

**Should We Screen for
Bladder Cancer in a High
Risk Population: A Cost per
Life-Year Saved Analysis?**

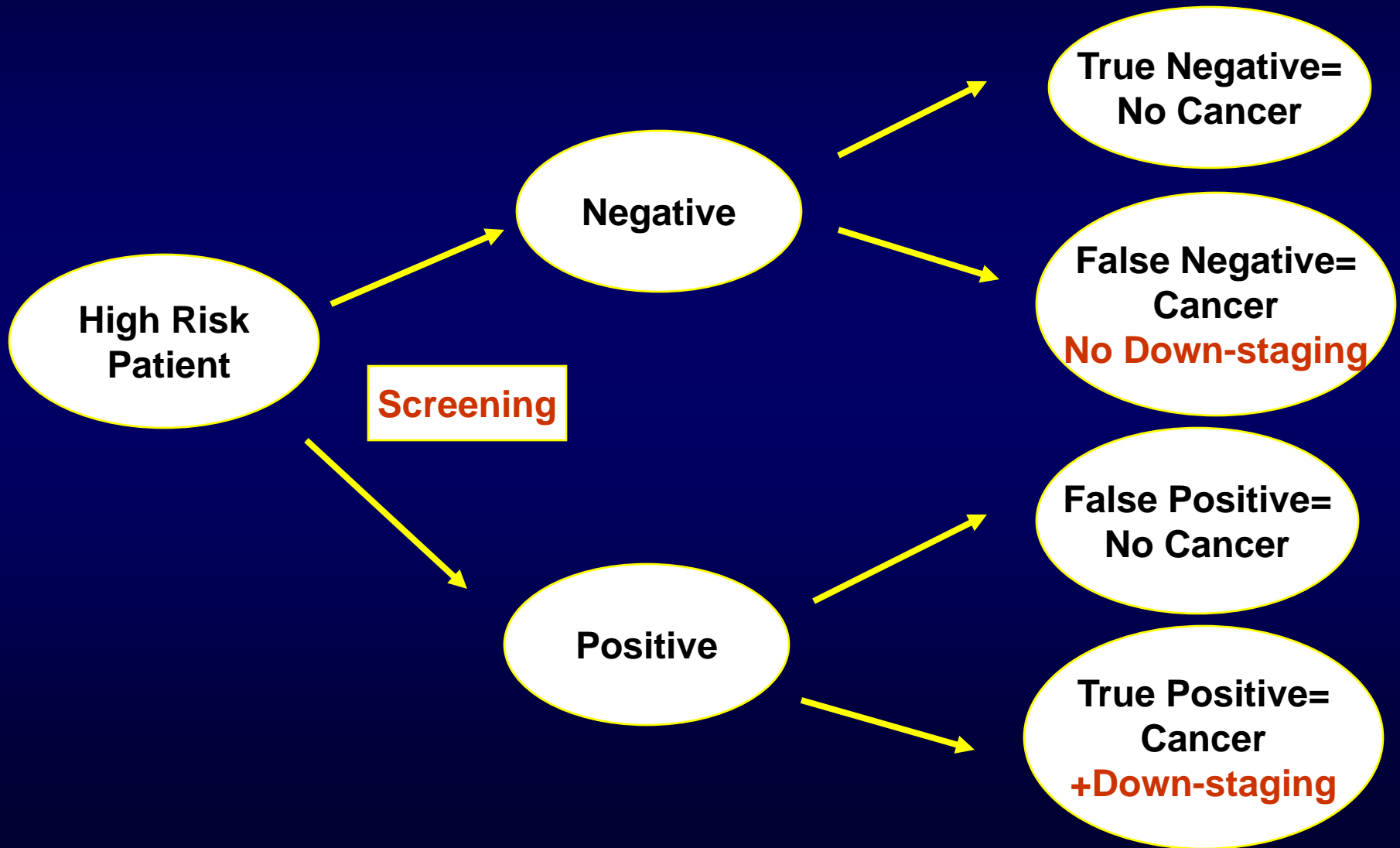
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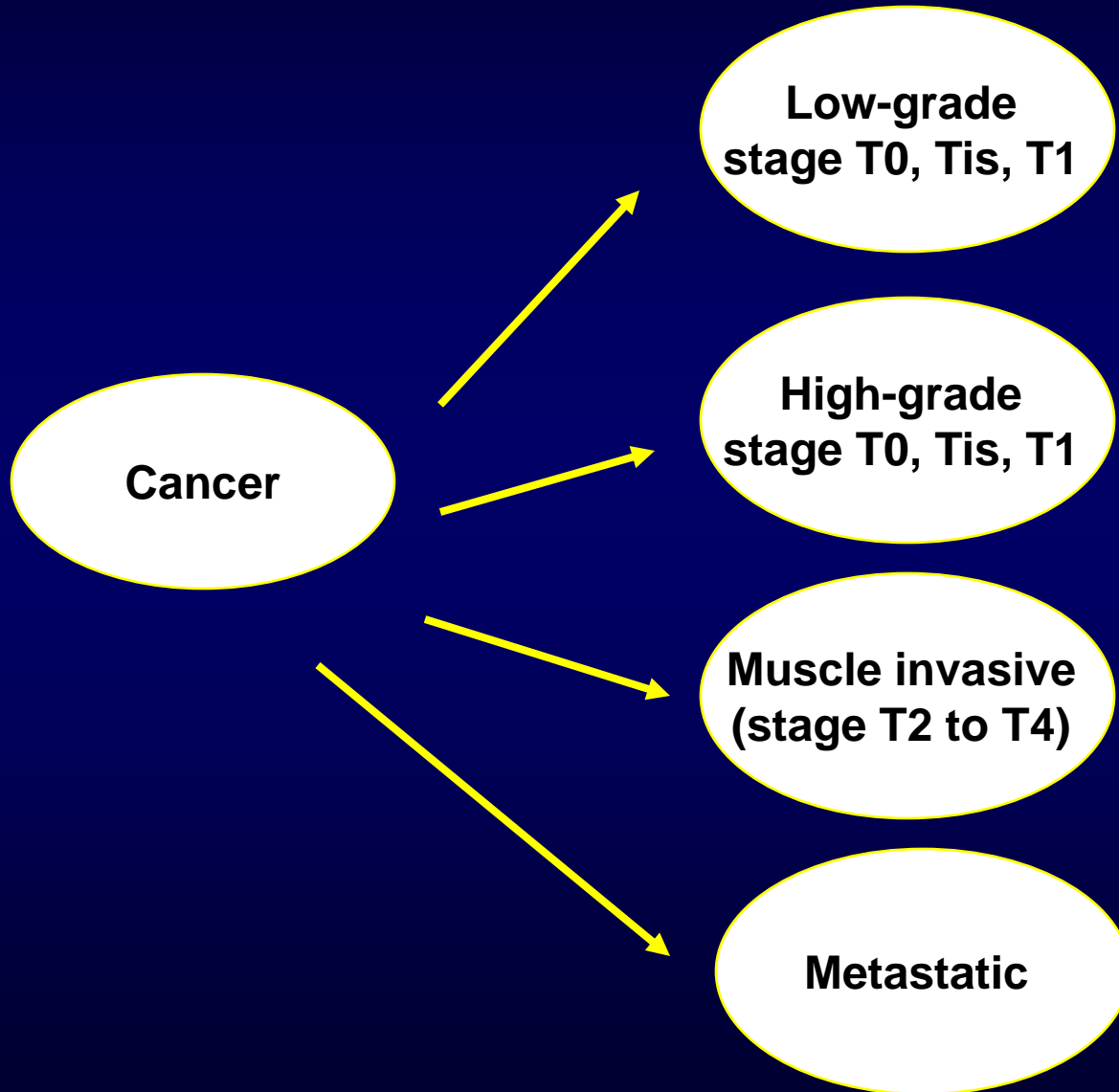
Should We Screen?

- **Prevalence**
 - 5th most common cancer
 - Known risk factors
- **Detection Methods**
 - Hgb dipstick, urine markers
 - BladderChek (NMP22): FDA approved for detection in high risk population
- **Survival Benefit**
 - 25% muscle-invasive at presentation
 - Less invasive cancers have better survival
- **Cost-effectiveness**

Markov Model



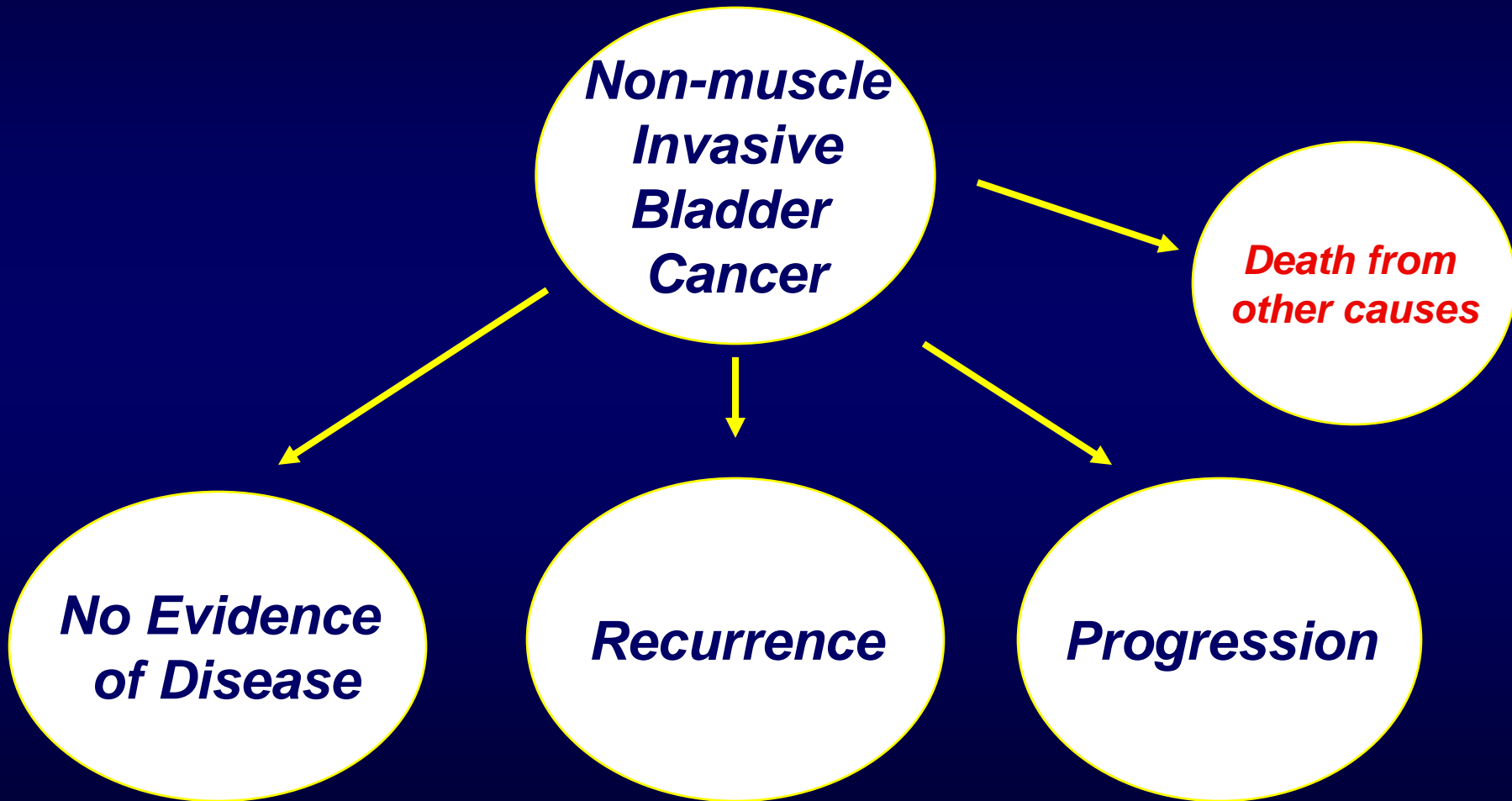
Markov Model



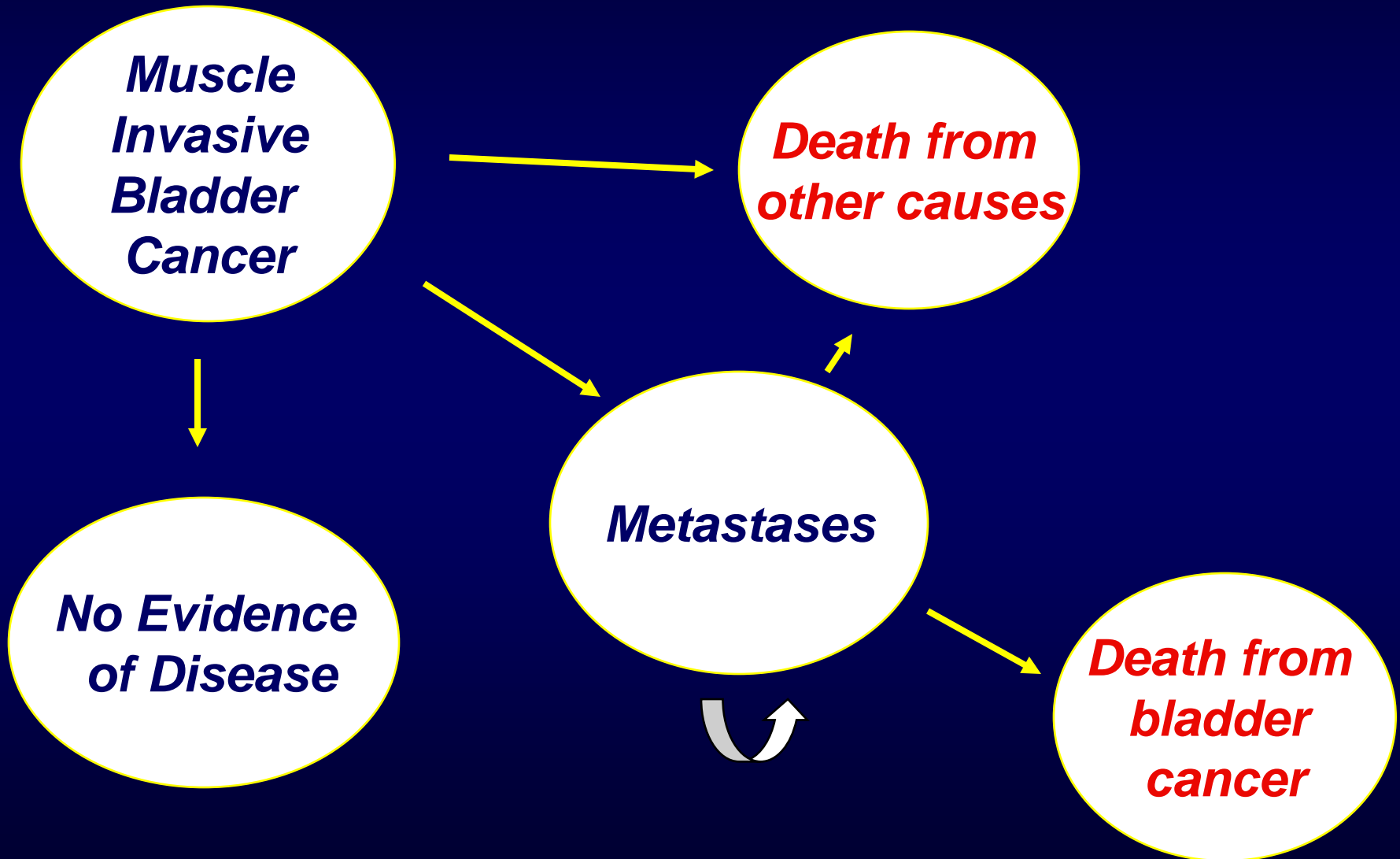
AJCC stage distribution: NCDB

Stage	%
0	44.3
1	28.9
2	12.9
3	7
4	7

Markov cycle



Markov cycle



BladderChek (NMP22) Screening

- 1331 patients with no Hx cancer:
 - Hx smoking
 - Symptoms: hematuria, dysuria
- Bladder cancer in 79 pts (6%)
 - Sens. 55.7%
 - Spec. 85.7%
 - PPV: 19.7%
 - NPV: 97%
- 60 yr olds with Hx smoking: PPV 37%

Grossman et al. JAMA 293, 2005

Hematuria Home Screening

- 1575 healthy men 50 years old or older tested urine with Hgb dipsticks for 14 days
- Mean Age: 65 years
- Smoking:
 - Current: 16%
 - Former: 44%

Messing et al. Urology Vol 45 (3), March 1995,
Pages 387-397

Grade and Stage in Screened and Unscreened Patients

Bladder Cancer: Grade and Stage	Unscreened	Screened
Low-Grade (1,2) Superficial (Ta,T1)	290 (57%)	11 (52.4%)
High-Grade (3) Superficial (Ta,T1, TIS)	99 (19.4%)	9 (42.9%)
Muscle Invasive or Greater	122 (23.9%)	1 (4.8%)
Totals	511	21

Model Assumptions

Variable	Base Case
Cancer Incidence	4%
Marker Accuracy	
Sensitivity	
Low grade	.61 (.35-.81)
High grade	.79 (.63-.89)
Specificity	.86 (.84-.88)
Down-staging with screening	50%
Yearly rate of death from other causes	0.65%

Lotan and Roehrborn. Urology 2003 Jan;61(1):109-18
Grossman et al. JAMA 293, 2005

Model Assumptions

	Yearly %				
	1	2	3	4	5
Recurrence: Non-muscle invasive					
Low Grade	30	10	5	5	5
High Grade	35	15	5	3	3
Progression: Non-muscle invasive					
Low Grade	4	2	2	1	1
High Grade	10	10	5	3	2
Progression to Metastases after Cystectomy	25	13	8	4	4
Death from Bladder Cancer in Patients with Metastatic Disease after Chemotherapy	42	80	50		

Herr. J Clin Oncol 1995
 Millan-Rodriguez F. J Urol 2000
 Lotan Y. J Clin Oncol 2005
 von der Maase. J Clin Oncol 2000

Heney NM. J Urol 1983
 Haukaas S. BJU Int 1999
 Stein JP. J Clin Oncol 2001

Model Costs

Cost Parameters	Base Case
NMP-22 test	\$24
Office cystoscopy	\$206
Cytology	\$56
Intravenous Pyelogram	\$126
CT scan Abdomen/pelvis	\$337
Office visit Level 3	\$55
TURBT	\$3,812
BCG	\$1,620
Cystectomy	\$22,292
Chemotherapy	\$43,000
Last 6 months of life	\$50,000
Discount Rate	3%

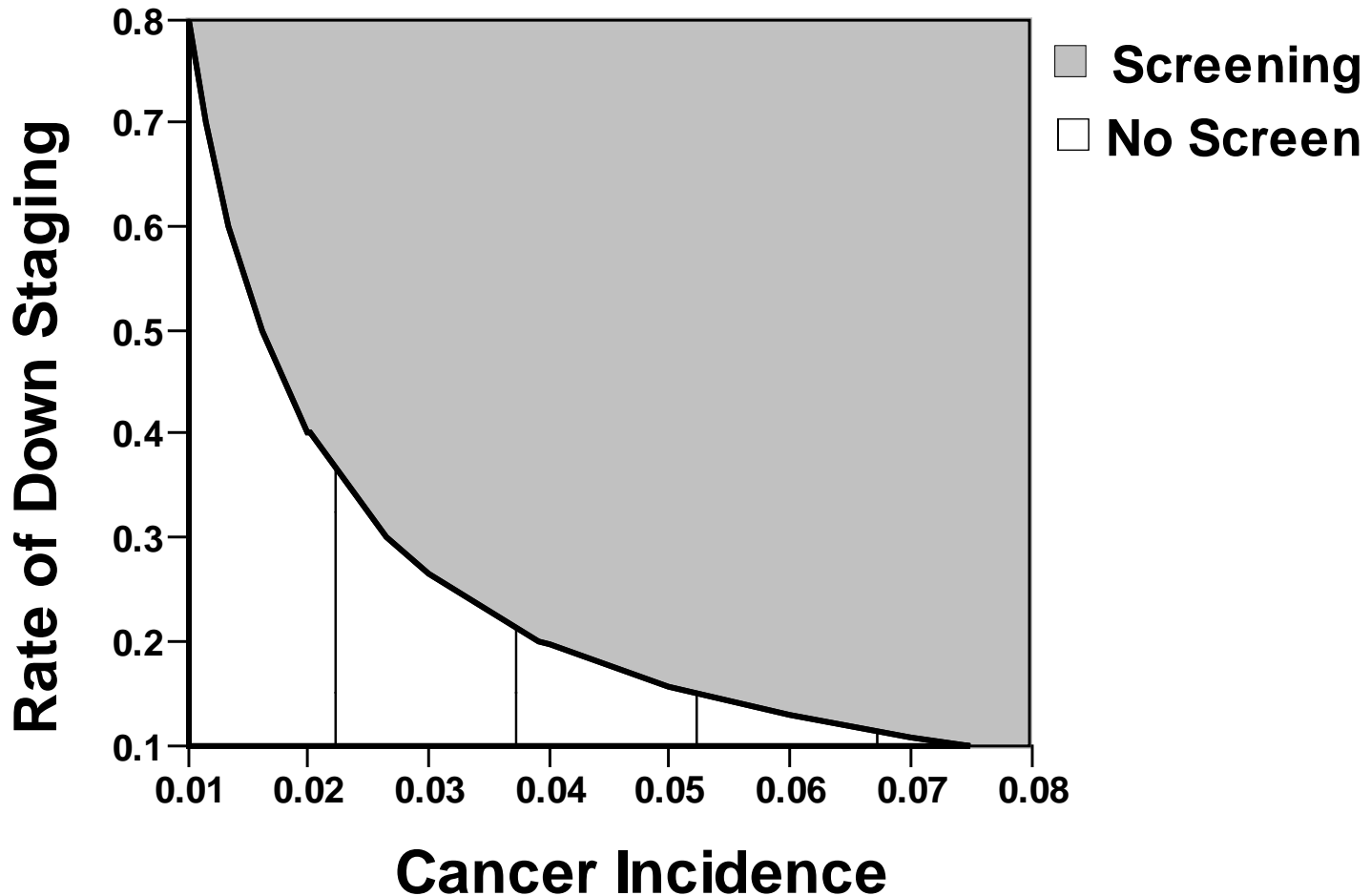
Model Outcomes

Cancer Incidence	Survival Benefit (LYS/1000)	CE (\$/LYS)	Cost Savings (\$ per 1000)
0.50%	0.37	126,366	
1%	0.75	34,841	
1.5%	1.12	4,333	
2%	1.49		16,000
3%	2.25		59,000
4%	3.00		101,000
5%	3.74		144,000
6%	4.49		185,000

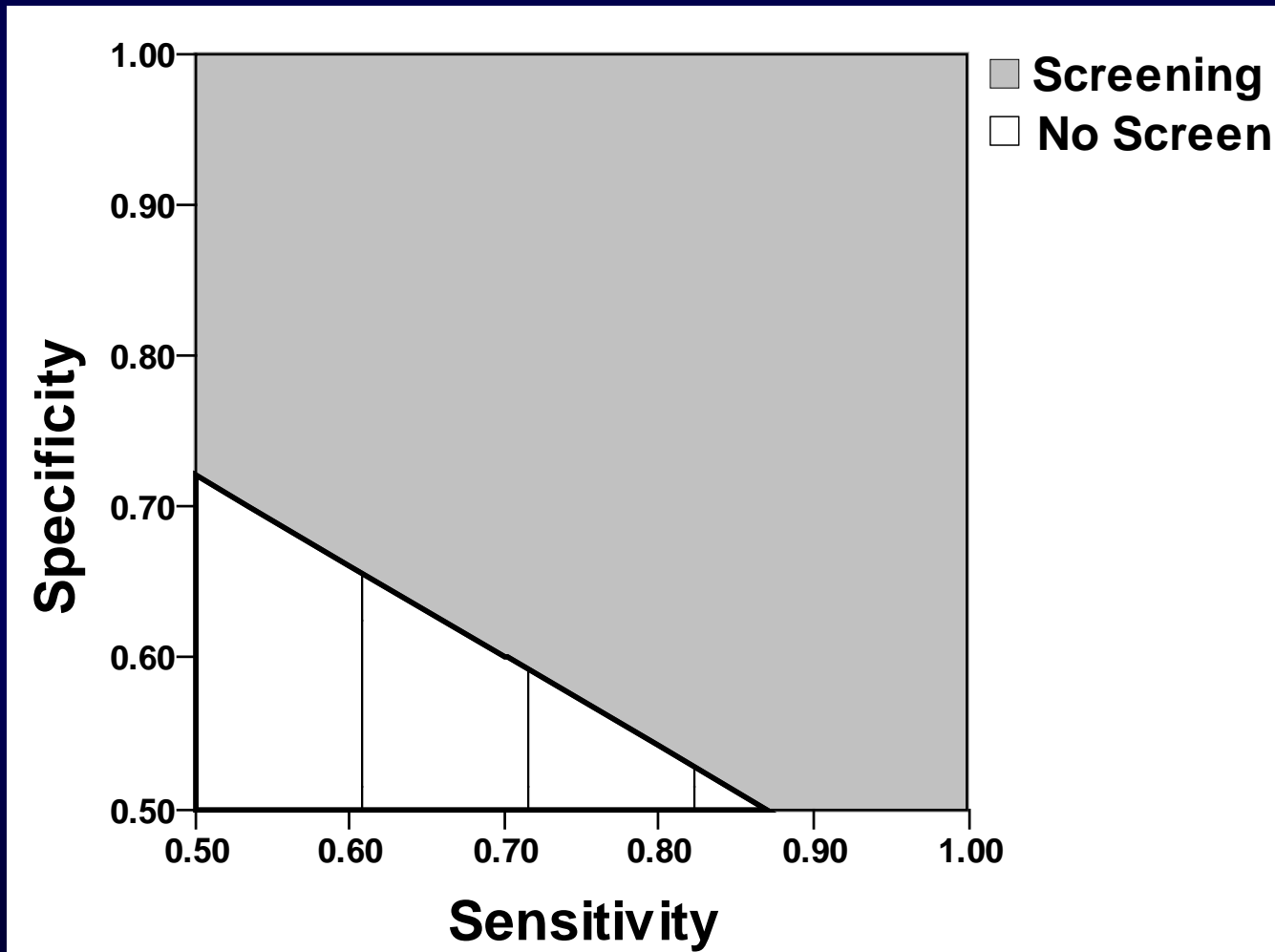
One-way Sensitivity Analyses

Variable	Base Case	Threshold
Cancer Incidence	4%	1.6%
Cost Parameters		
Screening test (NMP-22)	\$24	\$126
Office cystoscopy	\$206	\$694
Marker Accuracy		
Sensitivity		
Low grade	.61(.35-.81)	^
High grade	.79 (.63-.89)	26%
Specificity	.86 (.84-.88)	54%
Down-staging with screening	50%	20%

2-way Sensitivity Analysis



2-way Sensitivity Analysis



Varying Interval of Screening

- Base model: one-time screen
 - lack of data regarding yearly incidence rates of cancer after a negative prior screen.
- Annual Screen:
 - initial cancer incidence of 4%
 - subsequent yearly incidence of 0.1%
 - \$46,693/LYS
- Biannual Screen:
 - initial cancer incidence of 4%
 - subsequent yearly incidence of 0.1%
 - \$6,837/LYS
- **Since there are very few additional cancers detected, the incremental discounted life year gain is less than 0.1 years**

Cystoscopy and cytology as screening tool

- **Assume**
 - 95% sensitivity and specificity
 - cancer incidence of 4%
- **LYS: 3.6 per 1000**
- **CE: \$30,387/LYS**
- **A cancer incidence of only 1%**
 - \$291,000/LYS

Conclusions

- Model found that a urine-based marker such as bladderchek (NMP-22) can **reduce mortality** and **save costs** in a high risk population.
- Prospective trials needed to determine:
 - Cancer incidence in high risk populations
 - accuracy of bladder cancer detection in a completely asymptomatic cohort
 - Survival benefits of screening