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**Abstract**

# A Web-Based Tool to Facilitate Shared Decision-Making Regarding Neoadjuvant Chemotherapy Use in Muscle-Invasive Bladder Cancer

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**Abstract**

**Background:** Urothelial bladder cancer kills over 16,000 people annually. Approximately 30% of affected patients have cancer cells invading the muscularis propria at the time of diagnosis. Standard management for muscle-invasive bladder cancer (MIBC) patients involves radical cystectomy and pelvic lymph node dissection. Approximately 50% of these patients will develop fatal metastatic recurrence. In an attempt to eradicate micrometastatic disease, neoadjuvant chemotherapy (NAC) was integrated into treatment. Even though studies show that this improves these patients' prognosis, population-based studies have demonstrated that NAC is still underutilized. The difficulty of predicting an individual patient's outcome with cystectomy alone and the potential added benefit with NAC was cited as a common reason for this.

**Objective:** The aim of this study is to develop a web-based app for MIBC patients treated with cystectomy, with or without NAC, designed to improve prediction and enhance communication of these patients' prognosis.

**Methods:** This study included patients from the National Cancer Database (2003 through 2011) who were diagnosed with MIBC and were subsequently treated with cystectomy. Patient, tumor, and facility-level predictors were incorporated in the outcome prediction model and a state-transition model was synthesized to calculate the 5-year death risk with and without NAC. Internal and external cross-validations were performed to validate the predictions. Using U.S. Life Tables, bladder cancer-specific and other cause mortality were distinguished from all cause mortality rates. The effect of NAC was integrated using a literature-derived hazard ratio (HR). Finally, a web-based tool was developed using the state transition model and usability testing was performed.

**Results:** A total of 9,824 patients who had MIBC and underwent cystectomy met the eligibility criteria and were included in the prediction model (Figure 1). Factors such as race, advanced age, higher clinical T stage, and higher comorbidity index were associated with shorter survival. On the other hand, factors like private insurance, higher income, and undergoing cystectomy at a higher volume facility were associated with longer survival. The prediction model was well-calibrated across geographical regions. Individualized survival estimates of each patient can be generated using the web-based app (BladderCancerRisk.org) by feeding in the predictor variables and a user-defined HR associated with the effect of NAC. The output of the tool is displayed using infographics (Figures 2 and 3). A cohort consisting of 13 clinicians field-tested the usability of the tool.

**Conclusions:** A web-based user-friendly app was developed for patients with MIBC treated with cystectomy, with or without NAC, which individualizes outcome prediction and communication in these patients, and may also facilitate physician-patient shared decision-making. This app can be easily accessed or prescribed by the physicians using the Rx Universe platform (a digital platform that enables physicians to directly "prescribe" evidence-based mobile health applications to patients).

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**KEYWORDS**

Muscle invasive bladder cancer; Radical cystectomy; Neoadjuvant chemotherapy; Mortality

**Figure 1.** Patients included in the analysis and reasons for patient exclusions.

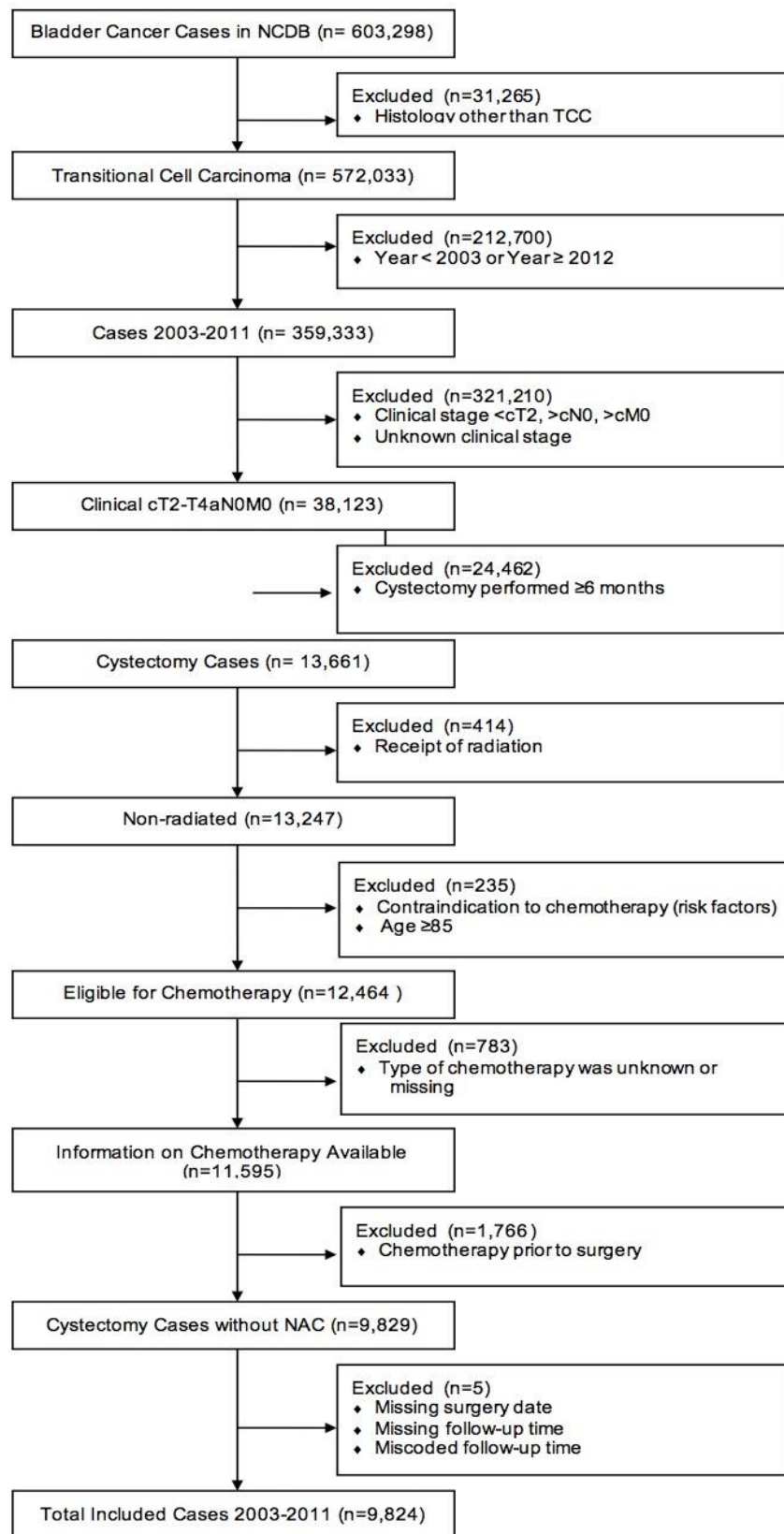


Figure 2. BladderRisk.org web-based prediction tool (a) data entry screen (b) infographics results output screen.

Figure 3. BladderRisk.org web-based prediction tool (a) data entry screen (b) infographics results output screen.



## Multimedia Appendix 1

Full poster.

[\[PDF File \(Adobe PDF File\), 1MB-Multimedia Appendix 1\]](#)

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