### Table S1 Demographic and clinicopathological characteristics by age at diagnosis in LN+ group

| Characteristics                                      | n (%)        | Age at diagnosis, years (percent within age group) | P    |
|------------------------------------------------------|--------------|---------------------------------------------------|------|
|                                                      |              | <50 | 50–59 | 60–69 | 70–79 | ≥80 |
| **Sex**                                              |              |     |       |       |       |     |
| Male                                                 | 2,393 (74.13)| 123 (72.35) | 456 (74.63) | 802 (76.53) | 704 (73.18) | 308 (70.48) | 0.137 |
| Female                                               | 835 (25.87)  | 47 (27.65)  | 155 (25.37)  | 246 (24.37)  | 258 (26.82)  | 129 (29.52)  |
| **Race**                                             |              |     |       |       |       |     |
| Caucasian                                            | 2,851 (88.32)| 141 (82.94) | 526 (86.09)  | 919 (87.69)  | 875 (90.96)  | 390 (89.24)  | 0.001 |
| African                                              | 216 (6.69)   | 20 (11.76)   | 58 (9.49)    | 73 (6.97)    | 48 (4.99)    | 17 (3.89)    |
| Other                                                | 144 (4.46)   | 8 (4.71)     | 25 (4.09)    | 48 (4.58)    | 34 (3.53)    | 29 (6.64)    |
| Unknown                                              | 17 (0.53)    | 1 (0.59)     | 2 (0.33)     | 8 (0.76)     | 5 (0.52)     | 1 (0.23)     |
| **Marital status**                                   |              |     |       |       |       |     |
| Married                                              | 1,986 (61.52)| 81 (47.65)   | 349 (57.12)  | 670 (63.93)  | 638 (66.32)  | 248 (56.75)  | <0.001 |
| Single                                               | 1,149 (35.59)| 85 (50.00)   | 242 (39.61)  | 351 (33.49)  | 295 (30.67)  | 176 (40.27)  |
| Unknown                                              | 93 (2.88)    | 4 (2.35)     | 20 (3.27)    | 27 (2.58)    | 29 (3.01)    | 13 (2.97)    |
| **Year of diagnosis**                                |              |     |       |       |       |     |
| 2004–2007                                            | 1,127 (34.91)| 71 (41.76)   | 229 (37.48)  | 356 (33.97)  | 346 (35.97)  | 125 (28.60)  | 0.053 |
| 2008–2011                                            | 1,089 (33.74)| 55 (32.35)   | 195 (31.91)  | 349 (33.30)  | 327 (33.99)  | 163 (37.30)  |
| 2012–2015                                            | 1,012 (31.35)| 44 (25.88)   | 187 (30.61)  | 343 (32.73)  | 289 (30.04)  | 149 (34.10)  |
| **Grade**                                            |              |     |       |       |       |     |
| I                                                    | 16 (0.50)    | 3 (1.76)     | 3 (0.49)     | 1 (0.10)     | 6 (0.62)     | 3 (0.69)     | 0.052 |
| II                                                   | 64 (1.98)    | 6 (3.53)     | 12 (1.96)    | 23 (2.19)    | 13 (1.35)    | 10 (2.29)    |
| III                                                  | 982 (30.42)  | 55 (32.35)   | 201 (32.90)  | 338 (32.35)  | 262 (27.23)  | 126 (28.23)  |
| IV                                                   | 2,048 (63.44)| 102 (60.00)  | 376 (61.54)  | 651 (62.12)  | 637 (62.22)  | 282 (64.53)  |
| Unknown                                              | 118 (3.66)   | 4 (2.35)     | 19 (3.11)    | 35 (3.34)    | 44 (4.57)    | 16 (3.66)    |
| **Histology**                                         |              |     |       |       |       |     |
| Pure UC                                              | 3,010 (93.25)| 145 (85.29)  | 574 (93.94)  | 984 (93.89)  | 901 (93.66)  | 406 (92.91)  | <0.001 |
| Variant histology (total)                            | 218 (6.75)   | 25 (14.71)   | 37 (6.06)    | 64 (6.11)    | 61 (6.34)    | 31 (7.09)    |
| Squamous cell                                        | 75 (2.32)    | 9 (5.29)     | 17 (2.78)    | 18 (1.72)    | 18 (1.87)    | 13 (2.97)    |
| Neuroendocrine                                       | 65 (2.01)    | 3 (1.76)     | 5 (0.82)     | 23 (2.19)    | 26 (2.70)    | 8 (1.83)     |
| Adenocarcinoma                                       | 37 (1.15)    | 8 (4.71)     | 5 (0.82)     | 13 (1.24)    | 8 (0.83)     | 3 (0.69)     |
| Other VH                                             | 41 (1.27)    | 5 (2.94)     | 10 (1.64)    | 10 (0.95)    | 9 (0.94)     | 7 (1.60)     |
| **T stage**                                          |              |     |       |       |       |     |
| NMIBC (Tis + Ta + T1)                                | 67 (2.08)    | 9 (5.29)     | 14 (2.29)    | 20 (1.91)    | 21 (2.18)    | 3 (0.69)     | <0.001 |
| T2                                                   | 653 (20.23)  | 40 (23.53)   | 141 (23.08)  | 231 (22.04)  | 192 (19.96)  | 49 (11.21)   |
| T3                                                   | 1,558 (48.27)| 68 (40.00)   | 291 (47.63)  | 488 (46.56)  | 458 (47.61)  | 253 (57.89)  |
| T4                                                   | 950 (29.43)  | 53 (31.18)   | 165 (27.00)  | 309 (29.48)  | 291 (30.25)  | 132 (30.21)  |
| LNE, median (IQR)                                    | 14 (8.23)    | 16.5 (8.29)  | 16 (9.25)    | 15 (8.24)    | 13 (8.22)    | 12 (6.20)    | <0.001 |
| **Chemotherapy**                                     |              |     |       |       |       |     |
| No/unknown                                           | 1,418 (43.93)| 46 (27.06)   | 191 (31.26)  | 373 (35.59)  | 474 (49.27)  | 334 (76.43)  | <0.001 |
| Yes                                                  | 1,810 (56.07)| 124 (72.94)  | 420 (68.74)  | 675 (64.41)  | 488 (50.73)  | 103 (23.57)  |

LN+, lymph node positivity; UC, urothelial carcinoma; VH, variant histology; NMIBC, non-muscle-invasive bladder cancer; IQR, interquartile range.
| Age at diagnosis | Overall survival | Cancer specific survival |
|------------------|------------------|-------------------------|
|                  | HR (95% CI)      | P value          | HR (95% CI)       | P value          |
| <50              | 0.643 (0.519–0.798) | <0.001         | 0.754 (0.593–0.960) | 0.022          |
| 50–59            | 0.771 (0.668–0.890) | <0.001         | 0.820 (0.693–0.969) | <0.020          |
| 60–69            | 0.723 (0.636–0.823) | <0.001         | 0.731 (0.628–0.852) | <0.001          |
| 70–79            | 0.896 (0.790–1.917) | 0.090          | 0.890 (0.766–1.035) | 0.129          |
| ≥80              | 1.000 (reference)         | 1.000 (reference) | 1.000 (reference)         |

LN+, lymph node positive; HR, hazard ratio; CI, confidence interval.