

Risk-stratified surveillance protocol improves cost effectiveness after radical nephroureterectomy in patients with upper tract urothelial carcinoma

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Background:

To develop a surveillance protocol with improved cost-effectiveness after radical nephroureterectomy (RNU), as the cost-effectiveness of oncological surveillance after RNU remains unclear.

Methods:

We retrospectively evaluated 426 patients with RNU for upper tract urothelial carcinoma (UTUC) without distant metastasis at 4 hospital. Patients with routine oncological follow-up were stratified into normal-, high- and very high-risk groups according to a pathology-based protocol utilizing pathological stage, lymphovascular invasion (LVI) and surgical margin (SM). Cost-effectiveness of the pathology-based protocol was evaluated, and a risk score-based protocol was developed to optimize cost-effectiveness. Risk scores were calculated by adding risk factors independently associated with recurrence-free survival. Patients were stratified by low-, intermediate- and high-risk score. Estimated cost per recurrence detected by pathology-based and risk score based protocols was compared.

Results:

Of 426 patients, 109 (26%) and 113 (27%) experienced visceral and intravesical recurrences, respectively. The pathology-based protocol found significant differences in recurrence-free survival in the visceral recurrence but not in the intravesical recurrence. The medical costs per visceral recurrence detected were high, especially in normal-risk ($\leq pT2N0$, LVI-, SM-) patients. We developed a risk score associated with visceral recurrence using Cox regression analysis. The risk score-based protocol was significantly more cost-effective than the pathology-based protocol. Estimated cost differences reached \$747,929 per visceral recurrence detected, a suggested 55% reduction.

Conclusions:

A risk score-stratified surveillance protocol has the potential to reduce over investigation after RNU without adverse effects on medical.

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Background of patients

n	426
Age (years)	70 ± 8.9
ECOG-PS >1, n=	290 (68%)
Hypertension, n=	10 (2.3%)
Diabetes Mellitus (DM), n=	185 (43%)
Cardiovascular disease (CVD), n=	70 (16%)
Smoking, n=	75 (18%)
eGFR before surgery (ml/min/1.73m ²)	193 (45%)
Hydronephrosis, n=	58 ± 18
Neoadjuvant chemotherapy (NAC), n=	266 (62%)
Clinical stage	102 (24%)
≥cT3, n=	229 (54%)
cN+, n=	34 (8.0%)
Tumor location, n=	
Renal pelvis	166 (39%)
Ureter	235 (55%)
Multiple	25 (5.9%)
Laparoscopic surgery, n=	75 (18%)
Postoperative complications (G3 or higher), n=	14 (3.3%)
Pathological outcome, n=	
≥pT3	182 (43%)
pN+	30 (7.0%)
High grade	397 (93%)
Surgical margin (SM) positive	14 (3.3%)
Lymphovascular invasion (LVI) positive	127 (30%)
Median follow-up (Months)	40
Disease recurrence, n=	
Intravesical	113 (27%)
Visceral	109 (26%)
Deceased, n=	
Cancer-specific	80 (19%)
Any cause	103 (24%)

Multivariate analysis for risk score calculation

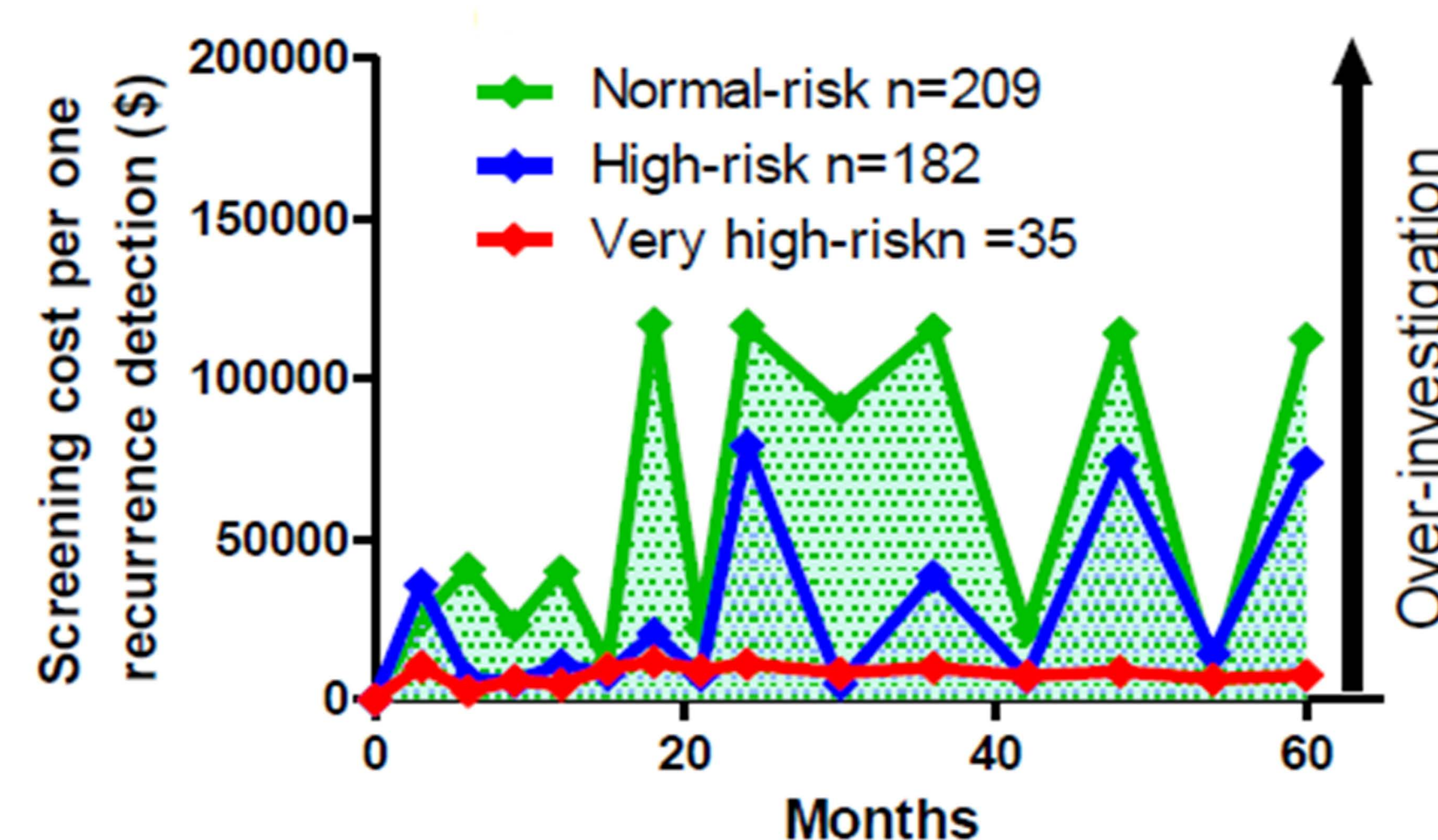
Factor	P value	HR	95% CI	Risk score
Tumor in ureter	<0.001	2.25	1.44-3.52	1
Hydronephrosis	<0.001	2.83	1.76-4.56	1
Lymph node involvement (cN+ or pN+)	<0.001	3.13	1.97-4.97	2
Preoperative CKD	<0.001	3.49	2.17-5.62	2
pT3-4	<0.001	4.52	2.96-6.89	2
LVI+	<0.001	4.68	3.18-6.89	2
SM+	<0.001	8.85	4.78-16.4	2

Low risk (0-2)
Intermediate risk (3-5)
Very high risk (6-12)

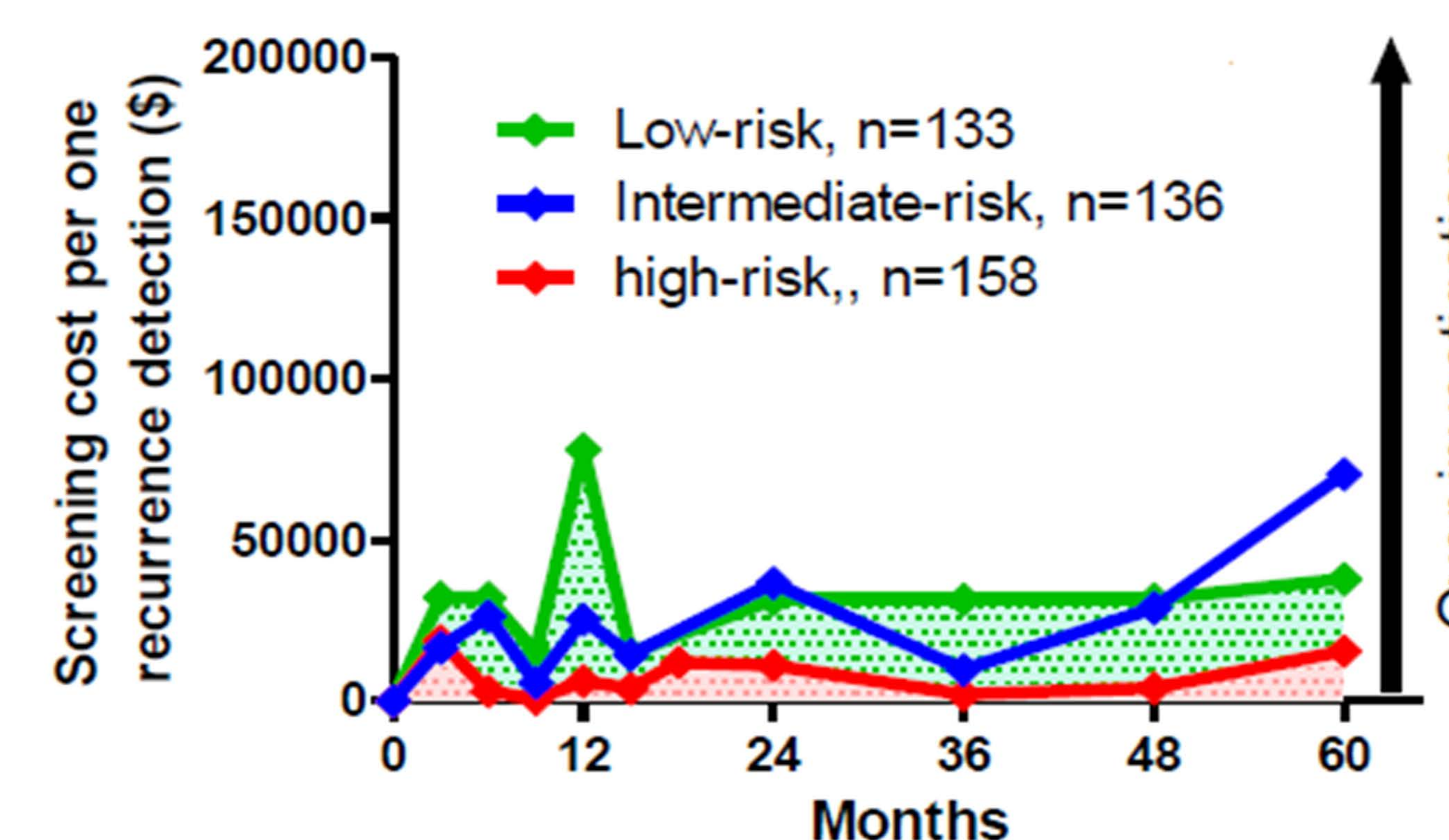
Risk score-based protocol

Risk-score-based	Months after RNU													
	3	6	9	12	15	18	21	24	30	36	42	48	54	60
Type of investigation														
Basic exam (blood and serum test, ultrasound, and chest X-ray)	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Urine analysis, cytology and cystoscope	•	•	•	•	•	•	•	•	•	•	•	•	•	•
CT scan of chest/abdomen/pelvis														
Low-risk (0-2)				•										•
Intermediate-risk (3-5)		•		•				•		•		•		•
Very high-risk (6-12)	•	•	•	•	•	•	•	•	•	•	•	•	•	•

Estimated screening cost (Pathology-based protocol)



Estimated screening cost (Risk score-based protocol)



Total surveillance cost for 5 years

