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Introduction

The COVID-19 pandemic impacted healthcare services, including cancer diagnostics and management.

Individuals with cancer were observed to have a higher risk of severe events (a composite endpoint defined as the percentage of patients being admitted to the intensive care unit requiring invasive ventilation or death) when compared with non-cancer patients (seven [39%] of 18 patients vs 124 [8%] of 1572 patients; Fisher's exact p=0.0003). (1)
 Cancer diagnostics and surgery have been disrupted by the response of healthcare services to the coronavirus disease 2019 (COVID-19) pandemic. Progression of cancers while treatment is delayed can lead to an impact on patients' long-term survival. (2)

This study analyzes the effects of COVID-19 on mean Time to Treatment Initiation (TTI) for breast, colon-rectal, non-small cell lung (NSCLC), and prostate cancers.

Methods

Retrospective cohort study analyzing changes in mean TTI at an academic center from January 2018 to December 2023. "Pre-COVID" defined as Jan 2018 – Mar 2020; "COVID" as Mar 2020 - Feb 2021; and "Post-COVID" from Mar2021 - Dec2023. ANOVA, chi-square, or Fisher's exact tests were used to test for differences.

Results

The cohort comprised 2671 breast, 933 colon-rectal, 1829 NSCLC, and 1739 prostate cancers. (Table 1) TTI was 34.7, 31.3, and 39.9 days (p<0.001) for breast in the pre-COVID, COVID, and post-COVID periods. For colon-rectal, TTI was 27.2, 27.6, and 34.8 days in the three analyzed periods (p=0.007). NSCLC was 43.1, 46.0, and 55.6 days (p<0.001), and prostate was 66.7, 56.6, and 70.7 days (p=0.006). (Table 2)

Considering Surgery as first treatment, NSCLC and prostate showed important increase in TTI. (Figure 1) For chemotherapy the Median TTI was higher in the post-covid for colon-rectal and prostate. (Figure 2)

Results

Table 1. Demographic characteristics of study cohort for non-metastatic breast, colon-rectal, non-small cell lung (NSCLC) and prostate 2018 to 2023.

| | Non-metastatic breast n=2671 | Colon-rectal n=933 | Non-small cell lung n=1829 | Prostate n=1739 |
|---|---------------------------------|-----------------------|-------------------------------|--------------------|
| Age [Mean(SD)] | 61.9 (12.6) | 64.6 (14.0) | 70.1 (9.8) | 67.1 (8.2) |
| | n (%) | n (%) | n (%) | n (%) |
| Female | 2656 (99) | 437 (47) | 1000 (55) | 0 (0) |
| Race | | | | |
| White | 2321 (87) | 824 (88) | 1691 (92) | 1497 (86) |
| Black | 95 (3.6) | 36 (3.9) | 37 (2.0) | 138 (7.9) |
| Others | 249 (9.3) | 73 (7.8) | 100 (5.5) | 94 (5.4) |
| Hispanic Origin | 247 (9.3) | 73 (7.8) | 79 (4.3) | 114 (6.6) |
| Tobacco status | | | | |
| Current smoker | 289 (11) | 145 (16) | 760 (42) | 208 (12) |
| Never used | 1451 (54) | 438 (47) | 138 (7.6) | 833 (48) |
| Previous use | 929 (35) | 347 (37) | 929 (51) | 688 (40) |
| Primary insurance | | | | |
| Medicaid | 399 (15) | 178 (19) | 198 (11) | 182 (10) |
| Medicare | 1178 (44) | 458 (49) | 1296 (71) | 949 (55) |
| HMO_PPO | 1075 (40) | 283 (30) | 302 (17) | 573 (33) |
| Military | 1 (0.04) | 2 (0.2) | 20 (1.1) | 16 (0.9) |
| Other | 7 (0.3) | 1 (0.1) | 0 (0) | 1 (0.1) |
| Non-specified | 9 (0.3) | 11 (1.2) | 13 (0.7) | 17 (1.0) |
| None | 2 (0.1) | 0 (0) | 0 (0) | 1 (0.1) |
| Histology | | | | |
| Adenocarcinoma | 2449 (92) | 894 (96) | 1094 (60) | 1707 (98) |
| Large cell carcinoma | 15 (0.6) | 0 (0) | 19 (1.0) | 0 (0) |
| Non-small cell carcinoma | 151 (5.7) | 16 (1.7) | 258 (14) | 27 (1.6) |
| Sarcomatoid carcinoma | 3 (0.1) | 0 (0) | 6 (0.3) | 0 (0) |
| Small cell carcinoma | 3 (0.1) | 1 (0.1) | 0 (0) | 5 (0.3) |
| Squamous cell carcinoma | 0 (0) | 1 (0.1) | 452 (25) | 0 (0) |
| Other | 50 (1.9) | 21 (2.3) | 0 (0) | 0 (0) |
| Clinical stage | | | | |
| Stage 0 to 2C | 1861 (70) | 105 (11) | 927 (51) | 1137 (65) |
| Stage 3A to 4C | 190 (7.1) | 275 (29) | 748 (41) | 468 (27) |
| None | 50 (1.9) | 9 (1.0) | 12 (0.7) | 17 (1.0) |
| N/A | 29 (1.1) | 4 (0.4) | 85 (4.7) | 1 (0.1) |
| Unknown | 541 (20) | 540 (58) | 57 (3.1) | 116 (6.7) |
| Time to treatment initiation [Mean(SD)] | 36.7 (26.6) | 30.6 (35.9) | 49.6 (46.3) | 67.1 (62.5) |
| One year survival | 97.37% | 84.68% | 69.38% | 96.91% |
| First treatment | | | | |
| Chemo | 261 (9.8) | 306 (33) | 372 (20) | 540 (31) |
| Radiation | 25 (0.9) | 25 (2.7) | 722 (39) | 595 (34) |
| Surgery | 2385 (89) | 602 (65) | 735 (40) | 604 (35) |

Table 2. Time to Treatment Initiation (TTI) and characteristics of study cohort for non-metastatic breast, colon-rectal, non-small cell lung (NSCLC) and prostate by COVID period, 2018 to 2023.

| | Non-metastatic breast | | | | Colon-rectal | | | | Non-small cell lung | | | | Prostate | | | |
|--|-----------------------|-------------|-------------|---------|--------------|-------------|-------------|---------|---------------------|-------------|-------------|---------|-------------|-------------|-------------|---------|
| | Pre-COVID | COVID | Post-COVID | p-value | Pre-COVID | COVID | Post-COVID | p-value | Pre-COVID | COVID | Post-COVID | p-value | Pre-COVID | COVID | Post-COVID | p-value |
| | n=965 | n=421 | n=1285 | | n=375 | n=149 | n=409 | | n=639 | n=302 | n=888 | | n=617 | n=264 | n=858 | |
| Age, mean (std) ¹ | 62.0 (12.9) | 61.0 (12.5) | 62.2 (12.5) | 0.230 | 64.7 (14.3) | 65.3 (15.0) | 64.1 (13.4) | 0.650 | 70.0 (9.8) | 69.6 (9.5) | 70.3 (9.8) | 0.510 | 66.6 (8.2) | 66.5 (8.6) | 67.7 (8.0) | 0.022 |
| Female, n (%) ² | 960 (99) | 418 (99) | 1278 (99) | 0.900 | 189 (51) | 76 (51) | 192 (47) | 0.470 | 339 (53) | 169 (56) | 492 (55) | 0.590 | 0 | 0 | 0 | n/a |
| White race, n (%) ² | 863 (96) | 372 (97) | 1086 (96) | 0.330 | 333 (96) | 134 (98) | 357 (95) | 0.420 | 605 (98) | 268 (97) | 818 (98) | 0.720 | 536 (91) | 223 (93) | 738 (91) | 0.840 |
| Hispanic ethnicity, n (%) ² | 83 (8.7) | 53 (7.8) | 131 (10) | 0.220 | 20 (5.3) | 12 (8.1) | 41 (10) | 0.048 | 19 (3.0) | 13 (4.3) | 47 (5.3) | 0.090 | 35 (5.7) | 24 (9.1) | 65 (6.5) | 0.170 |
| Public insurance, n (%) ² | 572 (59) | 243 (58) | 762 (59) | 0.820 | 240 (64) | 111 (75) | 285 (70) | 0.045 | 517 (81) | 243 (80) | 734 (83) | 0.570 | 382 (62) | 158 (60) | 591 (69) | 0.003 |
| Clinical stage 0 to 3C, n (%) ² | 505 (95) | 358 (97) | 1093 (95) | 0.460 | 84 (60) | 39 (56) | 97 (57) | 0.800 | 372 (66) | 195 (70) | 611 (73) | 0.010 | 506 (88) | 224 (89) | 668 (86) | 0.280 |
| Days to treatment, mean (std) ¹ | 34.7 (27.2) | 31.3 (22.8) | 39.9 (26.8) | 0.001 | 27.2 (28.6) | 27.6 (26.8) | 34.8 (43.7) | 0.007 | 43.1 (43.3) | 46.0 (51.4) | 55.6 (45.9) | 0.001 | 66.7 (64.7) | 56.6 (63.4) | 70.7 (60.4) | 0.006 |

¹ANOVA to test means ²Chi-square or Fisher's exact test

Conclusion

The coronavirus disease 2019 (COVID-19) pandemic posed insurmountable challenges to healthcare systems globally. Cancer therapy is complex, and outcomes are centered on timing.

The time to treatment initiation TTI was affected by COVID-19, and its effects varied according to the type of cancer. For all cancer analyzed the TTI was statistically higher in the Post-COVID. This might indicate the long-term impact of the pandemic in the health systems. Future studies should quantify the effects of increasing TTI on upstaging and survival.

References

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- (2) Thoracic Surgery Outcomes Research Network, Inc. COVID-19 Guidance for Triage of Operations for Thoracic Malignancies: A Consensus Statement from Thoracic Surgery Outcomes Research Network. Ann Thoracic Surg. April 2020;

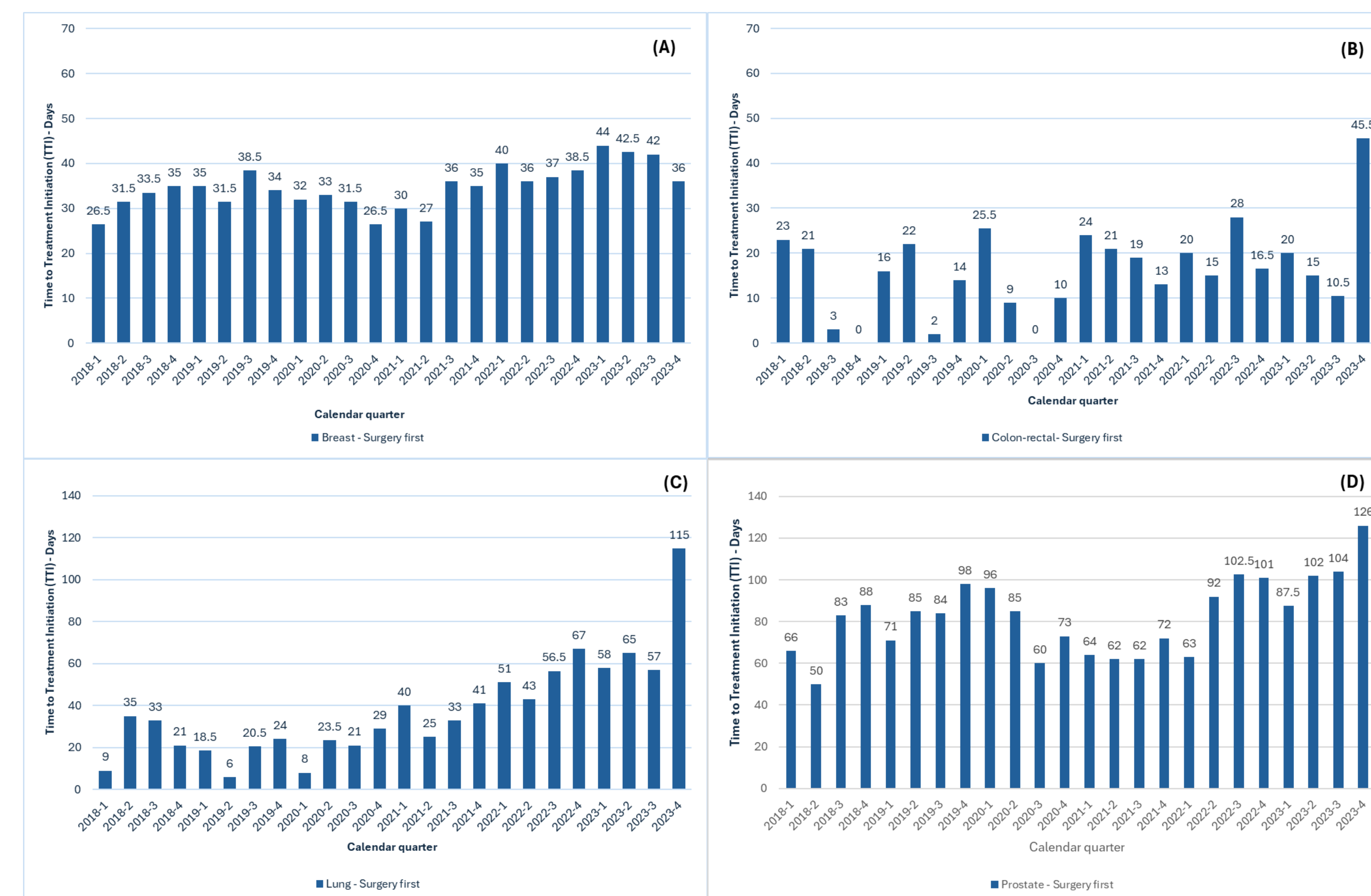


Figure 1. Median Time to Treatment Initiation (TTI) for surgery as first treatment for breast (A), colon rectal (B), non-small cell lung (NSCLC) (C) and prostate (D) per quarter, 2018 to December 2023.

Figure 2. Median Time to Treatment Initiation (TTI) for Chemotherapy as first treatment for breast (A), colon rectal (B), non-small cell lung (NSCLC) (C) and prostate (D) per quarter, 2018 to December 2023.

