

Cancer care inequities in the carceral system: diagnostic and treatment pathways in North Carolina

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Abstract

Background

Cancer is the leading cause of death among incarcerated populations in the United States (U.S.). Structural barriers, comorbidities, and fragmented correctional healthcare systems may delay diagnosis and treatment. Few studies have systematically examined treatment patterns or the time of initiation of cancer therapy in this population. We examined diagnostic and treatment pathways among incarcerated patients with cancer in North Carolina.

Methods

We conducted a retrospective cohort study of adults aged 18–75 years with solid tumors who were incarcerated in the North Carolina state prison system and treated at a large tertiary cancer center between 2014 and 2023. Electronic health records were linked to the hospital cancer registry to capture diagnosis dates, cancer type, treatment modality, and timing of therapy initiation. Time from diagnosis to first treatment was calculated overall and by modality (surgery, radiation, chemotherapy, hormone therapy, and immunotherapy). We evaluated treatment patterns and time to initiation, including a subgroup of patients diagnosed at the tertiary cancer center, using descriptive statistics and Kaplan-Meier methods.

Results

Among 697 patients, cancers of the genitourinary, gastrointestinal, and lung/pulmonary systems were most common. Over 40% had no documented cancer-directed treatment at the tertiary cancer center within one year of diagnosis. Among those treated, the mean time to first treatment was 68 days, longest for local therapies (surgery and radiation; 74 days) and shortest for systemic therapies (chemotherapy, hormone therapy, and immunotherapy; 53 days). In analyses limited to patients diagnosed at the tertiary cancer center, mean time to treatment initiation was 76 days, with modality patterns similar to those observed in the overall cohort.

Conclusions

Cancer care for incarcerated patients in one Southeastern U.S. state was characterized by prolonged time to treatment initiation and a high proportion without documented cancer-directed treatment within one year of diagnosis. These findings may reflect care fragmentation during incarceration or following community reentry. Diagnostic pathways shape treatment delivery, highlighting carceral barriers to specialized cancer care. Strengthening data infrastructure, standardizing referral pathways, and

implementing coordinated care policies are essential to advance timely, equitable cancer treatment at the intersection of public health and justice imperatives.

Background

Nearly two million people are incarcerated in the United States (U.S.) across federal, state, local, and tribal systems, representing the largest carceral population in the world (Sawyer & Wagner, 2025). Over the past decade, cancer has surpassed heart disease as the leading cause of illness-related death in state prisons (Aziz et al., 2021; Carson, 2021; Zhao, Kajeepeta, et al., 2025). Mass incarceration represents a distinct social and structural determinant of health (Ramaswamy et al., 2023; Wildeman & Wang, 2017), and is associated with numerous adverse health outcomes (Massoglia & Pridemore, 2015; National Academies of Sciences et al., 2019; Nowotny & Kuptsevykh-Timmer, 2018; Schnittker et al., 2011; Wildeman & Wang, 2017). Cancer prevalence is rising among incarcerated individuals, who face poorer outcomes than the general population, yet evidence on their cancer treatment remains limited (Manz et al., 2021; Oladeru et al., 2022; Richman et al., 2024).

The U.S. prison population is aging and disproportionately composed of individuals from socioeconomically disadvantaged communities, which compounds health risks (American Civil Liberties Union, 2012; Freudenberg et al., 2005; Geller & Curtis, 2011; Wilper et al., 2009). Approximately 15% of the U.S. incarcerated population is now aged 55 or older, highlighting the growing burden of age-related diseases, including cancer (Widra, 2023). Access to timely, high-quality cancer care is challenging in correctional settings, where most prisons rely on external hospital and tertiary care centers for specialty treatments, such as surgery, chemotherapy, and radiation (Burkett et al., 2023; Huh et al., 2018; McKillop, 2018). While these centers may offer access to comprehensive cancer services, relying on off-site care introduces logistical and financial barriers, complicates coordination, and can delay treatment initiation (Aziz et al., 2021; Sunthakar et al., 2020). Limitations in transportation, communication across health systems, and state-funded healthcare resources further exacerbate these challenges (Burkett et al., 2023).

Behavioral and clinical risk factors, including higher prevalence of smoking, alcohol use, substance use, and comorbidities, may also contribute to later-stage cancer diagnoses and poorer outcomes among incarcerated populations (Manz et al., 2021; Valera et al., 2019). Despite a constitutional right to healthcare established in *Estelle v. Gamble* (Roberts, 1978), incarcerated individuals often face systemic barriers that limit timely access to quality care (Huh et al., 2018; Thamm et al., 2025). The exclusion of incarcerated populations from national cancer registries and prospective studies has hindered research on treatment patterns and outcomes in this population (Oladeru et al., 2019; Sinha & White, 2017; Wang et al., 2019; Zhao, Bradley, et al., 2025).

Recent efforts to link state cancer registry data with Department of Corrections records offer unique opportunities to study cancer outcomes among incarcerated patients, including diagnosis stage, treatment initiation, and survival. These linkage projects remain limited to a small number of states –

most notably Massachusetts and Connecticut – and are logistically complex (Oladeru et al., 2022; Puglisi et al., 2021; Zhao, Bradley, et al., 2025), but they provide critical infrastructure for examining disparities in cancer care within correctional systems. While these data sources primarily serve as foundation datasets rather than reporting treatment delays or mean time to therapy, they lay essential groundwork for studies focused on treatment patterns, timeliness of care, and the role of diagnostic pathways in shaping cancer outcomes.

Despite growing recognition of cancer as a major cause of morbidity and mortality in carceral settings, research on cancer treatment patterns and timeliness of care for incarcerated populations remains limited (Manz et al., 2021). To address this gap, we examined cancer treatment initiation among incarcerated patients receiving care at a large tertiary cancer center in North Carolina, with particular attention to whether the diagnostic pathway was associated with delays in treatment.

Methods

Study Design and Setting

We conducted a retrospective cohort study of adult patients (≥ 18 years) diagnosed with or treated for solid organ cancer at the North Carolina Basnight Cancer Hospital or at an affiliated University of North Carolina (UNC) Health system center between April 14, 2014 and April 14, 2023. The Basnight Cancer Hospital, part of the UNC Health system, is a designated safety-net hospital and the primary referral center for individuals incarcerated within the North Carolina Department of Adult Corrections (formerly the Department of Public Safety). Most patients received care at Basnight, though some were treated at affiliated UNC Health System centers.

Data Sources and Linkage

De-identified electronic health record (EHR) data were obtained through the North Carolina Translational and Clinical Sciences (NC TraCS) Institute. Eligible patients had at least one EHR-documented encounter related to cancer diagnosis or treatment. NC TraCS staff linked EHR records with the hospital cancer registry using a combined deterministic and probabilistic matching approach. Deterministic linkage was used to identify such items as medical record number, name, date of birth, social security number, and partial MRNs; unmatched records underwent probabilistic linkage and manual review to resolve discrepancies.

Cancer treatment information, including surgery, chemotherapy, radiation therapy, hormone therapy, and immunotherapy, was abstracted from both EHR data and the hospital cancer registry. Because registry data are standardized and more complete for patients receiving care across multiple systems, the registry was prioritized as the reference source for treatment dates. EHR-derived treatment encounters were validated using Common Procedure Terminology (CPT) codes and provider documentation. A patient was classified as receiving a specific treatment modality if at least one relevant CPT-coded

encounter occurred after diagnosis. For surgical treatments, a member of the research team reviewed EHR and registry documentation to confirm that procedures represented initial cancer-directed surgery rather than diagnostic or subsequent operations.

Study Population

Incarceration history was identified through EHR documentation of insurance or payor status (e.g., “Department of Public Safety” or “Department of Adult Corrections”). Individuals were classified as having an incarceration history if they were incarcerated at any hospital encounter during the study period, independent of the timing of their cancer diagnosis or treatment. Timing of incarceration relative to diagnosis was verified using direct EHR review and Department of Adult Corrections billing records. It is possible that a number of patients receiving cancer care might have been incarcerated in local jails or federal prisons, rather than the state facilities. However, this is unlikely to represent a substantial number of patients due to the systems of care that exist within the state. Through a process called “safekeeping,” local jails may send individuals whose medical needs they are unable to meet to be housed and receive medical care in state prison facilities (“Transfer of prisoners when necessary for safety and security; application of section to municipalities,” 2019). Patients sent for safekeeping to receive cancer care would thus be in the custody of the Department of Adult Corrections rather than that of their local jail. Further, the Federal Bureau of Prisons operates an administrative security federal medical center that provides cancer care within the boundaries of North Carolina. As a result, patients needing cancer care during incarceration in a federal facility would receive the bulk of their care at the federal medical center, rather than at a UNC facility.

Of the 913 incarcerated adults diagnosed or treated for cancer at UNC, we excluded patients with multiple primary cancers ($n = 4$); non-solid tumors, skin cancers, or unknown tumor types ($n = 154$); and diagnoses before 18 years of age or after 75 years of age. Patients more than 75 years of age were excluded to reduce treatment variation attributable to age-related changes in treatment intent and clinical decision-making. We also excluded individuals diagnosed before or at an indeterminate time relative to incarceration who lacked incarceration-related healthcare encounters near the time of diagnosis ($n = 36$). Our final analytic sample included 697 incarcerated cancer patients (Fig. 1).

Outcome Ascertainment

Time to cancer treatment was defined as the number of days between the documented cancer diagnosis date and initiation of the first treatment, regardless of modality. Analyses were limited to 304 patients who received at least one cancer treatment at UNC within one year (defined as 365 days) of diagnosis and whose diagnosis and treatment did not occur on the same day. Patients with documented concurrent diagnosis and treatment were universally those receiving surgery, and for this group, we were unable to ascertain the time since receipt of a presumptive diagnosis without tissue sampling or completion of diagnostic testing outside UNC that was not entered into the EHR. Patients whose earliest

treatment occurred more than 365 days after diagnosis were excluded, as these treatments could reflect early recurrence or second-course therapy rather than initial treatment. Excluding same-day diagnosis and treatment ensured meaningful measurement of treatment delays, although this approach may not capture cancers for which same-day treatment is common, such as testicular cancer. Treatment modality-specific analyses were further restricted to groups with ≥ 11 patients to ensure sufficient sample size for comparison.

Treatment dates from the hospital cancer registry were prioritized, with EHR-derived dates used to supplement any missing records. For each patient, the earliest recorded initiation date for surgery, chemotherapy, radiation, hormone therapy, or immunotherapy was used to define the first treatment. Missing day fields ($< 5\%$) were imputed using the mid-month date when only month and year were available, in accordance with standard cancer registry practices (Liu et al., 2022).

We also calculated the time to first cancer treatment according to the diagnostic pathway. Among incarcerated patients, 168 (24%) were diagnosed at UNC. Of these patients, 113 (68%) were also treated at UNC within one year of diagnosis. For patients diagnosed and treated at UNC, the diagnosis date was defined as the biopsy date confirmed by a pathology report and corroborating documentation in the EHR. For patients diagnosed at an external, non-UNC facility ($n = 529$, 76%), the diagnosis date was defined as the earliest biopsy date recorded in the hospital cancer registry or, when available, the earliest diagnostic procedure documented in the UNC EHR.

Covariates

Demographic characteristics, including age at diagnosis, sex, and race, were abstracted from the EHR. Race may have been documented in the EHR based on patient report or abstracted from carceral system records, and is included in the analysis as a social rather than biological variable. Health behavior covariates, including alcohol use, tobacco use, and substance use, were derived from provider-documented EHR data across medical encounters during incarceration; survey or patient-reported data were not available. Substance use history was defined as any recorded illicit or intravenous drug use.

Clinical characteristics, including tumor type, stage, and grade, were obtained from the hospital cancer registry. Cancer stage was recorded according to standard definitions (Stages 0–4). Tumor grade was collapsed for analysis as low (Grade 1), intermediate (Grade 2), or high (Grades 3–4). Unknown or missing values for cancer stage and grade were retained as separate categories.

Statistical Analysis

Descriptive statistics summarized sociodemographic and clinical characteristics, with categorical variables reported as frequencies and percentages and continuous variables, including time to first cancer treatment, reported as means with standard deviations. Cancer treatment patterns and time to first treatment were summarized for all patients and among patients diagnosed at UNC. Analyses were

further stratified by initial treatment modality (local therapy, systemic therapy, or combined local and systemic therapy) and by specific treatment sequence.

Unadjusted time to first treatment was evaluated using Kaplan-Meier survival curves among all patients and among patients diagnosed at UNC to examine whether diagnostic site was associated with differences in time to treatment. All analyses were conducted with SAS software version 9.4 (SAS Institute, Inc., Cary, NC). This study was reviewed by the Institutional Review Boards at the University of North Carolina at Chapel Hill (IRB#22–0556) and Duke University in accordance with the Declaration of Helsinki (#Pro00106936) and operated under a waiver of informed consent for analysis of existing data.

Results

Our study sample included 697 patients, with a mean age at diagnosis of 55.6 years (SD = 10.8); 85% identified as male; 49% were categorized as Black; and 70% had an EHR-documented history of tobacco use (Table 1). The most common cancer types were genitourinary (38%), gastrointestinal (22%), and lung (13%) cancers, with definitions for the included cancer types provided in **Supplementary Table 1**. Most patients had missing stage (60%) and grade (71%) information; among those with available data, high-stage and high-grade tumors were more prevalent than low-stage and low-grade tumors. Patients diagnosed at UNC were generally similar to the overall cohort across sociodemographic and clinical characteristics.

Overall, among 548 incarcerated patients (excluding those whose diagnosis and first treatment occurred on the same day), more than 4 in 10 did not have a record of cancer treatment within one year of diagnosis. For the 304 patients (55.5%) who received treatment, the mean time from diagnosis to first treatment (any modality) was 68.1 days (SD = 54.8; Table 2). Local therapies, including surgery or radiation, were the most common treatment modality (n = 178, 33%) with a mean time to first treatment of 74.2 days (SD = 61.5). Systemic therapies, including chemotherapy, hormone therapy, and immunotherapy, alone were less common (n = 45, 8%) with a mean time of 53.0 days (SD = 36.6). Combined local and systemic therapies were received by 15% of patients (n = 81), with a mean time to first treatment of 62.9 days (SD = 45.3).

In the sensitivity analysis of patients diagnosed at UNC (n = 166), nearly one-third (n = 53) did not have recorded treatment information within one year of diagnosis. For the 113 patients (68.1%) who received treatment, the mean time from diagnosis to first treatment (any modality) was 76.4 days (SD = 53.3; Table 2). Local therapies and combined local and systemic therapies were more common, while systemic therapies alone were less common compared with the overall cohort. UNC-diagnosed patients generally experience slightly longer times to first treatment compared with the overall cohort.

Kaplan-Meier analyses of time to first cancer treatment showed that treatment initiation increased steadily over time (Fig. 2). Within the first 60 days, 145 (48%) of all patients had started treatment (any modality); the same proportion (48%) started treatment among UNC-diagnosed patients. By 120 days, 236 (78%) of all patients had received treatment versus 94 (82%) of UNC-diagnosed patients. The vast

majority (95%) initiated treatment before one year (365 days). Overall, UNC-diagnosed patients followed a similar trajectory to the full cohort.

Discussion

In this cohort of incarcerated cancer patients, we observed substantial delays in initiating treatment as well as gaps in care. More than 4 in 10 patients had no documented cancer-directed treatment within one year of diagnosis. This may represent loss-to-follow-up within the prison system or in the community after release. Among patients who received treatment, the mean time from diagnosis to first treatment was 68 days, with local therapies (surgery and radiation) averaging 74 days, exceeding the clinically meaningful benchmark of 60 days for timely cancer care across most cancer types (Hanna et al., 2020). Patients diagnosed at UNC experienced slightly longer times to first treatment compared with the overall cohort (UNC diagnosed mean: 76 days versus overall cohort mean: 68 days), though treatment trajectories over the first year were broadly similar. Differences in treatment patterns by diagnostic pathway suggest that where and how cancer is diagnosed within the carceral healthcare system may meaningfully shape subsequent access to care.

Our findings must be interpreted within the structural realities of the carceral system. Although tertiary cancer centers often offer streamlined diagnosis-to-treatment pathways, the carceral context introduces additional administrative, logistical, and security-related barriers that can further delay care (Burkett et al., 2023). Patients diagnosed with cancer may face prolonged intervals to treatment initiation due to custody approvals, transportation coordination, and fragmented communication between correctional health services and oncology teams (Oladeru et al., 2025). Prior work demonstrates that incarceration-related constraints delay access to specialty care, particularly for complex conditions such as cancer (Aziz et al., 2021; Huh et al., 2018; Sunthankar et al., 2020). Delays in access to diagnostic procedures not available within the carceral health care system may have contributed to the longer time to treatment that we observed for patients who were both diagnosed and treated at UNC.

Consistent with prior literature, delays in initiating cancer treatment beyond 60 days are considered clinically meaningful for most cancer types, as they are associated with higher cancer-specific mortality (Hanna et al., 2020; Neal et al., 2015). In our cohort, the mean time from diagnosis to first treatment was 68 days, with local therapies averaging 74 days and systemic therapies 53 days. Notably, 52% of patients had not started any treatment within 60 days, highlighting the magnitude of delays in this population. Given the high burden of comorbidities and overrepresentation of racially, socioeconomically, and structurally marginalized populations in carceral settings, incarcerated patients may be especially vulnerable to the harms of delayed cancer care (Burkett et al., 2023; Wang et al., 2022; Zeng, 2025). Our findings highlight structural barriers inherent to the carceral healthcare system as key drivers of delayed cancer treatment, motivating closer examination of data fragmentation, care coordination, and policy interventions that improve timely cancer care delivery for incarcerated populations.

Efforts to evaluate the timeliness of cancer care for incarcerated populations are substantially constrained by fragmented health data systems. EHRs often fail to capture complete cancer histories for individuals who move between correctional facilities, community hospitals, and tertiary cancer centers, resulting in gaps in documentation and continuity of information (Thompson et al., 2020; Thompson et al., 2015; Tucker et al., 2019). These limitations are particularly pronounced for incarcerated and other structurally marginalized populations and complicate efforts to accurately measure diagnosis-to-treatment intervals.

Linking EHR data with hospital-based cancer registries offers one strategy to improve completeness, as registries provide standardized, system-wide cancer information (Bradley et al., 2010; Manion et al., 2012; Miriovsky et al., 2012; Thompson et al., 2015; Wagner et al., 2005). However, registries may miss treatments delivered in outpatient oncology clinics, contracted community settings, or facilities serving incarcerated patients (Hoopes et al., 2021; Thompson et al., 2020; Tucker et al., 2019). As a result, neither data source alone fully captures cancer care delivered across multiple systems that incarcerated patients often navigate (Charlton et al., 2022). These data limitations directly affect the interpretation of observed delays in treatment initiation, as incomplete capture of diagnostic workup or prior care may obscure where and when treatment delays occur.

These challenges are compounded by the absence of incarceration indicators in national health surveys and by federal restrictions on research involving incarcerated populations, which limit even low-risk epidemiologic studies (Sinha & White, 2017; Wang et al., 2019). In response, some states have begun linking correctional records with statewide cancer registries, generating critical insights into cancer diagnosis, treatment initiation, survival, and long-term outcomes (Oladeru et al., 2022; Oladeru et al., 2025; Puglisi et al., 2021). Expanding similar data linkage efforts – particularly in the Southeastern U.S., where correctional health infrastructures differ substantially from those in the Northeast – will be essential to capture regional variation and inform more equitable cancer care policy.

Although combining EHR and registry data can enhance capture of treatment patterns, these linkages remain labor-intensive and are not routinely available, particularly in carceral health settings. Privacy regulations, fragmented carceral healthcare infrastructures, and restricted access to incarceration-related data further limit the development of comprehensive cancer datasets (Binswanger et al., 2019; Gaber et al., 2024; Institute of Medicine Committee on Ethical Considerations for Revisions to DHHS Regulations for Protection of Prisoners Involved in Research, 2007). The lack of accessible, linkable health and carceral data remains a major barrier to population-level research on incarceration and cancer outcomes (Zhao, Bradley, et al., 2025). The absence of multi-state or national datasets further limits the ability to assess regional variation or benchmark care. Addressing these data gaps is a necessary precursor to policy reform aimed at improving care coordination, reducing treatment delays, and advancing equity in cancer care delivery for incarcerated populations.

Carceral health policy is undergoing an unprecedented shift as states increasingly apply for Medicaid 1115 waivers that extend health services to incarcerated individuals during the pre-release period,

supporting continuity of care and reentry into the community (Barsky et al., 2025; KFF, 2025). As of November 2025, North Carolina is one of three Southeastern states with an approved waiver, joining Kentucky and West Virginia, while Arkansas and Louisiana await approval. This status positions North Carolina to pilot reforms that strengthen care coordination, standardize data sharing between carceral and clinical systems, and reduce delays in cancer treatment. Standardized referral pathways, shared scheduling systems, and dedicated care coordinators between carceral facilities and tertiary care centers have been identified as promising strategies to mitigate delays in specialty care delivery (Iwai et al., 2024; Jindal et al., 2023; Manz et al., 2025a, b). Expanding these waivers in the Southeastern U.S., where incarceration rates and cancer disparities are high, could markedly improve access to timely and equitable cancer care for incarcerated and recently released populations.

Investments in data infrastructure are equally critical. Routine linkage of carceral health records, community EHRs, and cancer registries would enable health systems and policymakers to systematically monitor treatment timelines, identify breakdowns in care delivery, and establish accountability for cancer outcomes among incarcerated individuals (Bradley et al., 2010; Thompson et al., 2015; Zhao, Bradley, et al., 2025). Without incarceration identifiers and interoperable data systems, inequities in cancer care remain largely invisible and difficult to address (Binswanger et al., 2019; Sinha & White, 2017). Together, these policy strategies position timely cancer care for incarcerated individuals as a measurable standard of quality and equity rather than an aspirational goal, aligning public health practice with legal, ethical, and human rights frameworks that affirm access to care regardless of incarceration status (Institute of Medicine Committee on Ethical Considerations for Revisions to DHHS Regulations for Protection of Prisoners Involved in Research, 2007; Wang et al., 2019).

This study has several limitations, but also notable strengths that advance understanding of cancer care for incarcerated populations. Our analysis reflects care outcomes at a single tertiary cancer center serving as the primary referral site for the North Carolina state prison system. While generalizability may be limited, this setting offers a rare opportunity to study cancer care within a centralized carceral healthcare network – a key strength given the scarcity of data from the Southeastern U.S., a region with high incarceration rates, pronounced cancer disparities, and limited prior research.

Sample size constraints, particularly for modality-specific treatments such as adjuvant or neoadjuvant chemotherapy, immunotherapy, and for women (Carson, 2021), limited detailed subgroup analyses. The absence of comprehensive carceral movement records restricted our ability to track transfers or custody changes that could affect care continuity. Nevertheless, incarceration status was rigorously validated through EHR review, carceral billing indicators, and manual confirmation, supporting the reliability of the cohort.

Leveraging both hospital-based cancer registry and EHR data also allowed a more complete view of treatment trajectories. Probabilistic linkage, while imperfect, is validated for large datasets (Clark & Hahn, 1995; Garvin et al., 2019; Thompson et al., 2020; Tromp et al., 2011), and EHR data strengthened capture of treatment orders, clinical encounters, and documentation not routinely recorded in registries.

Data quality is often limited by poor interoperability across carceral and clinical systems (Bellass et al., 2022; Binswanger et al., 2019), and care delivered outside captured settings may explain observed gaps. Yet, this also highlights a strength of our study: it identified systemic fragmentation in cancer care for incarcerated patients and pinpoints opportunities to improve data infrastructure, interoperability, and reporting.

While we cannot determine the exact causes of treatment delays exceeding 60 days, our study is among the first in the Southeastern U.S. to quantify time to treatment, report the proportion of patients exceeding clinically meaningful thresholds, and describe treatment patterns among incarcerated adults. Substantial proportions of patients lacked documented treatment within one year, reflecting the complexity and fragmentation of care across multiple systems. Our findings illustrate how structural and systemic factors inherent to incarceration shape treatment trajectories and outcomes.

Using a large, diverse safety-net hospital cohort, our study offers regionally relevant insights into cancer care delivery in Southeastern carceral settings and highlights opportunities to improve timely diagnosis, treatment initiation, and continuity of care. Linking prison and specialty care records and examining care transitions can clarify how structural and social factors influence outcomes, while strengthened data systems and seamless care coordination are critical to mitigating inequities and advancing timely, equitable cancer care for incarcerated populations.

Conclusions

Cancer care for incarcerated adults in the Southeastern U.S. reflects the intersection of structural disadvantage, fragmented healthcare systems, and persistent inequities in access to specialty care. In this large, contemporary cohort, mean treatment initiation exceeded 60 days, and over half of the patients had no documented treatment within this period, highlighting systemic barriers beyond individual clinical factors. Variation in treatment patterns by diagnostic pathway further demonstrates how incarceration shapes cancer care trajectories and may exacerbate disparities. By integrating EHR and cancer registry data, our study provides a more comprehensive understanding of treatment delivery, revealing critical gaps in care coordination, documentation, and continuity. Our findings underscore the urgent need for stronger data systems, standardized referral pathways, and policies that support timely, coordinated care for incarcerated individuals. Ensuring equitable access to diagnosis and treatment is both a public health imperative and a matter of justice, requiring systemic reforms that dismantle structural barriers to affirm the fundamental right to health for all patients, regardless of incarceration status.

Abbreviations

CPT: Common Procedure Terminology

Dx: Diagnosis

EHR: Electronic health record

NC TraCS: North Carolina Translational and Clinical Sciences Institute

Tx: Treatment

UNC: University of North Carolina

Declarations

Ethics approval and consent to participate

This study was reviewed by the institutional review boards at the University of North Carolina at Chapel Hill and Duke University in accordance with the Declaration of Helsinki and operated under a waiver of informed consent.

Author Contribution

Authors' contributions JB led the writing and the analysis. HN, YI, AK, and LBR contributed to the writing, reviewing, and conceptualization of the content.

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Data Availability

The data that support the findings of this study are available from UNC and the cancer registry, but restrictions apply to the availability of these data, which were purchased for the current study and so are not publicly available.

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Tables

Table 1

Sociodemographic and clinical characteristics of incarcerated cancer patients at a single North Carolina tertiary care center, overall and among patients who were both diagnosed and treated at the tertiary care center, 2014–2023

Age at Diagnosis (years), Mean [SD]	All Patients (N = 697)	All UNC Diagnosed Patients (N = 168)
	55.6 [10.8]	56.0 [10.9]
18–39 years	66 (10)	18 (11)
40–49 years	117 (17)	23 (14)
50–54 years	100 (14)	25 (15)
55–59 years	153 (22)	38 (23)
60–64 years	125 (18)	33 (20)
65–75 years	136 (20)	31 (19)
EHR-Documented Race		
White	310 (45)	74 (44)
Black	339 (49)	83 (50)
Another underrepresented race ^a	41 (6)	< 11 ^d
Missing	7	1
Biological Sex		
Female	108 (16)	33 (20)
Male	589 (85)	135 (80)
Marital Status at Diagnosis		
Single	381 (74)	86 (73)
Married or domestic partners	63 (12)	17 (14)
Divorced, separated, or widowed	73 (14)	15 (13)
Missing	180	50
EHR-Documented Tobacco History		
Current or former tobacco user	433 (70)	96 (66)
Never a tobacco user	107 (17)	30 (21)
Not asked at time of medical visit	77 (13)	20 (14)

Age at Diagnosis (years), Mean [SD]	All Patients (N = 697)	All UNC Diagnosed Patients (N = 168)
	55.6 [10.8]	56.0 [10.9]
Missing	80	22
EHR-Documented Alcohol History		
Current or former alcohol user	241 (26)	68 (42)
Never an alcohol user	379 (56)	81 (50)
Unknown	59 (9)	13 (8)
Missing	18	6
EHR-Documented Substance Use History^b		
Substance use history	84 (12)	16 (10)
No substance use history	595 (88)	146 (90)
Missing	18	6
Primary Cancer Type^c		
Brain and Nervous System	23 (3)	< 11 ^d
Breast	40 (6)	18 (11)
Endocrine	28 (4)	< 11 ^d
Gastrointestinal	153 (22)	23 (14)
Genitourinary	263 (38)	75 (45)
Gynecologic	32 (5)	< 11 ^d
Head and Neck	65 (9)	23 (14)
Lung	89 (13)	15 (9)
Sarcoma	< 11 ^d	< 11 ^d
Cancer Stage^c		
Stage 0	12 (2)	< 11 ^d
Stage 1	94 (14)	41 (24)

Age at Diagnosis (years), Mean [SD]	All Patients (N = 697)	All UNC Diagnosed Patients (N = 168)
	55.6 [10.8]	56.0 [10.9]
Stage 2	52 (8)	18 (11)
Stage 3	51 (7)	15 (9)
Stage 4	69 (10)	12 (7)
Cannot be determined	36 (5)	< 11 ^d
Unknown	73 (11)	19 (11)
Missing	310 (45)	48 (29)
Cancer Grade^c		
Low (Grade 1)	33 (5)	< 11 ^d
Intermediate (Grade 2)	109 (16)	22 (13)
High (Grades 3 and 4)	57 (8)	12 (7)
Unknown	114 (16)	< 11 ^d
Missing	384 (55)	119 (71)

Table 2

Receipt and timing of cancer treatment within one year of diagnosis among incarcerated cancer patients at a single North Carolina tertiary care center, overall and among patients who were both diagnosed and treated at tertiary care center, 2014–2023

	All Cancer Patients ^a (N = 548)			UNC Diagnosed Patients ^a (N = 166)		
	n	%	Time to treatment, Mean (SD)	n	%	Time to treatment, Mean (SD)
No Cancer Treatment	244	44.5		53	31.9	
Any Cancer Treatment	304	55.5	68.1 (54.8)	113	68.1	76.4 (53.3)
Local Therapy	178	32.5	74.2 (61.5)	58	34.9	83.7 (63.4)
Surgery Only	82	15.0	73.1 (61.6)	37	22.3	76.5 (53.0)
Radiation Only	79	14.4	73.6 (63.0)	16	9.6	106.6 (86.2)
Surgery and Radiation	17	3.1	82.6 (55.8)	< 11 ^c	< 11 ^c	63.6 (32.0)
Systemic Therapy^b	45	8.2	53.0 (36.6)	< 11^c	< 11^c	64.9 (26.5)
Local and Systemic Therapies	81	14.8	62.9 (45.3)	47	28.3	69.3 (41.2)
Surgery first	13	2.4	48.7 (24.8)	< 11 ^c	< 11 ^c	51.3 (19.0)
Radiation first	19	3.5	63.6 (60.7)	< 11 ^c	< 11 ^c	72.0 (38.5)
Chemotherapy first	28	5.1	51.8 (31.1)	17	10.2	50.3 (26.9)
Hormone therapy first	19	3.5	92.3 (46.5)	14	8.4	102.9 (46.4)
Abbreviations: SD, standard deviation						
^a Among incarcerated cancer patients who received treatment within a year of diagnosis, analyses were restricted to those whose diagnosis and treatment did not occur on the same day (i.e., time to first treatment = 0 days)						
^b Systemic therapies include patients who received chemotherapy only; hormone therapy only; immunotherapy only; or chemotherapy and immunotherapy						
^c Cell sizes < 11 were suppressed to protect patients' privacy						

Figures

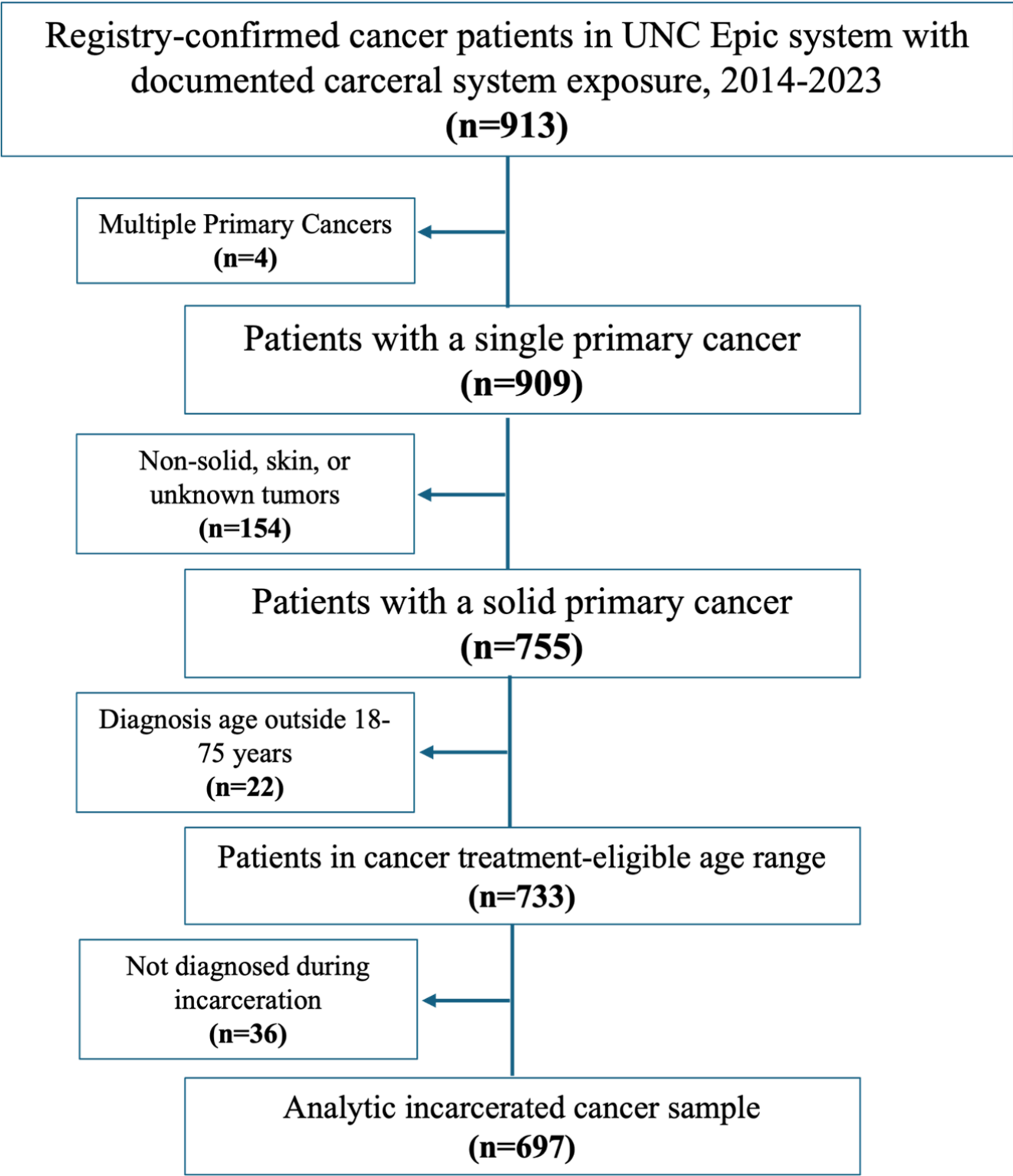
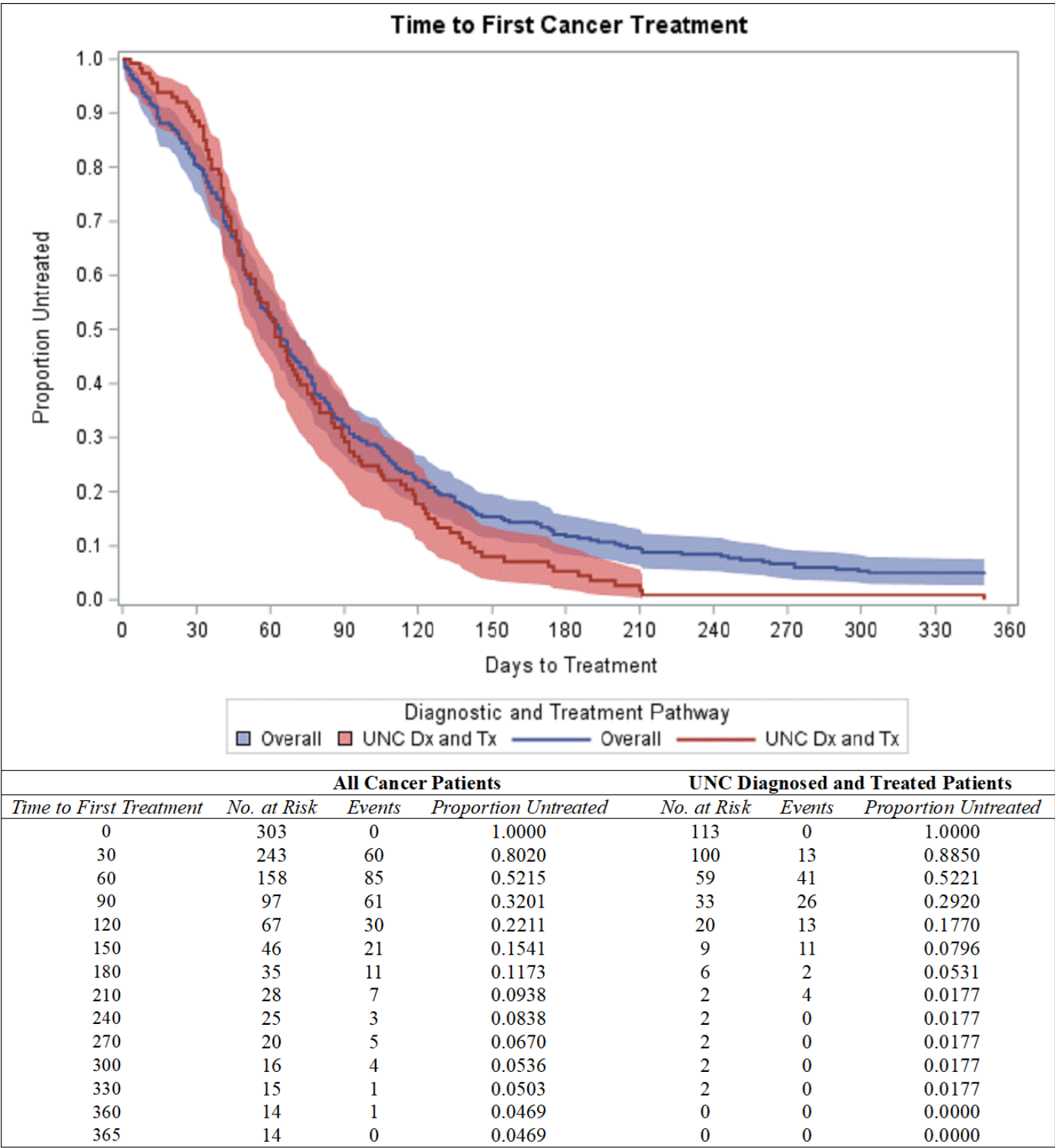


Figure 1

Study cohort selection flow diagram among patients who received cancer care within a large North Carolina tertiary care center, 2014-2023



Abbreviations: Dx, diagnosis; Tx, treatment

Figure 2

Unadjusted survival curves and confidence intervals for time to earliest initiated cancer treatment within one year of diagnosis among incarcerated cancer patients, overall and stratified by diagnostic and treatment pathway, 2014-2023

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [SupplementaryTable1.docx](#)