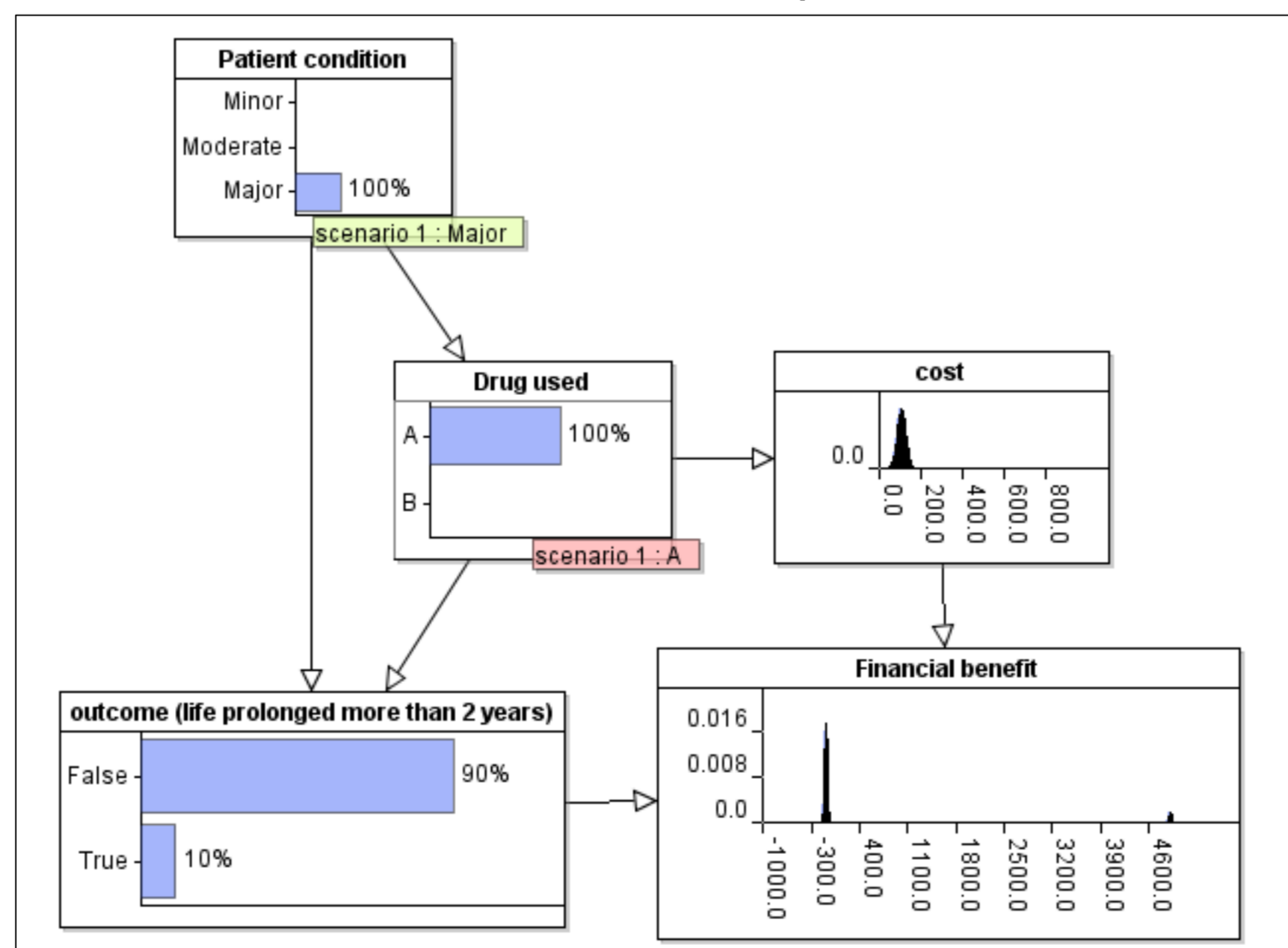


**Drug B: expensive and ineffective (mean financial benefit \$2777)**

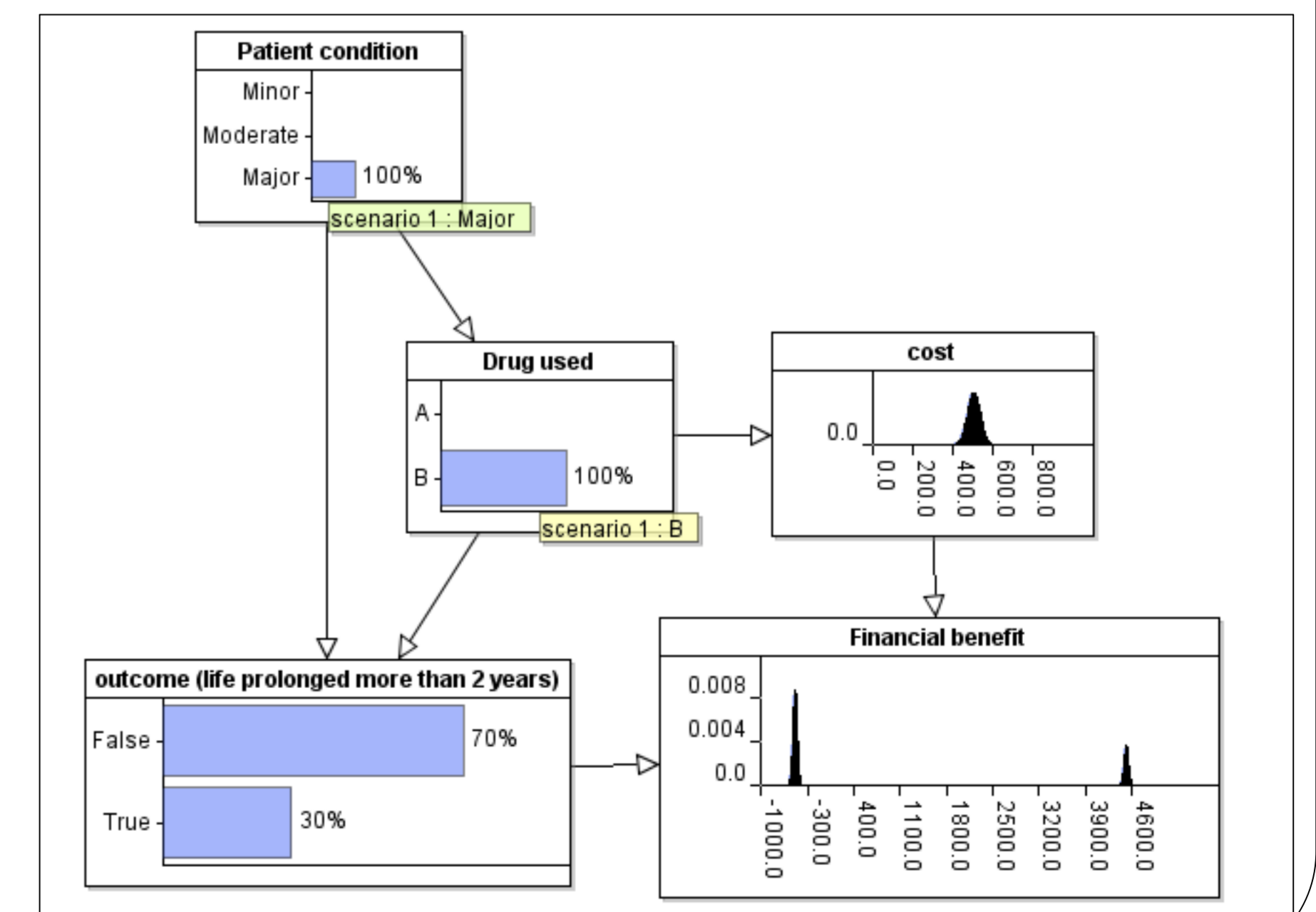


So consider only patients with major case of the disease

**Drug A: Only 10% positive outcome, mean financial benefit \$400**



**Drug B: 30% positive outcome, mean financial benefit \$1000**



## References

1. Fenton N.E, Neil M, Berger D, "Bayes and the Law", Annual Review of Statistics and Its Application, Volume 3, 2016
2. Constantinou, A. C., Fenton, N., Marsh, W., & Radlinski, L. (2016). "From complex questionnaire and interviewing data to intelligent Bayesian Network models for medical decision support", Artificial Intelligence in Medicine, 2016. Vol 67 pages 75-93
3. Fenton, N. E. (2014). Assessing evidence and testing appropriate hypotheses. Science & Justice, 54(6), 502-504.
4. Constantinou, A. C., Fenton, N. E. & Neil, M. (2013). Profiting from an inefficient Association Football gambling market: Prediction, Risk and Uncertainty using Bayesian networks. Knowledge-Based Systems, 50: 60-86.

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