



**Independent Cost Analysis for
Dana-Farber Cancer Institute Determination of Need
DoN Application #: DFCI-23040915-HE**

January 10, 2025

Prepared for Submission to:

Massachusetts Department of Public Health

Authored by:

Bryan J. Perry, Ph.D.*
FTI Consulting, Inc.
Center for Healthcare Economics and Policy
555 12th Street NW, Suite 700
Washington, D.C. 20004

* The views expressed herein are those of the author and do not reflect or represent the views of FTI Consulting, Inc., its management, its subsidiaries, its affiliates, or its other professionals.

Table of Contents

I.	Executive Summary	6
A.	Overview of the ICA Report.....	6
B.	Elements of the ICA	7
II.	Introduction.....	9
A.	Overview of the Proposed Project.....	9
B.	The Determination of Need and Independent Cost Analysis Process.....	11
C.	Assignment and Qualifications.....	11
III.	Overview of ICA Assessment Analyses and Methodology	12
A.	Overview of ICA Assessment Issues	12
B.	Overview of the Commonwealth's Cost Containment Goals.....	13
C.	Economic Analysis Used to Address Questions	14
IV.	Data Sources	16
V.	Identifying DFCI Patients	16
VI.	Cancer Care Service Lines	17
VII.	Defining Geographic Areas of Coverage for ICA Evaluation	19
A.	Overview of Methodology for Empirical Analysis of Service Areas	19
B.	Overview of DFCI and Health Systems Offering Inpatient Cancer Care Services	20
VIII.	Current Provision of Inpatient Cancer Care in Massachusetts	22
IX.	Forecast of Future Demand for Cancer Care	29
A.	Methodology for Estimating Current and Future Demand.....	29
B.	Projected Changes in Inpatient Cancer Care Services Utilization.....	31
X.	Predicting Shifts in Utilization for Inpatient Cancer Services	33
XI.	Prices for Inpatient Cancer Care Services in Relevant Service Lines.....	38
XII.	Forecasted Impacts of the Proposed Project on Inpatient Cancer Care Shares, Prices, and Spending.....	40
A.	Projected Changes in Shares.....	40
B.	Changes in Prices.....	41
C.	Changes in Total Medical Spending	43
XIII.	Specialized Cancer Care: CAR T and Bi-Specific Antibody Therapies	46
XIV.	Impacts on Diagnostic Imaging Services.....	49
A.	Defining Diagnostic Imaging Service Lines.....	49
B.	Geographic Areas of Coverage.....	49
C.	Current Provision of Outpatient Imaging Services in Massachusetts.....	50
D.	Forecast of Future Demand for Outpatient Imaging Services	53

E.	Evaluation of DFCI Need for Imaging Equipment.....	53
F.	Prices for Outpatient Diagnostic Imaging	57
G.	Forecasted Impacts of the Proposed Project on Outpatient Diagnostic Imaging Shares, Prices, and Spending	58
XV.	Impacts on Radiation Therapy Services	59
A.	Defining Radiation Therapy Service Lines	59
B.	Geographic Areas of Coverage.....	60
C.	Current Provision of Radiation Therapy Services in Massachusetts	61
D.	Forecast of Future Demand for Radiation Therapy Services.....	62
E.	Evaluation of DFCI Need for Radiation Therapy Equipment	63
F.	Prices for Radiation Therapy Services.....	67
G.	Forecasted Impacts of the Proposed Project on Radiation Therapy Services Shares, Prices, and Spending	68

Table of Tables

Table 1: ICD-10 Cancer Care Diagnosis Codes.....	18
Table 2: Demographic Characteristics of Massachusetts Inpatient Cancer Care Patient Panel.....	23
Table 3: Inpatient Cancer Care Discharges by Patient Origin and Service Line	24
Table 4: Massachusetts Inpatient Cancer Care Discharges by Hospital, 2022	26
Table 5: Inpatient Cancer Care Patients Treated at BWH Location by Bed License Holder and Attending Physician Affiliation, 2022	27
Table 6: Inpatient Cancer Care Discharges by Patient Origin	27
Table 7: Demographic Characteristics of Inpatient Cancer Care Patients by Health System.....	28
Table 8: Massachusetts Inpatient Cancer Care Discharges, Shares, and Payor Mix by System and Select Hospitals	29
Table 9: Total Massachusetts Population Projections and Growth Rates by Age Range.....	30
Table 10: Projected Demand for Inpatient Cancer Care by Patient HSA, 2025-2040	32
Table 11: Projected Demand for Inpatient Cancer Care by Payor Type, 2025-2040	33
Table 12: Projected Demand for Inpatient Cancer Care by Patient Race, 2025-2040	33
Table 13: Projected Demand for Inpatient Cancer Care by Acuity Level, 2025-2040	33
Table 14: Projected Inpatient Cancer Care Shifts from Proposed Project	36
Table 15: Estimated Relative Prices by Hospital and Payor, 2021	39
Table 16: Projected Statewide Inpatient Cancer Care Commercial Shares by Hospital.....	41
Table 17: Projected Inpatient Cancer Care Shares for DFCI by Payor Type, 2025-2040.....	41
Table 18: Alternative Projected DFCI Pricing Scenarios.....	42
Table 19: Estimated Changes in Inpatient Cancer Care Costs.....	44
Table 20: Estimated Changes in Inpatient Care Costs with Supply-Induced Demand, GAC Backfill	45
Table 21: Estimated Changes in Inpatient Care Costs with Supply-Induced Demand, Cancer Care Backfill	45
Table 22: Demographic Characteristics of DFCI Outpatient Imaging Patient Panel, 2021	51
Table 23: Massachusetts Outpatient Diagnostic Imaging Procedures by Provider, 2021	52
Table 24: Projected Demand for CT Procedures by Payor Type, 2025-2040	53
Table 25: Projected Demand for PET-CT Procedures by Payor Type, 2025-2040	53
Table 26: Projected CT Scanner Demand, 2025	55
Table 27: Projected MRI Scanner Demand, 2025.....	56
Table 28: Projected PET-CT Scanner Demand, 2025	56
Table 29: Estimated Relative Outpatient CT and PET-CT Prices by Hospital and Payor, 2021.....	57
Table 30: Estimated Changes in Outpatient Imaging Costs, 2025-2040.....	59
Table 31: Demographic Characteristics of DFCI Radiation Therapy Patient Panel, 2021	61
Table 32: Massachusetts Radiation Therapy Procedures by Provider, 2021.....	62
Table 33: Projected Demand for LINAC Procedures by Payor Type, 2025-2040	63
Table 34: Projected Demand for CT Simulator Procedures by Payor Type, 2025-2040.....	63
Table 35: Projected LINAC Demand, 2025.....	65
Table 36: Projected CT Simulator Demand, 2025	66
Table 37: Projected CT Simulator Demand Based on Forecasted LINAC Demand, 202.....	66
Table 38: Estimated Relative LINAC and CT Simulator Prices by Hospital and Payor, 2021.....	68
Table 39: Estimated Changes in Radiation Therapy Services Costs, 2025-2040	69

Table of Figures

Figure 1: Overview of Massachusetts Health Systems Providing Inpatient Cancer Care	21
Figure 2: Overview of Boston Area Health Systems Providing Inpatient Cancer Care.....	22
Figure 3: Current and Potential CAR T Providers in and around Massachusetts	48
Figure 4: DFCI Outpatient Diagnostic Imaging Primary Service Area (90%), 2021	50
Figure 5: DFCI Radiation Therapy Services Primary Service Area (90%), 2021	61

I. EXECUTIVE SUMMARY

A. Overview of the ICA Report

1. Dana-Farber Cancer Institute, Inc. (DFCI or Applicant) filed a Determination of Need (DoN) Application for project number DFCI-23040915-HE on October 24, 2023.¹ The DoN Application covers development of a freestanding, dedicated inpatient cancer hospital with imaging and radiation oncology capabilities (the Proposed Project).²
2. As part of the DoN application process, the Massachusetts Department of Public Health (DPH) has requested an Independent Cost Analysis (ICA) of the Proposed Project.³ FTI Consulting (FTI) was asked to provide an independent and objective analysis of the Proposed Project and the DoN Application at the direction of the DoN program. While DFCI has contracted and finances work conducted by FTI's Center for Healthcare Economics and Policy, FTI's operations and analysis are independent of DFCI, and DFCI has no input into decisions made in this analysis with relation to methods, data, or conclusions. FTI has also conducted the ICA analyses independently of the staff of the DoN program at the Massachusetts DPH. This independent analysis and the ICA report include assessment and analysis of specific questions and issues about the Proposed Project using and applying relevant standards to data and information.⁴
3. FTI was asked by DPH to provide analysis on the impact of the Proposed Project on utilization, capacity, prices, competition, equitable access, and healthcare costs of the services implicated by the Proposed Project and to assess the bearers of any cost impacts. The questions posed by DPH cover both current and future time frames. FTI was also asked to evaluate specific findings and conclusions in the DFCI submissions and to present these assessments with the major elements in an ICA report along with relevant supporting data and analyses.⁵
4. In conducting its analyses, FTI had access to and made use of extensive data and information, which are summarized throughout this report and its appendix. The report makes use of FTI economist and professional staff experience in healthcare, including in evaluating price, competition, capacity,

¹ "Dana-Farber Cancer Institute, Inc. – Hospital/Clinic Substantial Capital Expenditure: Determination of Need application material received by the Department of Public Health for Dana-Farber Cancer Institute, Inc. – Hospital/Clinic Substantial Capital Expenditure." <https://www.mass.gov/info-details/dana-farber-cancer-institute-inc-hospitalclinic-substantial-capital-expenditure>.

² See Section II.A below for a detailed summary of the Proposed Project.

³ See, Letter from Dennis Renaud to Benjamin A. Wilson, dated February 2, 2024 (<https://www.mass.gov/doc/independent-cost-analysis-letter-pdf-dana-farber-cancer-institute-inc-hospitalclinic/download>).

⁴ Specifically, DFCI has filed a DoN Application for which an ICA is being required to assess whether the Proposed Project will be consistent with the healthcare cost-containment goals of Massachusetts.

⁵ In conducting our review of the DFCI Application, we considered the documents and information provided by DFCI and others to the DPH as part of the DoN application process, including publicly available information. This report and accompanying appendix provide a complete listing of all source data and information used in this report. Among the materials considered were several submissions by DFCI to the DPH.

service areas, demand and utilization forecasts, and economically appropriate modeling of inpatient and outpatient healthcare services. The report's analysis applies these capabilities to address the specific questions (see Section I.B) of the impact of the Proposed Project on price and competition, utilization and capacity, cost impacts, equitable access, and consistency with Massachusetts cost containment goals. Empirical work supporting the assessment is presented in this report and its appendix along with relevant assumptions and methodologies.

5. After applying standard principles of economic analyses to the specific requirements of the questions set out in the ICA to relevant data and information, FTI reached the conclusions and findings set out below.

B. Elements of the ICA

6. This section outlines the questions posed by DPH to FTI in connection with this ICA (the "ICA Questions").⁶ DPH asked FTI to assess three specific areas of inquiry: (i) the effects of the Proposed Project on prices and competition for healthcare services in Massachusetts, (ii) the effects of the Proposed Project on utilization of services and the capacity of providers to provide relevant healthcare services, and (iii) the Proposed Project's potential to increase equitable access to cancer care. DPH also posed additional questions beyond these specific areas.
7. Regarding questions related to prices and competition, DPH asked FTI to address the following questions:
 - How will the Project change utilization at higher versus lower priced providers, and what will be the subsequent impact on health care prices/spending for commercial and public payors?
 - How will the Project change price levels for the Applicant's relevant services, and what will be the subsequent impact on health care prices/spending for commercial and public payors?
 - How will the Project impact the Applicant's relevant market share for services and its negotiating leverage, and what will be the subsequent impact on health care prices/spending for commercial and public payors?
8. Regarding questions related to utilization and capacity, DPH asked FTI to address the following questions:
 - Evaluate the Applicant's calculation of need for the proposed project. The ICA should document current service availability throughout the state, the current population served (including payor mix) and patient demographics of the state (including by cancer providers in

⁶ Letter from Dennis Renaud to Lisa O'Connor, May 14, 2024.

the state) and expected changes in the population and demographics in the state over the next ten years. The ICA should also analyze current and potential utilization of the services and shifts from existing providers and the subsequent impact on cost and health equity outcomes, including assessing DFCI and competitors' patient profiles (e.g., demographics, insurance coverage, and acuity levels).

- What conditions have to/need to be met for Dana-Farber to achieve their volume projections?
- Where will DFCI's projected inpatient volume originate once the proposed hospital is in operation? How does the source of projected inpatient volume compare to the current sources of inpatient volume? What assumptions are implicit in the Applicant's calculation/estimation of historical and projected inpatient volume?
- How much, if any, of the Applicant's projected need for highly specialized inpatient oncology care (CAR T Cell Therapy and Bispecific Antibodies) can be met by other providers within the Commonwealth? (And by which providers?) How much of the projected need can only be addressed by the advanced care that the Applicant will provide at the proposed Facility?
- Analyze the Applicant's projected need by bed type: ICU versus medical/surgical.
- Evaluate potential shifts in utilization of services by inpatient cancer patients, including assessing changes from lower-cost to higher-cost services, settings or health care providers, and the subsequent impact on the payer mix and financial stability of health care providers, including lower-cost and safety net providers who serve a disproportionate number of publicly insured (e.g. MassHealth) and uninsured people. The assessment should include the Applicant's and competitor's patient profiles (e.g. demographics (race, ethnicity, language, disability status, etc.).
- Evaluate access to the project services by individuals enrolled in MassHealth (e.g. MassHealth Accountable Care Organization participants), individuals in subsidized insurance products through the Health Connector Authority (i.e., ConnectorCare health plans), and safety net programs (e.g. MassHealth Limited, Health Safety Net)
- Evaluate the potential for the project to lead to "supply-induced demand" for health care services.

9. Regarding questions related to equitable access to cancer care, DPH asked FTI to address the following questions:

- Evaluate the current and projected makeup of the Applicant's Patient Panel by Race/Ethnicity, Payer Mix, and Patient Origin.

- Evaluate current and projected Patient Panel utilization of the Applicant's services (inpatient and outpatient services that would expand through the Proposed Project) by race/ethnicity, payer mix, and/or patient origin.
10. DPH also asked FTI to address three overarching questions regarding healthcare costs:
- Based on this analysis, is the Proposed Project consistent with the Commonwealth's efforts to meet the health care cost-containment goals, including scope and size of any impact?
 - If costs increase under the project, who bears the consequences of that increase in costs: third-party payors, patients, or health plan sponsors (e.g., employers)?
 - If savings are realized under the project, who benefits from those savings?
11. This report and its accompanying appendix answer the ICA Questions and provide the analysis and data used to support FTI's conclusions. Section III.C below outlines these analyses with references to relevant sections of the report.

II. INTRODUCTION

A. Overview of the Proposed Project

12. DFCI proposes to develop a freestanding, dedicated inpatient cancer hospital in Boston with imaging and radiation oncology capabilities to ensure that it is able to meet the growing need for sophisticated cancer care.⁷ To provide the Applicant's patients with access to a full continuum of services, the new facility will be located adjacent to Beth Israel Deaconess Medical Center (BIDMC), and the two facilities will be connected via a tunnel and bridge.⁸
13. The Proposed Project would include the construction of a new, approximately 688,100 square-foot inpatient hospital facility to be located at 1 Joslin Place, Boston, Massachusetts 02215. The facility would include 300 adult inpatient beds and 20 observation beds. Thirty of the 300 inpatient beds would be transferred from DFCI's current licensed beds, and the remaining 270 would be new licensed beds. The Proposed Project would also include the addition of two magnetic resonance imaging (MRI) machines, two computed tomography (CT) machines, one positron emission tomography machine (PET-CT), three linear accelerators (LINACs), and two CT simulator machines.
14. **Inpatient Cancer Care** – DFCI currently employs physicians that provide inpatient oncology services (cancer care) to patients in its 30 medical/surgical licensed beds located at Brigham and

⁷ DFCI DoN Application #: DFCI-23040915-HE Project Description and Narrative. <https://www.mass.gov/doc/project-description-narrative-pdf-dana-farber-cancer-institute-inc-expenditure/download> (hereafter, "Application Narrative"), p. 2.

⁸ See DFCI's announcement of the collaboration with BIDMC. "Dana-Farber Beth Israel Deaconess Cancer Collaboration," <https://www.dana-farber.org/about/dana-farber-beth-israel-deaconess-cancer-collaboration>.

Women's Hospital (BWH). Additionally, DFCI physicians provide inpatient cancer care to patients in BWH-licensed beds located throughout BWH. The DoN Application envisions that a significant percentage of patients currently receiving medical oncology services at BWH from DFCI physicians will shift to receiving care in the new DFCI facility. The Application also envisions patients receiving medical oncology services at BIDMC will shift to the new DFCI facility. Similarly, the Application envisions patients receiving surgical oncology services at BWH will shift to BIDMC.⁹

15. **Emergency Departments** – Emergency departments (EDs) are an important entry point for inpatient cancer care admissions. Cancer patients often manage multiple symptoms and complications related to the disease and ongoing treatment. These can often be addressed in an outpatient setting, but patients sometimes seek care in the ED (and are sometimes subsequently hospitalized). According to a recent study, ED visits by cancer patients in the United States increased over 67% from 3.7 million visits in 2012 to 6.2 million visits in 2019 (5.4% of all ED visits that year), and more than half of these visits were potentially preventable.¹⁰ DFCI has piloted a cancer-specific acute care clinic to serve urgent medical needs of cancer patients which reduced emergency department visits and subsequent hospitalizations.¹¹ An emergency department is not planned to be included in the new DFCI hospital. However, the new DFCI facility would be physically connected to BIDMC which does have an emergency department.
16. **Imaging Equipment** – Imaging is a key component of cancer care and is utilized throughout the diagnosis and treatment process, including for detection of cancers, determination of spread of cancers, inpatient diagnoses and treatments, assessing efficacy of treatments, and outpatient care. According to the Application, DFCI's utilization of inpatient imaging services increased between 2020 and 2022 by over 40% for MRI scans, 25% for CT scans, and 43% for PET-CT scans.¹² Similarly, the Application reports an increase in outpatient imaging utilization—approximately a 81% increase in MRI scans, 38% increase in CT scans, and 22% increase in PET-CT scans.¹³ Based on calculations by the Applicant, the anticipated demand from the Proposed Project will require two CT scanners, two MRI scanners, and one PET-CT scanner.¹⁴ These calculations are assessed in greater detail in Section XIV below.

⁹ Application Narrative, p. 28.

¹⁰ Majka ES, Trueger NS. Emergency Department Visits Among Patients With Cancer in the US. JAMA Netw Open. 2023;6(1):e2253797. doi:10.1001/jamanetworkopen.2022.53797.

¹¹ Application Narrative, p. 2.

¹² Application Narrative, p. 7.

¹³ The Application notes that some of this increase in outpatient imaging utilization is attributable to opening a new site in Chestnut Hill in 2021 (Application Narrative, p. 7).

¹⁴ Application Narrative, p. 25.

17. **Radiation Therapy** – Radiation therapy is used in curing and mitigating nearly every type of cancer. It can be used as a standalone treatment or in concert with other cancer treatments (e.g., chemotherapy, surgery, and immunotherapy). LINAC machines are commonly used to delivery radiation treatments, and CT simulator machines are often used to prepare for radiation treatment. The DoN Application calculates that the Proposed Project will generate demand requiring ten LINACs and three CT simulators.¹⁵ The Application proposes adding three LINACs and two CT simulators to the three existing DFCI LINACs, three existing BIDMC LINACs, and one BIDMC CT simulator.¹⁶ These projected demand calculations are assessed in greater detail in Section XV below.
18. As detailed below, FTI conducted an independent review and evaluation of DFCI’s analyses of current and projected demand, demographics, utilization, and estimated need for the facilities and equipment set out in its Application, supporting documents, and responses to DPH questions.

B. The Determination of Need and Independent Cost Analysis Process

19. This Independent Cost Analysis was conducted “[P]ursuant to M.G.L. c. 111, § 25C(h), the Department of Public Health (Department) will require Dana Farber Cancer Institute, Inc., to commission an Independent Cost Analysis (ICA) for Determination of Need (DoN) Application # DFCI-23040915-HE.”¹⁷
20. As part of the DoN process, “the department may also require the applicant to provide an independent cost-analysis, conducted at the expense of the applicant, to demonstrate that the application is consistent with the commonwealth’s efforts to meet the health care cost-containment goals established by the commission.”¹⁸ As detailed below, this report includes a review of these cost-containment goals.
21. DPH’s request letter to FTI identified the key areas of analysis to be covered by this report, including specific questions which are set out below in Section III.A.

C. Assignment and Qualifications

22. FTI was tasked to provide an independent analysis of specific questions and issues set out in the ICA Questions on the DFCI Application. FTI was also asked to evaluate specific calculations in the DFCI

¹⁵ Application Narrative, pp. 26-27.

¹⁶ The Application notes that this collection of nine LINACs is short of DFCI’s projected need for ten (Application Narrative, p. 26).

¹⁷ Letter from Dennis Renaud to Benjamin A. Wilson, February 2, 2024 (<https://www.mass.gov/doc/independent-cost-analysis-letter-pdf-dana-farber-cancer-institute-inc-hospitalclinic/download>).

¹⁸ Mass. Gen. Laws ch. 111, § 25C(h).

Application. FTI was asked to prepare this report and provide supporting data, information, and analyses. These data sources are included in the text of the report and accompanying appendix.

23. This report was prepared by Bryan J. Perry, Ph.D., a Senior Managing Director in FTI's Center for Healthcare Economics and Policy, a business unit that specializes in healthcare economics and applied microeconomics. He was supported by staff experienced in healthcare analyses, including assessment of service areas, pricing and competition, capacity and utilization, and predictive modeling of changes in healthcare markets. Dr. Perry has extensive experience in healthcare and competition research, economic modeling, healthcare data, and the analytics applied in this report, and he has authored expert reports in matters before federal and state agencies.

III. OVERVIEW OF ICA ASSESSMENT ANALYSES AND METHODOLOGY

A. Overview of ICA Assessment Issues

24. DFCI filed a DoN Application with DPH for Project DFCI-23040915-HE in which DFCI proposes to build a new 688,100 square-foot inpatient hospital facility with 300 adult inpatient beds and adding two MRI machines, two CT machines, one PET-CT machine, two CT simulator machines, and three LINACs. DFCI currently has 30 inpatient licensed beds that would be transferred to the new facility as part of the 300 planned beds. The maximum capital expenditure for the project is \$1,675,700,000.¹⁹
25. The DPH has required that DFCI hire an outside group to conduct an ICA to assess several aspects of the proposed project and ensure the project is consistent with state cost-containment goals. DFCI, in consultation with DPH, has contracted the Center for Healthcare Economics and Policy, a segment within FTI Consulting, to conduct the ICA. While DFCI financed the analysis conducted by FTI, FTI's analysis and operations are independent of DFCI, and DFCI had no input into decisions FTI made in this analysis with relation to methods, data, or conclusions.
26. The questions set out by DPH are organized around three major headings and additional questions. The first question posed by the DPH is, "Based on this analysis, is the Proposed Project consistent with the Commonwealth's efforts to meet the health care cost-containment goals, including scope and size of any impact?" The remaining categories group several questions.
27. Questions on the impact on prices and competition seek to assess how the Proposed Project may change prices paid and total spending by commercial and public payors. Specifically, these questions ask for analysis of price changes arising from changes in DFCI's market share and negotiating

¹⁹ Application Narrative, p. 3.

leverage, changes in prices for cancer services, or shifts in utilization between higher and lower-priced providers.

28. Questions on the impact on utilization and capacity seek to confirm that DFCI's projections of demand are reasonable; to describe the demographic characteristics of that demand; to assess the potential for shifts in utilization across services, settings, or providers; to evaluate access to project services for individuals across payors; and to evaluate the potential for the project to lead to supply-induced demand.
29. Questions regarding equitable access to cancer care are ones that may be answered in the course of answering the other questions yet include requests for specific outputs so that DPH can make comparisons and verifications.
30. Two additional questions ask which group or groups (i.e., third-party payors, patients, or health plan sponsors) will bear the estimated additional costs or realize the estimated incremental savings.

B. Overview of the Commonwealth's Cost Containment Goals

31. DPH has instructed that FTI determine whether the Proposed Project is consistent with the Commonwealth's efforts to meet the healthcare cost-containment goals established by the Health Policy Commission (HPC). Sections V-XV of this report present the analytical framework and empirical results assessing the Proposed Projects in the context of the HPC's cost-containment goals.
32. The starting point for FTI's independent analysis is examination of HPC's current statewide target benchmark for growth in total healthcare expenditures (THCE), which is 3.6%. Change in TCHE per state resident is calculated based on the change in expenditures per capita using data from state, federal, and commercial payors.²⁰ At the state level, since THCE is tracked on a per capita basis but unadjusted for health status, changes in population health, but not size, could drive changes in THCE.
33. While FTI conducted its own independent analysis, we examined recent reports from HPC on cost growth to consider factors that HPC has identified as influencing actual cost trends and modes of conducting empirical analysis of cost trends.²¹ The HPC indicates in its 2023 report that, according to its assessment, recent healthcare spending growth has been driven primarily by an increase in prices. In addition to price, the report identifies excessive or unnecessary utilization (both use of high-cost sites of care and overprovision of services) as another driver of healthcare spending growth.²²

²⁰ Massachusetts Health Policy Commission. 2023 Cost Trends Report. Sept. 2023. <https://www.mass.gov/doc/2023-health-care-cost-trends-report/download>, p. 5.

²¹ For purposes of this report, FTI took the HPC report(s), findings, methodologies, and assessments as given and did not undertake further assessment.

²² Massachusetts Health Policy Commission. 2023 Cost Trends Report. Sept. 2023. <https://www.mass.gov/doc/2023-health-care-cost-trends-report/download>, p. 3.

Total healthcare expenditures per capita increased an average of 3.2% per year between 2019 and 2021.²³

34. FTI also considered some of the underlying trends in the Commonwealth that are related to, but independent of, the Proposed Project. For example, the HPC report identifies high prices as a primary driver of commercial spending and growth. The report further states that these high prices “incentiviz[e] the expansion and overprovision of high-priced, high-margin services (e.g., imaging, cancer treatments, orthopedic centers) at the expense of lower-paid services such as primary care or behavioral health care.”²⁴

C. Economic Analysis Used to Address Questions

35. The ICA Questions require an assessment of current utilization, volumes, and prices for cancer care services. DFCI is proposing to expand capacity for cancer care in Massachusetts, which necessitates an analysis of how the capacity expansions will affect other providers of cancer care. Projecting healthcare costs into the future is a challenging exercise even without incorporating proposed changes in the supply of those services. Many factors are necessary to incorporate into any such analysis as many factors interact with each other simultaneously to produce prices and volumes and their consequent costs.²⁵
36. Healthcare cost (or medical spending) projections can be decomposed into two core elements: prices and volumes. This report considers each element of price and volume (e.g., visits, encounters, patients) separately, beginning by characterizing each using current data and then making projections forward in a status quo environment. Then, for both prices and utilization, it uses standard economic and quantitative methods to predict how each would be affected by the specific changes in supply that have been proposed by DFCI in the Proposed Project.
37. DFCI provides cancer care for patients across its own licensed beds as well as beds leased from BWH. This ICA analysis first identified DFCI-associated cancer care across both facilities. FTI then estimated the shift in volumes as a result of the Proposed Project. According to the Application, DFCI anticipates that a significant volume of cancer care will shift from higher-priced health sites of care to relatively lower-priced ones. A significant percentage of patients currently receiving medical oncology services at BIDMC or BWH will begin receiving such services from the Applicant.

²³ Massachusetts Health Policy Commission. 2023 Cost Trends Report. Sept. 2023. <https://www.mass.gov/doc/2023-health-care-cost-trends-report/download>, p. 5.

²⁴ Massachusetts Health Policy Commission. 2023 Cost Trends Report. Sept. 2023. <https://www.mass.gov/doc/2023-health-care-cost-trends-report/download>, p. 18.

²⁵ Moreover, predicting future prices and volumes are complicated by factors such as changes in supply as well as changes in demand, both of which are projected to occur in this setting.

38. Because DFCI physicians treat patients in both DFCI and BWH beds, these patients cannot be directly observed in available claims data by reference to the listed facility. Section V sets out the methodology employed to identify DFCI patients using a physician roster for DFCI as a starting point for identifying DFCI-related care.
39. To analyze the cost impacts of the Proposed Project, relevant healthcare service lines were identified, including inpatient cancer care services. Section VI defines these service lines for the purpose of the economic and quantitative analyses. These service lines are defined using standard approaches applied in the evaluation of healthcare markets and consumer choice for inpatient and outpatient services. The geographic scope of DFCI's provision of care is assessed and analyzed in Section VII. Using inpatient and outpatient claims data, this section also identifies relevant providers within each service line.
40. Section VIII provides detailed analysis of the patients, providers, and payors for each of the relevant service lines. These apply standard methodologies and a standard basis for estimating shares based on volumes in a geography and by provider.
41. The ICA Questions involve economic evaluation of current demand, as well as demand and utilization in the future, after the expansion of DFCI's bed capacity. Section IX uses population projections and trends in inpatient cancer care incidence to project forward the evolution of inpatient cancer care services utilization, both overall and by payor category from current levels. Projections were conducted for both the short term (for 2025) and long term (through 2040). The time frames for projections will use as their starting point the most recent utilization data available (2022).
42. Section X details the modeling of shift in utilization of inpatient cancer care services across facilities due to the Proposed Project and DFCI's methodology for calculating need for inpatient beds. Section XI sets out the detailed analyses of current prices for relevant service lines at the provider level, including commercial, Medicare, and Medicaid prices. Section XII combines the projected shifts in utilization with the analyses of current providers and prices within each service line, and evaluates the Proposed Project's impact on inpatient cancer care shares, prices, and total medical spending. Section XIII analyzes the role of novel, specialized cancer care in this analysis.
43. Section XIV and Section XV provide analysis of the Proposed Project's impact in the diagnostic imaging services and radiation therapy services service lines respectively. Each section discusses relevant services and geographies; current providers and prices; forecasted future demand; DFCI's forecasted need for additional equipment to support forecasted demand; and the impacts of the Proposed Project on shares, prices, and total medical spending in the service lines.

44. For each component of the Proposed Project and across all assessed time horizons, this report finds that the baseline projected impacts of the project on healthcare expenditures fall below the Commonwealth's established benchmark growth rate.

IV. DATA SOURCES

45. In order to perform the analyses required by the ICA questions, FTI made use of several datasets and data sources for empirical analysis, including healthcare claims data, demographic data, health data, healthcare facility capacity data, and population projections data. For convenience, the key data sources and information used with accompanying citations are summarized in the sections below. A complete summary is provided in the appendix to this report.

V. IDENTIFYING DFCI PATIENTS

46. Because DFCI provides care in both its licensed beds and in beds leased from BWH, inpatient cancer care by DFCI physicians cannot be readily identified by reference to facility information in discharge or claims data. FTI ascribed all patients admitted to DFCI-licensed beds as DFCI patients. FTI identified DFCI patients admitted to beds leased by DFCI from BWH through their attending physician. DFCI provided a roster of 1,764 physicians with privileges at DFCI.²⁶ Using the 2022 Massachusetts Center for Health Information and Analysis (CHIA) Case Mix Data,²⁷ FTI compiled a profile for each physician, including the number of inpatient discharges at DFCI or BWH²⁸ for which they were listed as the attending physician and the proportion of which were patients with a neoplasm.²⁹ The 254 DFCI physicians with a minimum of five BWH discharges and at least 25% of their inpatient discharges being for neoplasm patients were included in the set used to identify DFCI inpatient cancer patients.³⁰ All BWH discharges with a neoplasm diagnosis and a DFCI physician from this set were allocated to the DFCI patient count.
47. This physician-based methodology for patient identification has several advantages. First, academic research demonstrates that a cancer patient's physician is an important factor in their choice of hospital.³¹ Patients tend to follow their physician when choosing a facility for inpatient care.³²

²⁶ Letter from Caroline Powers to Lisa O'Connor, dated June 26, 2024. The roster "includes physicians with privileges at Dana-Farber, defined as active staff who see patients." The dataset excludes active staff with no privileges and "Distinguished Staff." It contains the first and last name of each physician and their Massachusetts license number.

²⁷ See Appendix Section I.A for a detailed description of these data.

²⁸ Expanding the set of hospitals where DFCI physicians may have treated patients to all hospitals in Massachusetts identified very few additional physicians meeting the criteria. This implies that DFCI physicians perform nearly all of their inpatient care in DFCI or BWH licensed beds.

²⁹ See Section VI below for the methodology used to identify patients with a neoplasm.

³⁰ The restriction to these physicians and to exclusively using attending physicians (rather than, for example, including operating physicians) may lead the estimated number of DFCI patients to be understated.

³¹ See Section X below for a summary of this research.

³² Sensitivity of the ICA results to this pattern is explored through various alternative scenarios below.

Consistent with this, even for DFCI patients admitted through the BWH emergency department, 90% had a previous inpatient or outpatient encounter with DFCI in the prior year. Second, though the FTI methodology differs in key ways from the approach taken by DFCI in its Application, as shown below, each methodology identifies a similar number of DFCI patients. Finally, modeling of the facility-level market dynamic following the implementation of the Proposed Project requires separating the facility shares (where many DFCI patients are treated in the BWH facility) from the physician roles. A physician-based approach allows for distinguishing between facility-based and physician-based factors in economic evaluation of payment, pricing, and bargaining leverage.

VI. CANCER CARE SERVICE LINES

48. In order to evaluate the impact of the Proposed Project on healthcare costs, this report examines the specific services that are currently provided by DFCI and that would be provided through the Proposed Project. Service line definitions are used to reference the overall type or category of service provided. Though service lines typically encompass differentiated services, grouping these services allows for consistent measurement of utilization across providers, within and across health systems and over time. Service line definitions for empirical research in healthcare tend to use defined sets of diagnoses or procedures, defined by particular codes or groupers (e.g., ICD, CPT, or DRG codes).
49. Because the new DFCI facility will provide exclusively adult cancer care, this analysis restricts attention for all service lines to adult patients (age eighteen and above) with a non-benign neoplasm diagnosis. This approach is consistent with the nature of the Proposed Project, the typical services observed in the claims data for DFCI physicians, and DFCI's own approach for characterizing its services.³³ Specifically, cancer care diagnoses were identified in inpatient and outpatient claims data using the ICD-10 diagnosis codes listed below in Table 1.

³³ Application Narrative, p. 19.

Table 1: ICD-10 Cancer Care Diagnosis Codes³⁴

ICD-10 Code	Description
C00-C96	Includes malignant neoplasm, malignant melanoma, lymphoma, leukemia, basal and squamous cell carcinoma, mesothelioma, Kaposi's sarcoma, gastrointestinal stromal tumor, Merkel cell carcinoma, malignant carcinoid tumor, mycosis fungoides, Sezary Disease
D00-D09	Includes carcinoma in situ and melanoma in situ
D37-D49	Includes neoplasm of uncertain behavior, benign carcinoid tumors, refractory anemia, desmoid tumor
Z19	Includes hormone sensitivity malignancy status
Z51.0	Includes antineoplastic radiation therapy
Z51.1	Includes chemotherapy for neoplasm
Z51.11	Includes antineoplastic chemotherapy
Z51.12	Includes antineoplastic immunotherapy

50. This analysis uses five service lines: (1) inpatient cancer care, (2) inpatient medical cancer care, (3) inpatient surgical cancer care, (4) outpatient cancer imaging (with CT, MRI, and PET-CT scans analyzed independently), and (5) radiation therapy for cancer (with use of LINACs and CT simulators analyzed independently). These service lines cover the proposed new or expanded services, facility, and equipment in the Proposed Project and are thus used for economic analyses of existing and projected supply and demand.

51. Inpatient cancer care is defined as all inpatient admissions with a cancer care diagnosis, as described above. Because the new DFCI facility would not provide surgical care, this service line is split further into medical cancer care and surgical cancer care. Any inpatient discharge with a surgical procedure that would typically be performed in an operating room setting is allocated to the surgical cancer care service line.³⁵ The remaining inpatient cancer care discharges are assigned to the medical cancer care service line. This approach to inpatient service line definition is similar but not identical to the approach used by DFCI in its Application. The diagnosis codes used for identifying cancer care are identical to DFCI's approach, but the Application indicates that "the Applicant's clinical leadership team assessed [the claims]...on a discharge-by-discharge basis" and excluded "patients with an admission unrelated to cancer."³⁶ DFCI did not provide details as to which specific discharges,

³⁴ Source: Centers for Medicare & Medicaid Services. ICD-10-CM Tabular List of Diseases and Injuries. (February 2024). <https://www.cms.gov/medicare/coding-billing/icd-10-codes>.

³⁵ FTI identified these surgical procedures by reviewing ICD-10 procedure codes used in claims in the inpatient cancer care service line. A full list of the procedure codes identified as surgical can be found in the Appendix.

³⁶ Application Narrative, p. 19.

procedures, or DRGs it excluded, so FTI could not independently evaluate DFCI's approach nor could it replicate the discharge-by-discharge review. In this regard, the service line definition in this analysis may be more inclusive than the definition used in DFCI's Application. Conversely, this report's approach is more restrictive than DFCI with regard to surgical care. While the Application excluded "surgical-only patients," this report's definition is more conservative with respect to the number of DFCI discharges because it excludes any surgical patients. The resulting analyses based on this service line, therefore, may underestimate overall projected demand for DFCI services at its new facility by cancer care patients with surgical procedures. As shown in Table 4 below, FTI's methodology identifies 10,687 medical cancer care inpatient discharges in 2022 for BIDMC and DFCI combined. This is similar to the estimated number of combined discharges calculated by DFCI in its Application.³⁷

VII. DEFINING GEOGRAPHIC AREAS OF COVERAGE FOR ICA EVALUATION

A. Overview of Methodology for Empirical Analysis of Service Areas

52. This ICA report develops several economic analyses for independent evaluation of competition, pricing, capacity, and utilization that use geographic areas or service areas. These include analysis of the scope of area served by existing or new DFCI facilities, identification of alternatives serving patient populations, utilization, share, predicted shifts from one location to another location, and pricing among others.
53. The ICA Questions directed the FTI to assess service availability, patient demographics, and projected trends on a statewide basis. Consequently, the majority of the analysis in this report is presented for Massachusetts as a whole. When considering questions of incremental demand, changes in prices, and changes in cost, our analysis is based on Massachusetts residents only, excluding out of state or international patients, consistent with the Commonwealth's cost-containment goals definitions.³⁸ On the other hand, we include non-Massachusetts residents in our review of DFCI's projected utilization of the proposed new hospital beds and new equipment in order to accurately incorporate capacity constraints.
54. Economic analyses in this report involve assessment of the proposed DFCI facility, the patient population served by this facility for specific services, and the alternative facilities that are or could be used by that patient population (or from where shifts to the relocated or expanded new services could occur). Economic analysis of patient populations and alternative providers in healthcare

³⁷ Application Narrative, p. 21.

³⁸ In some instances in the claims data, patients' geographic origin is unknown. In these cases, FTI conservatively included these patients in analyses of Massachusetts residents.

economics often uses the concept of Primary Service Areas (PSAs).³⁹ Typically, PSAs are defined by the region from which a provider draws a specific fraction of its patients (e.g., 90% of inpatient discharges or outpatient claims).

55. As shown below, at least 20% of DFCI's inpatient cancer care discharges are drawn from out-of-state patients, and within Massachusetts DFCI draws patients from every county of the Commonwealth. This implies that standard PSAs for DFCI inpatient cancer care would encompass all or essentially all regions of the state. The geographic scope of this draw area and the ICA Questions directives support statewide analysis of inpatient cancer care for assessment of the Proposed Project.
56. Some forecast scenarios described more fully below incorporate reallocation of non-cancer care patients between existing inpatient hospital providers following the construction of DFCI's new facility. To account for care delivered on a potentially more local basis than cancer care, this report makes use of health service areas (HSAs) defined by the Massachusetts Executive Office of Health and Human Services.⁴⁰ These regions include six collections of zip-codes that are grouped into the Western, Central, Northeast, Metro West, Southeast, and Boston regions.
57. Sections XIV.B and XV.B below provide additional detail regarding DFCI's geographic service areas for outpatient diagnostic imaging and radiation therapy respectively.

B. Overview of DFCI and Health Systems Offering Inpatient Cancer Care Services

58. Applying the methodology described above, FTI defined service areas for each service line. We note here that there may be providers not depicted on the maps below that serve as alternatives for patients in a specific service area. Moreover, facilities located physically outside of an area may be important alternatives that are used or could be conveniently used by patients.⁴¹
59. Figure 1 depicts the hospital locations of health systems providing inpatient cancer care (as defined above) in Massachusetts. Figure 2 provides the same depiction of locations in the Boston area. There are numerous other hospitals providing cancer care that are not included on the map yet are included

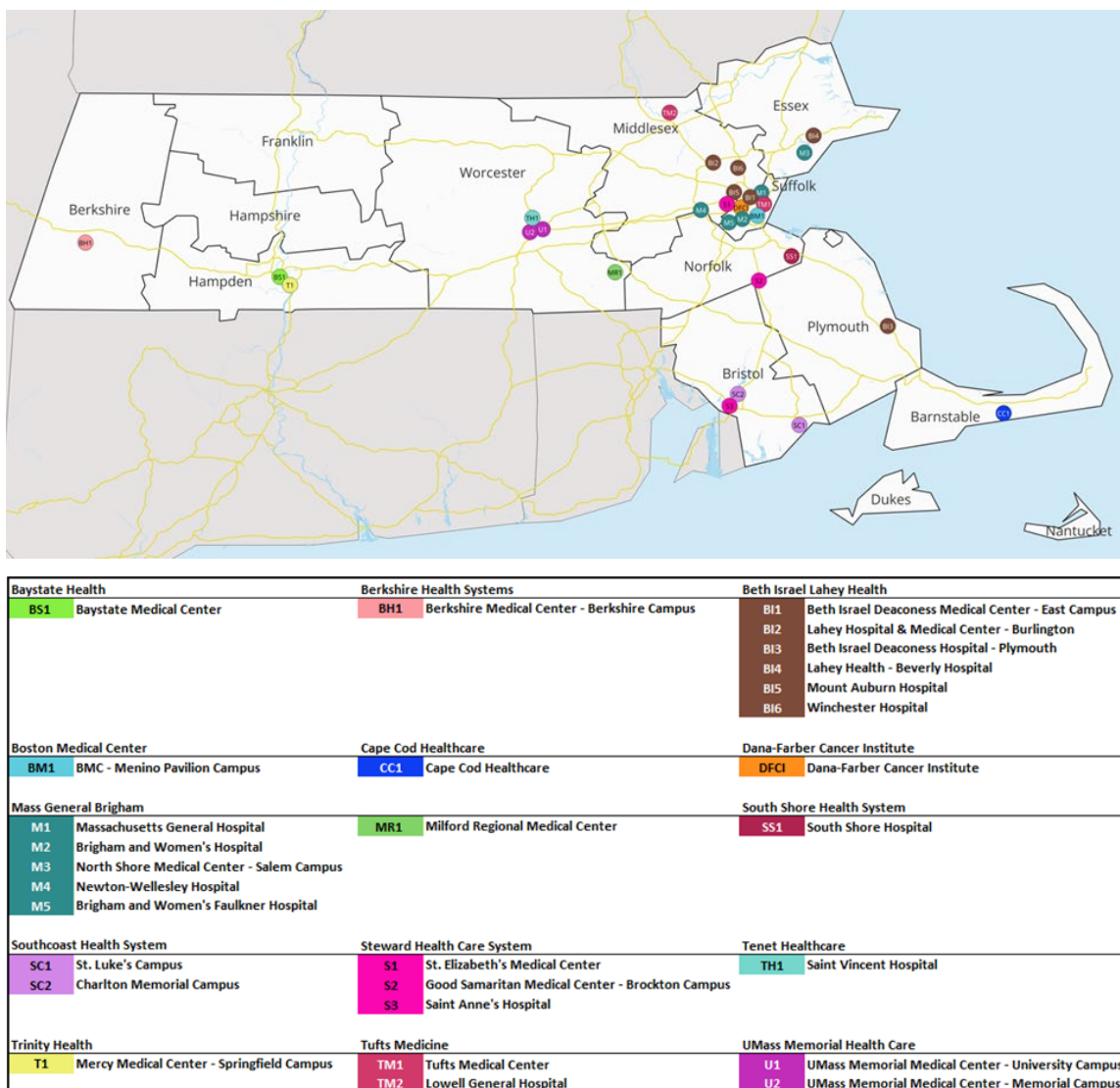
³⁹ For example, some agency screening methods for healthcare and hospital transactions involve construction of PSAs for each of the parties to a transaction using discharge or visit data. While specific methodologies for constructing PSAs vary, the general approach includes defining the scope of the PSA based on the patient population of the entity (using ZIP codes and counts of patients). PSAs are used for screening purposes and do not necessarily define antitrust markets. See, Garmon, C. (2017) "The accuracy of hospital merger screening methods." *The RAND Journal of Economics* 48(4):1068-1102.

⁴⁰ Massachusetts Executive Office of Technology Services and Security. "MassGIS Data: MA Executive Office of Health & Human Services Regions" (April 2022), <https://www.mass.gov/info-details/massgis-data-ma-executive-office-of-health-human-services-regions>.

⁴¹ Market share analyses below include all such facilities. See, for example, American Bar Association, Section of Antitrust Law, "Health Care Mergers and Acquisitions Handbook, Second Edition," *American Bar Association* (2018) for approaches including provider locations when defining relevant geographic aspects in market definition.

in the empirical analyses that follow.⁴² DFCI's current location (co-located with BWH) is depicted on the map. Mass General Brigham (MGB) and Beth Israel Lahey Health have the largest number of facilities in the state. Other entities with multiple locations include UMass Memorial Health Care, Tufts Medicine, and Southcoast Health System.⁴³ Consistent with the distribution of the population across Massachusetts, most inpatient cancer care hospitals are centered around the Boston metro area, with additional facilities distributed around other areas of the state.

Figure 1: Overview of Massachusetts Health Systems Providing Inpatient Cancer Care⁴⁴

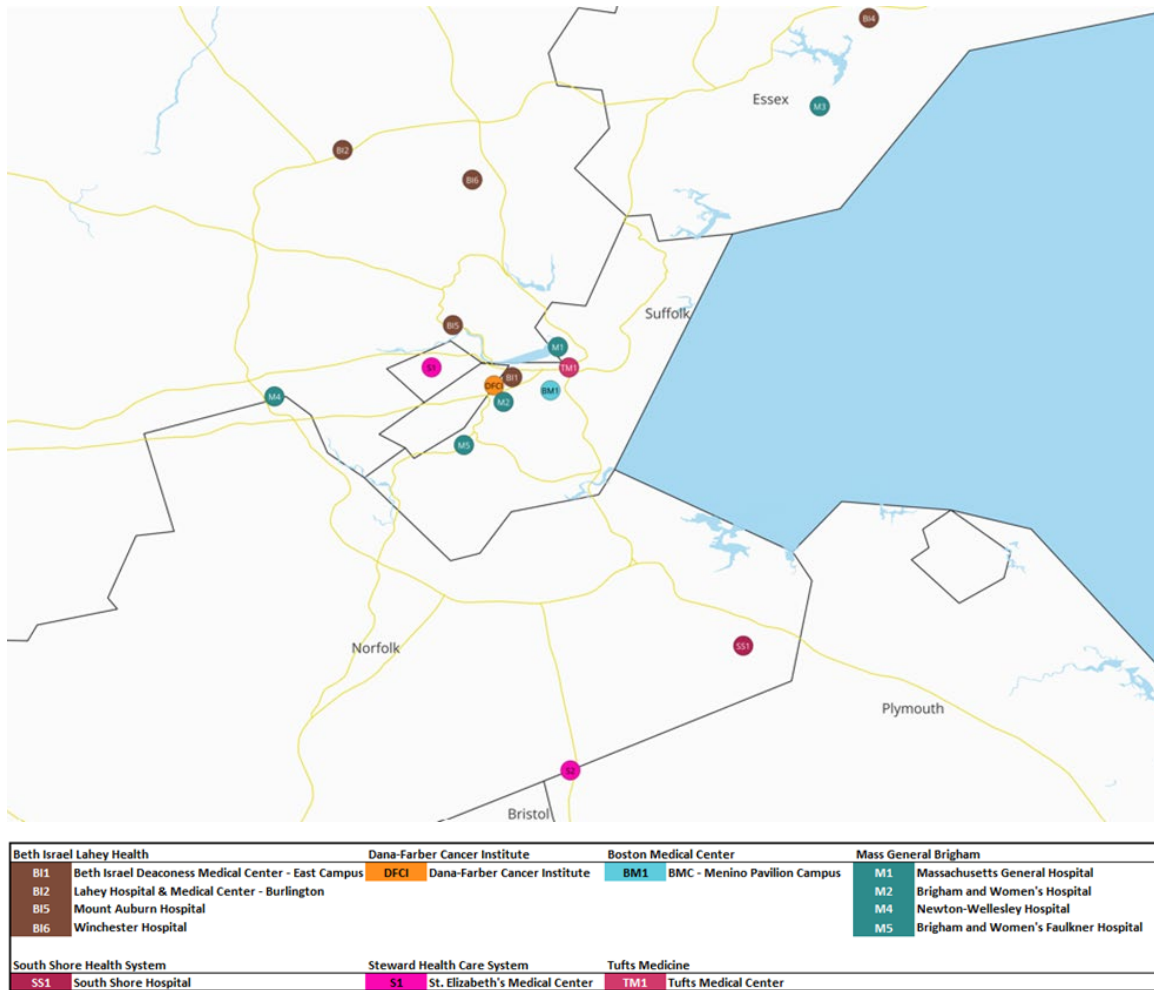


⁴² Hospitals excluded from the map each provide less than 1% of inpatient cancer care in the state, however, there are forty-one such locations collectively providing 16% of the inpatient cancer care services.

⁴³ Steward Health Care System also had three locations as of this 2022 data, but these facilities have since become affiliated with other systems.

⁴⁴ Source: 2022 CHIA Case Mix Data.

Figure 2: Overview of Boston Area Health Systems Providing Inpatient Cancer Care⁴⁵



VIII. CURRENT PROVISION OF INPATIENT CANCER CARE IN MASSACHUSETTS

60. This section provides detailed analysis of the patients, providers, and payors for each of the relevant service lines. These apply standard methodologies and a standard basis for estimating shares based on volumes in a geography and by provider. FTI used CHIA data and information on licensed facilities to identify specific providers of the relevant services.
61. Table 2 sets out demographic information for patients receiving inpatient cancer care in Massachusetts in 2022 by number of discharges, and separately for medical and surgical inpatient cancer care. The distribution of discharges skews toward older individuals. The statewide payor mix for inpatient cancer care is 63% Medicare, 21% commercial, and 10% Medicaid⁴⁶ with the remaining discharges coming from other government funding or self-pay patients. Across the 73,155 inpatient

⁴⁵ Source: 2022 CHIA Case Mix Data.

⁴⁶ Throughout this report, Medicaid refers to and includes MassHealth insurance coverage.

cancer care discharges in Massachusetts, the average length of stay is 6.9 days with an average statewide daily census of approximately 1,380 patients. More than 85% of inpatient cancer care discharges are classified as medical, but average acuity, as measured by case weight per discharge, is significantly higher for surgical patients (2.6 versus 2.0). Because surgical patients are, on average, younger than medical patients, the share with commercial insurance rather than Medicare is also higher.

Table 2: Demographic Characteristics of Massachusetts Inpatient Cancer Care Patient Panel⁴⁷

		Total	%	Medical	%	Surgical	%
Age	18-34	1,705	2%	1,510	2%	195	2%
	35-54	7,961	11%	6,419	10%	1,542	16%
	55-64	14,351	20%	11,866	19%	2,485	26%
	65-74	21,628	30%	18,464	29%	3,164	33%
	75+	23,883	33%	21,807	34%	2,076	22%
	Unknown Age	3,627	5%	3,510	6%	117	1%
Sex	Female	34,798	48%	30,169	47%	4,629	48%
	Male	38,353	52%	33,403	53%	4,950	52%
Payor Type	Medicare	46,255	63%	41,340	65%	4,915	51%
	Commercial	15,670	21%	12,420	20%	3,250	34%
	Medicaid	6,978	10%	6,054	10%	924	10%
	Self-Pay/Other	2,312	3%	2,093	3%	219	2%
	Other Government	1,940	3%	1,669	3%	271	3%
Race	White	60,660	83%	52,738	83%	7,922	83%
	Black/African American	5,404	7%	4,839	8%	565	6%
	Asian	2,318	3%	1,958	3%	360	4%
	Other	2,969	4%	2,575	4%	394	4%
Ethnicity	Non-Hispanic	68,757	94%	59,771	94%	8,986	94%
	Hispanic	4,379	6%	3,786	6%	593	6%
DRG Weight	0-1	12,013	16%	11,798	19%	215	2%
	1-2	41,479	57%	37,248	59%	4,231	44%
	2+	19,663	27%	14,530	23%	5,133	54%
	Case Mix Index	2.1		2.0		2.6	
	Average Length of Stay	6.9		7.0		6.0	
	Average Daily Census	1,380		1,222		157	
Total	Total	73,155	100%	63,576	100%	9,579	100%

⁴⁷ Source: 2022 CHIA Case Mix Data. Throughout this report, patients are determined to be Massachusetts residents if their address is in Massachusetts or if their address is unknown, unless otherwise designated.

62. Table 3 shows the number of inpatient cancer care discharges by Massachusetts county, with 8% of discharges coming from out-of-state discharges.

Table 3: Inpatient Cancer Care Discharges by Patient Origin and Service Line⁴⁸

	Total	%	Medical	%	Surgical	%
Massachusetts	72,285	90.2%	62,861	91.1%	9,424	85.0%
<i>Middlesex County</i>	14,777	18.4%	12,782	18.5%	1,995	18.0%
<i>Essex County</i>	8,843	11.0%	7,737	11.2%	1,106	10.0%
<i>Worcester County</i>	8,297	10.4%	7,121	10.3%	1,176	10.6%
<i>Norfolk County</i>	8,160	10.2%	7,110	10.3%	1,050	9.5%
<i>Suffolk County</i>	7,547	9.4%	6,678	9.7%	869	7.8%
<i>Plymouth County</i>	6,891	8.6%	6,036	8.7%	855	7.7%
<i>Bristol County</i>	5,858	7.3%	5,056	7.3%	802	7.2%
<i>Hampden County</i>	4,617	5.8%	3,998	5.8%	619	5.6%
<i>Barnstable County</i>	3,295	4.1%	2,873	4.2%	422	3.8%
<i>Berkshire County</i>	1,490	1.9%	1,289	1.9%	201	1.8%
<i>Hampshire County</i>	1,351	1.7%	1,179	1.7%	172	1.6%
<i>Franklin County</i>	738	0.9%	638	0.9%	100	0.9%
<i>Dukes County</i>	240	0.3%	200	0.3%	40	0.4%
<i>Nantucket County</i>	135	0.2%	122	0.2%	13	0.1%
<i>Windham County</i>	*	*	*	*	*	*
<i>Unknown County</i>	*	*	*	*	*	*
Out of State	6,440	8.0%	5,010	7.3%	1,430	12.9%
Unknown State	1,401	1.7%	1,165	1.7%	236	2.1%
Total	80,126	100.0%	69,036	100.0%	11,090	100.0%

63. In response to the ICA questions regarding price and competition, FTI analyzed the current shares of DFCI and alternative providers of inpatient cancer care in Massachusetts. Table 4 provides discharge volume and shares for total inpatient cancer care, medical inpatient cancer care, and surgical inpatient cancer care by health system and hospital for 2022. DFCI accounted for 7,456 inpatient cancer care discharges in 2022 (10.2% of the state total). Of these, 1,022 occurred in the 30 DFCI licensed beds and the remaining 6,434 occurred in beds leased from BWH. DFCI's inpatient cancer care discharges were split between medical care (5,923 discharges) and surgical care (1,533 discharges). Mass General Brigham and Beth Israel Lahey Health have the highest system-level shares (22.8% and 18.8% respectively), and Massachusetts General Hospital (MGH) is the largest single hospital provider of inpatient cancer care (11.5%). BIDMC has 7.7% share. The distribution of inpatient cancer care

⁴⁸ Source: 2022 CHIA Case Mix Data. A * indicates the number of discharges is less than 11 and has been redacted to comply with data confidentiality requirements.

across hospitals is disperse, with seventy-one hospitals in twenty-three systems providing some amount of care. Surgical inpatient cancer care is somewhat more concentrated in Boston-area hospitals and academic medical centers (e.g., MGH, BIDMC, DFCI, Tufts Medical Center, and Boston Medical Center) than medical inpatient cancer care, but the distribution is still diffuse across the whole state.

64. Table 5 shows the number of discharges and average daily census for inpatient cancer care patients treated in DFCI or BWH beds. In 2022, BWH housed beds that served 10,481 inpatient cancer patients with an average daily census of 224 beds. Thirty beds were licensed to DFCI, and DFCI physicians provided care for 1,022 discharges in those beds in 2022. DFCI attending physicians also provided care for 6,434 cancer discharges in beds leased from BWH. Separately, non-DFCI attending physicians provided care for 3,025 inpatient cancer patients. The combined average daily census in 2022 of cancer patients in BWH-licensed beds (regardless of attending physician affiliation) was 204, with 136 being used by DFCI patients and 68 by BWH patients.
65. Table 6 compares the distribution of patient origin for inpatient cancer care patients across all Massachusetts providers to the DFCI distribution. DFCI draws relatively more patients from Boston and its surrounding counties. DFCI serves significantly more out-of-state patients than the average Massachusetts hospital—at least 20.5% of its discharges.⁴⁹ While the ICA Questions focus on Massachusetts residents, the substantial number of out-of-state patients served by DFCI is relevant for assessing DFCI’s need calculations and for capacity constraints of the proposed new facility. These issues are more fully addressed in Section X below.

⁴⁹ A material amount of DFCI’s discharges (5.1%) do not have patient origin information. DFCI estimated its share of unique inpatient patients in 2022 coming from outside of Massachusetts to be 27%, raising the possibility that a substantial amount of the patients with unknown origin are from outside of Massachusetts. See Application Narrative, p. 9, Table 2.

Table 4: Massachusetts Inpatient Cancer Care Discharges by Hospital, 2022⁵⁰

System	Hospital Name	Discharges	Share of Discharges	Medical Discharges	Share of Medical Discharges	Surgical Discharges	Share of Surgical Discharges
Total		73,155	100%	63,576	100%	9,579	100%
Mass General Brigham	Total	16,656	22.8%	14,377	22.6%	2,279	23.8%
Mass General Brigham	Massachusetts General Hospital	8,446	11.5%	7,161	11.3%	1,285	13.4%
Mass General Brigham	Brigham and Women's Hospital	3,025	4.1%	2,836	4.5%	189	2.0%
Mass General Brigham	North Shore Medical Center - Salem Campus	1,747	2.4%	1,579	2.5%	168	1.8%
Mass General Brigham	Newton-Wellesley Hospital	1,569	2.1%	1,374	2.2%	195	2.0%
Beth Israel Lahey Health	Total	13,768	18.8%	11,938	18.8%	1,830	19.1%
Beth Israel Lahey Health	Beth Israel Deaconess Medical Center - East Campus	5,653	7.7%	4,764	7.5%	889	9.3%
Beth Israel Lahey Health	Lahey Hospital & Medical Center - Burlington	2,705	3.7%	2,176	3.4%	529	5.5%
Dana-Farber Cancer Institute	Dana-Farber Cancer Institute	7,456	10.2%	5,923	9.3%	1,533	16.0%
<i>Dana-Farber Cancer Institute</i>	<i>Brigham and Women's Hospital Leased Beds</i>	<i>6,434</i>	<i>8.8%</i>	<i>4,919</i>	<i>7.7%</i>	<i>1,515</i>	<i>15.8%</i>
<i>Dana-Farber Cancer Institute</i>	<i>Dana-Farber Cancer Institute Licensed Beds</i>	<i>1,022</i>	<i>1.4%</i>	<i>1,004</i>	<i>1.6%</i>	<i>18</i>	<i>0.2%</i>
UMass Memorial Health Care	Total	5,072	6.9%	4,380	6.9%	692	7.2%
UMass Memorial Health Care	UMass Memorial Medical Center - University Campus	2,510	3.4%	2,398	3.8%	112	1.2%
Steward Health Care System	Total	4,245	5.8%	3,727	5.9%	518	5.4%
Baystate Health	Total	3,862	5.3%	3,449	5.4%	413	4.3%
Baystate Health	Baystate Medical Center	3,162	4.3%	2,762	4.3%	400	4.2%
Tufts Medicine	Total	3,719	5.1%	3,249	5.1%	470	4.9%
Tufts Medicine	Tufts Medical Center	1,717	2.3%	1,418	2.2%	299	3.1%
South Shore Health System	Total	3,065	4.2%	2,809	4.4%	256	2.7%
South Shore Health System	South Shore Hospital	3,065	4.2%	2,809	4.4%	256	2.7%
Southcoast Health System	Total	2,244	3.1%	2,019	3.2%	225	2.3%
Boston Medical Center	Total	2,225	3.0%	1,920	3.0%	305	3.2%
Boston Medical Center	Boston Medical Center - Menino Pavilion Campus	2,225	3.0%	1,920	3.0%	305	3.2%
Cape Cod Healthcare	Total	2,026	2.8%	1,868	2.9%	158	1.6%
Cape Cod Healthcare	Cape Cod Hospital	1,470	2.0%	1,344	2.1%	126	1.3%
Tenet Healthcare	Total	1,763	2.4%	1,530	2.4%	233	2.4%
Other Health Systems	Total	7,054	9.6%	6,257	9.9%	797	7.1%

⁵⁰ Source: 2022 CHIA Case Mix Data. Hospitals with less than 2% share of total discharges are not included in the table, but their discharges are included in system totals. Health systems with less than 2% share are grouped into an “Other Health Systems” category.

Table 5: Inpatient Cancer Care Patients Treated at BWH Location by Bed License Holder and Attending Physician Affiliation, 2022⁵¹

Patient Type	Discharges	Length of Stay (days)	Average Daily Census (beds)
BWH Cancer Patients (non-DFCI attending)	3, 025	24, 900	68
DFCI Cancer Patients (BWH Leased Beds)	6, 434	49, 714	136
DFCI Cancer Patients (DFCI Licensed Beds)	1, 022	7, 188	20
Total	10, 481	81, 802	224

Table 6: Inpatient Cancer Care Discharges by Patient Origin⁵²

	Statewide	DFCI
Massachusetts	90.2%	74.5%
<i>Middlesex County</i>	18.4%	15.3%
<i>Essex County</i>	11.0%	6.2%
<i>Worcester County</i>	10.4%	6.7%
<i>Norfolk County</i>	10.2%	13.0%
<i>Suffolk County</i>	9.4%	10.2%
<i>Plymouth County</i>	8.6%	8.0%
<i>Bristol County</i>	7.3%	6.7%
<i>Hampden County</i>	5.8%	2.0%
<i>Barnstable County</i>	4.1%	4.1%
<i>Berkshire County</i>	1.9%	1.0%
<i>Hampshire County</i>	1.7%	0.7%
<i>Franklin County</i>	0.9%	0.3%
<i>Dukes County</i>	0.3%	*
<i>Nantucket County</i>	0.2%	*
<i>Windham County</i>	*	*
<i>Unknown County</i>	*	*
Out of State	8.0%	20.5%
Unknown State	1.7%	5.1%
Total	100.0%	100.0%

66. Table 7 provides the demographic profiles for DFCI's and other inpatient cancer care providers' patient panels. DFCI serves a, on average, younger (and therefore more likely to be commercially insured) patient population than the state average. Its share of patients with Medicaid and its racial and ethnic patient distributions are in line with state averages. The selected hospitals in Table 7,

⁵¹ Source: 2022 CHIA Case Mix Data.

⁵² Source: 2022 CHIA Case Mix Data. A * indicates the number of discharges is less than 11 and has been redacted to comply with data confidentiality requirements.

including DFCI, have a higher than state-average acuity and length of stay, driven primarily by the hospital providing care to a higher share of surgical patients. Table 8 provides the payor mix for the health systems with the largest shares of inpatient cancer care in Massachusetts. UMass Memorial Health Care provides relatively more care to Medicaid patients, and Steward Health Care System and Baystate Health provide more care to other government and self-pay patients than the state average.

67. FTI's analyses of CHIA utilization data for the state by payor and by other available demographic characteristics are generally consistent with DFCI's reported patient panel profiles in its Application and responses to DPH.

Table 7: Demographic Characteristics of Inpatient Cancer Care Patients by Health System⁵³

		State	DFCI	BWH	BIDMC
Age	18-34	2%	5%	3%	3%
	35-54	11%	19%	12%	13%
	55-64	20%	24%	22%	23%
	65-74	30%	32%	31%	32%
	75+	33%	19%	28%	27%
	Unknown Age	5%	1%	4%	3%
Sex	Female	48%	52%	50%	49%
	Male	52%	48%	50%	51%
Payor Type	Medicare	63%	49%	60%	59%
	Commercial	21%	38%	27%	25%
	Medicaid	10%	10%	8%	10%
	Self-Pay/Other	3%	2%	3%	2%
	Other Government	3%	2%	1%	4%
Race	White	83%	82%	79%	68%
	Black/African American	7%	7%	11%	14%
	Asian	3%	5%	2%	6%
	Other	4%	4%	5%	3%
Ethnicity	Non-Hispanic	94%	94%	94%	94%
	Hispanic	6%	6%	6%	6%
DRG Weight	0-1	16%	12%	18%	12%
	1-2	57%	48%	48%	50%
	2+	27%	40%	33%	38%
	Case Mix Index	2.1	2.6	2.7	2.5
	Average Length of Stay	6.9	7.6	8.2	8.8
	Average Daily Census	1,380	156	68	137
Total	Total	100%	100%	100%	100%

⁵³ Source: 2022 CHIA Case Mix Data.

Table 8: Massachusetts Inpatient Cancer Care Discharges, Shares, and Payor Mix by System and Select Hospitals⁵⁴

System Name	Discharges	Share	Payor Mix			
			Commercial	Medicare	Medicaid	Other
Statewide	73,155	100.0%	21.4%	63.2%	9.5%	5.8%
Mass General Brigham	16,656	22.8%	25.8%	61.1%	8.4%	4.7%
<i>Massachusetts General Hospital</i>	<i>8,446</i>	<i>11.5%</i>	<i>29.4%</i>	<i>56.2%</i>	<i>10.3%</i>	<i>4.1%</i>
<i>Brigham and Women's Hospital</i>	<i>3,025</i>	<i>4.1%</i>	<i>27.4%</i>	<i>59.6%</i>	<i>8.4%</i>	<i>4.5%</i>
Beth Israel Lahey Health	13,768	18.8%	20.0%	68.8%	7.1%	4.1%
<i>Beth Israel Deaconess Medical Center</i>	<i>5,653</i>	<i>7.7%</i>	<i>24.8%</i>	<i>59.3%</i>	<i>10.2%</i>	<i>5.7%</i>
Dana-Farber Cancer Institute	7,456	10.2%	37.6%	48.7%	10.4%	3.4%
UMass Memorial Health Care	5,072	6.9%	14.4%	63.8%	15.9%	5.9%
Steward Health Care System	4,245	5.8%	16.5%	62.1%	10.7%	10.7%
Baystate Health	3,862	5.3%	16.7%	62.3%	10.9%	10.1%
Tufts Medicine	3,719	5.1%	24.0%	61.2%	7.6%	7.1%

IX. FORECAST OF FUTURE DEMAND FOR CANCER CARE

A. Methodology for Estimating Current and Future Demand

68. The ICA analyses of capacity, utilization, pricing, and competition require estimates of current and future demand for the service lines involved in the Proposed Project. Independently derived estimates of current and projected utilization of services by service area are developed in this section for those purposes and are also useful for assessing the reasonableness of DFCI's estimates of demand and its projected needs.
69. To estimate current and future demand for services at the state, regional, and service area levels, we combined current population estimates and projections from the University of Massachusetts Donahue Institute (UMDI) with utilization data from the CHIA Case Mix Data and the CHIA Massachusetts All-Payer Claims Database (APCD).
70. To estimate current demand for relevant services, FTI determined utilization by service line, patient's ZIP Code Tabulation Areas (ZCTAs), aggregated payor category (i.e., commercial, Medicare, and Medicaid), age group (5-year age range), and sex. These age combinations matched the population projections provided by the UMDI. Current demand was determined based on 2022 utilization data from CHIA.
71. To project future demand for cancer care in the relevant service lines, FTI modeled growth in demand by age, sex, and ZCTA as a combination of expected population growth and growth in cancer care incidence (i.e., growth in the rate of cancer care utilization per capita).

⁵⁴ Source: 2022 CHIA Case Mix Data.

72. To estimate population growth, FTI used UMDI's population projections reported at the city level and mapped each city to individual ZCTAs using a crosswalk available from the US Census. If a city spanned multiple ZCTAs, its projected population was distributed according to the ZCTAs' populations. These ZCTA level estimates provide for the ability to estimate demand and changes in future utilization for specific service areas. Table 9 presents these population projections by age range for 2025 through 2040. The population ages 15 and above is projected to grow by 2.9% between 2025 and 2040.
73. Approximately 2% of discharges were missing ZIP code information, and to avoid losing these patients in the projections, the methodology distributed their visits proportionally within groups to ensure total utilization predictions would not be underestimated.⁵⁵

Table 9: Total Massachusetts Population Projections and Growth Rates by Age Range⁵⁶

Age Range	Population Projections				Growth (2025-2040)
	2025	2030	2035	2040	
15-19	394,277	394,498	386,321	403,506	2.3%
20-24	451,911	422,011	418,451	413,777	-8.4%
25-29	485,106	461,670	441,407	439,136	-9.5%
30-34	516,891	493,699	472,981	462,004	-10.6%
35-39	499,244	514,828	496,140	478,790	-4.1%
40-44	453,467	496,387	512,372	494,541	9.1%
45-49	411,622	452,592	492,908	507,114	23.2%
50-54	431,780	410,797	449,229	487,035	12.8%
55-59	462,874	422,979	402,773	439,480	-5.1%
60-64	479,020	441,599	403,977	386,447	-19.3%
65-69	433,039	445,281	410,725	376,782	-13.0%
70-74	349,870	391,583	402,391	370,772	6.0%
75-79	268,696	303,719	339,060	347,274	29.2%
80-84	165,749	214,505	242,265	269,391	62.5%
85+	167,993	190,741	230,972	267,961	59.5%
Total	5,971,538	6,056,887	6,101,971	6,144,010	2.9%

74. Because the incidence of cancer is growing (as noted in DFCI's Application), FTI adjusted the population-based projections of future demand for cancer care. To estimate trends in cancer care incidence, FTI calculated the compound annual growth rate (CAGR) in inpatient cancer care

⁵⁵ Utilization was limited to Massachusetts residents to the degree possible, except in measuring capacity constraints.

⁵⁶ Source: UMass Donahue Institute Massachusetts Population Estimates Program.

discharges per capita between 2019 and 2022 by age range and sex.⁵⁷ This adjustment factor was applied on an annual basis with population growth rates to the baseline 2022 utilization in each demographic bin.

75. This methodology assumes that growth in service utilization rates within each demographic group will be constant over time and that volume will otherwise change proportionally to population. For ease of exposition, the ICA analyses assume that the Proposed Project will be operational in 2025.⁵⁸ FTI then projected utilization and demand in five-year increments for the next fifteen years (i.e., through 2040).
76. The method for projecting utilization of services is based solely on the expected changes in population and cancer care incidence trends.⁵⁹ It does not account for potential changes in future demand that are driven by factors such as changes in treatment patterns, care-seeking behaviors, or entry or expansion of local facilities.⁶⁰

B. Projected Changes in Inpatient Cancer Care Services Utilization

77. This section presents the results of the demand projection methodology outlined above for each relevant service line.⁶¹
78. Utilization projections were developed by area, service, and payor. Application of the methodology results in initial projections that the total utilization of inpatient cancer care across all regions in the state will increase by 26.8% from 78,122 discharges in 2025 to 99,070 discharges in 2040. The majority of this growth in utilization is driven by the growth of older cohorts with higher cancer prevalence (e.g., individuals age 75 and above) and, to a lesser extent, by trends towards higher cancer-related hospitalization rates (including due to higher rates of cancer incidence). For context, this increase of nearly 26,000 additional discharges is larger than the current total number of inpatient cancer care discharges at MGH, BWH, BIDMC, and DFCI combined.

⁵⁷ Using the growth rate based on 2019 and 2022 utilization allows for abstraction away from COVID-19 pandemic-related dips or bounce backs in utilization unrelated to underlying disease trends.

⁵⁸ The methodology and results for estimating changes in total medical health expenditures is not sensitive to the exact date on which the Proposed Project begins operations.

⁵⁹ This demand projection methodology differs from the one employed by DFCI in its application that used expected growth rates in services by cancer bed type. Lacking data on bed types, FTI was unable to directly assess this methodology. The overall growth rate between 2022 and 2032 calculated by DFCI was 17.9%. This is similar to forecasted overall market growth of 19.7% between 2025 and 2035 estimated by FTI.

⁶⁰ In its Application, DFCI notes that novel cancer treatments such as CAR T-cell therapy and bi-specific antibody therapy currently require inpatient admission (Application Narrative, pp. 15-16). Because these therapies are new with limited available information in claims data, this methodology does not account for potential increased demand from these therapies. See Section XIII for a more detailed discussion of these issues.

⁶¹ The demand projections presented here do not include any changes in demand due to the Proposed Project increasing the amount of demand overall. This possibility is explored below in discussing the potential for the Proposed Project to lead to supply-induced demand.

79. To address questions about utilization by various segments of the population, FTI also evaluated utilization by patient geography, payor type, patient race, and patient acuity level. As shown in Table 10, the regions with the highest forecast growth in the state over this period are the Boston, Northeast, and Central HSAs (32.0%, 30.2%, and 29.8% respectively). Due to the aging population, Medicare patients are projected to see more inpatient cancer care utilization growth than other payors (38.6%) while utilization among commercially insured patients is projected to remain relatively stable (-0.2%) (see Table 11). Table 12 sets out projected demand growth by patient race with relatively similar growth rates across the largest patient populations. Table 13 provides demand projections by patient acuity level as measured by DRG weight.
80. In sum, the projected demand by Massachusetts residents for inpatient cancer care services is high and projected to grow significantly. The projected mix of demand by payor shows that Medicare will continue to account for the majority of demand and utilization. These trend projections as well as levels address the ICA Questions that require consideration and projections of likely demand for services in the future and for services from DFCI (as well as other providers). The methods used in this section by FTI are standard for estimating current utilization and demand and in forecast models of future demand. They provide a basis for estimating the proportion of the patient population that likely will come to DFCI for specific services at the new proposed facility.

Table 10: Projected Demand for Inpatient Cancer Care by Patient HSA, 2025-2040

HSA	2022	Projected Discharges				Growth (2025-2040)
	Discharges	2025	2030	2035	2040	
Metro West	16,219	17,213	18,963	20,600	22,039	28.0%
Southeast	16,127	17,159	18,861	20,257	21,278	24.0%
Northeast	14,532	15,523	17,251	18,846	20,205	30.2%
Central	9,055	9,692	10,811	11,786	12,576	29.8%
Boston	8,167	8,971	10,204	11,135	11,846	32.0%
Western	8,143	8,588	9,262	9,714	9,938	15.7%
Unknown	912	976	1,070	1,141	1,187	21.6%
Total	73,155	78,122	86,422	93,479	99,070	26.8%

Table 11: Projected Demand for Inpatient Cancer Care by Payor Type, 2025-2040

Payor	2022 Discharges	Projected Discharges				Growth (2025-2040)
		2025	2030	2035	2040	
Medicare/Managed Medicare	46,255	50,956	59,141	65,841	70,605	38.6%
Commercial/HMO/PPO	15,670	15,697	15,467	15,388	15,662	-0.2%
Medicaid	6,978	6,946	6,865	6,927	7,178	3.3%
Self-Pay/Other	2,312	2,493	2,798	3,049	3,251	30.4%
Other Government	1,940	2,030	2,152	2,273	2,374	16.9%
Total	73,155	78,122	86,422	93,479	99,070	26.8%

Table 12: Projected Demand for Inpatient Cancer Care by Patient Race, 2025-2040

Race	2022 Discharges	Projected Discharges				Growth (2025-2040)
		2025	2030	2035	2040	
White	60,470	64,772	71,970	78,070	82,826	27.9%
Black/African American	5,366	5,674	6,145	6,530	6,854	20.8%
Other	2,829	2,958	3,178	3,391	3,594	21.5%
Asian	2,305	2,418	2,633	2,819	2,978	23.1%
American Indian/Alaska Native	92	96	101	105	110	14.9%
Native Hawaiian or other Pacific Islander	37	37	37	36	37	1.3%
Unknown	2,056	2,168	2,358	2,528	2,671	23.2%
Total	73,155	78,122	86,422	93,479	99,070	26.8%

Table 13: Projected Demand for Inpatient Cancer Care by Acuity Level, 2025-2040

DRG Acuity	2022 Discharges	Projected Discharges				Growth (2025-2040)
		2025	2030	2035	2040	
0-1	12,013	12,883	14,387	15,703	16,810	30.5%
1-2	41,479	44,365	49,243	53,407	56,722	27.9%
2+	19,663	20,875	22,792	24,369	25,537	22.3%
Total	73,155	78,122	86,422	93,479	99,070	26.8%

X. PREDICTING SHIFTS IN UTILIZATION FOR INPATIENT CANCER SERVICES

81. The prior section estimated the projected demand for the inpatient cancer care services through 2040. This section describes the methodology employed for the ICA analysis, and its economic rationale, for predicting shifts in utilization patterns and estimates the impact of those shifts under various scenarios.
82. DFCI's DoN Application envisions that a significant percentage of patients currently receiving medical oncology services at BWH from DFCI physicians will shift to receiving care in the new DFCI facility. The Application also envisions patients receiving medical oncology services at

BIDMC will shift to the new DFCI facility. Similarly, the Application envisions DFCI patients receiving surgical oncology services at BWH will shift to BIDMC.⁶²

83. In order to model the impact and reasonableness of these projections, the ICA analysis modeled the impact of medical inpatient cancer care discharges from DFCI (both those in DFCI licensed beds and BWH leased beds) and BIDMC shifting to the new DFCI facility with DFCI's surgical patients shifting to BIDMC.
84. The predicted shifts in utilization of inpatient cancer care between providers presented above is based upon a key assumption, namely that DFCI inpatient patients will move from receiving care at BWH to the new facility. The basis for this assumption is founded in research showing cancer care patients' decisions about site of care is strongly influenced by their physicians.⁶³ The empirical analysis discussed in Section V above demonstrating that nearly all DFCI cancer patients admitted through the emergency department in 2022 had a previous encounter with a DFCI physician also provides strong evidence consistent with this assumption.
85. Because DFCI does not employ primary care physicians while MGB does, some cancer care referrals from MGB physicians currently to DFCI through BWH may in the future not go to DFCI, potentially limiting the number of inpatient cancer care discharges that will shift from MGB to DFCI. However, the baseline analyses presented below, under a third of MGB academic medical center discharges of medical cancer care patients are projected to shift to the new proposed DFCI facility. This leaves substantial scope for patients with MGB employed primary care physicians to not move to the new proposed facility.
86. Another consideration in evaluating the reasonableness of the assumption that DFCI's patients will shift to the new facility is the new facility's lack of its own emergency department. A significant portion (41% in 2022) of DFCI's existing admissions come through the BWH emergency department. Though the new DFCI facility will not have its own emergency department, it will be physically connected to the BIDMC emergency department, somewhat mitigating the concern that this

⁶² Application Narrative, p. 28.

⁶³ One study found that factors such as clinician communication and rapport, perception of clinician expertise, referral by physician, and continuity of care were important factors for patients in choosing hospitals for cancer care. Other factors, such as distance to the hospital and insurance considerations are unlikely to be differentiators between BWH and DFCI. Fong, Z. V., Lim, P. W., Hendrix, R., Castillo, C. F. D., Nipp, R. D., Lindberg, J. M., ... & Traeger, L. N. (2021). Patient and caregiver considerations and priorities when selecting hospitals for complex cancer care. *Annals of surgical oncology*, 28, 4183-4192. See also, Schulman-Green, Dena, Emily Cherlin, Renee Capasso, Sarah S. Mougalian, Shiyi Wang, Cary P. Gross, Preeti S. Bajaj et al. "Patient and family caregiver considerations when selecting early breast cancer treatment: implications for clinical pathway development." *The Patient-Patient-Centered Outcomes Research* 13 (2020): 683-697; Del Vecchio, Natalie J., Natoshia M. Askelson, Knute D. Carter, Elizabeth Chrischilles, Charles F. Lynch, and Mary E. Charlton. "Patterns and characteristics of patients' selection of cancer surgeons." *The American journal of surgery* 221, no. 5 (2021): 1033-1041.

restriction will limit DFCI's existing patient's access to the new facility. The impact of this dynamic is explored further in sensitivity analyses presented below.

87. In 2025, DFCI is projected to have 1,045 medical inpatient cancer care discharges in its licensed beds and 5,136 medical inpatient cancer care discharges in beds leased from BWH (6,181 total).⁶⁴ BIDMC is projected to have 5,089 medical inpatient cancer care discharges in 2025. These 11,270 discharges form the initial pool of medical discharges that could shift to the new DFCI facility. In 2025, DFCI is projected to have 1,597 surgical inpatient cancer care discharges (between its licensed and leased beds) that could shift to BIDMC, adding to BIDMC's 933 surgical inpatient cancer care discharges.
88. If all DFCI and BIDMC medical inpatient cancer care discharges shift to the new DFCI facility, it would have an average daily census (ADC) of 265 in 2025. This does not account for out-of-state demand for DFCI care which has historically accounted for 20% of DFCI discharges and would increase ADC by an estimated 33 patients. The new DFCI facility is planned to have 300 inpatient beds. Using a typical approach of 85% maximum occupancy, the new facility's maximum average daily census would be 255. Therefore, existing demand from DFCI and BIDMC medical inpatient cancer care patients is projected to immediately exceed the capacity of the new DFCI facility. This excess demand will exist without drawing additional patients from competitors or increasing in utilization of advanced therapies.
89. To account for this capacity constraint, FTI estimated a second scenario that limited the number of patients shifting to the new DFCI facility to a hypothetical maximum occupancy of 85%. The analysis first transferred all existing DFCI patients to the new facility with a proportional number of expected out-of-state DFCI discharges also expected to transfer.⁶⁵ The remaining 30,803 patient-bed days were then filled with BIDMC medical inpatient cancer care patients (3,348 of 5,089 discharges).⁶⁶ Table 14 shows the estimated result of these shifts. The new DFCI facility is projected to have 9,529 medical inpatient cancer care discharges in 2025 (hitting its capacity), and BIDMC is projected to have 1,741 medical inpatient cancer care discharges and 2,530 surgical cancer care discharges. BWH is projected to have 5,136 medical cancer care discharges shift to the new DFCI facility, 63.0% of the discharges previously occurring in BWH beds (or, equivalently, 32.5% of the total medical cancer care discharges that would have otherwise occurred in MGB academic medical centers). The projected

⁶⁴ For ease of exposition, the ICA analyses assume that the Proposed Project will be operational in 2025. Results of the ICA analysis would not materially change if a different year of initial operation was used and are therefore not sensitive to this assumption.

⁶⁵ FTI modeled an alternative scenario under which all BIDMC medical cancer care patients were transferred and the remaining available beds were then filled with discharges from DFCI patients currently in BWH beds. The results of this alternative approach differed only marginally from the baseline scenario presented in this report.

⁶⁶ For this scenario, FTI assumed that the transferring BIDMC patients were similar in acuity, length of stay, and payor mix to those that remained at BIDMC.

shift of 3,348 medical cancer care discharges from BIDMC to the new DFCI facility represents 65.8% of BIDMC's pre-shift count of these discharges. The net impact of these shifts in 2025 is 6,715 fewer inpatient cancer care discharges in BWH beds and 1,751 fewer inpatient cancer care discharges at BIDMC. Because the new DFCI facility is projected to be capacity constrained with these shifts, no other hospitals are projected to have changes in utilization under this scenario.⁶⁷

Table 14: Projected Inpatient Cancer Care Shifts from Proposed Project

Hospital	Medical Discharges			Surgical Discharges		
	Actual 2022	Quo 2025	Projected 2025	Actual 2022	Quo 2025	Projected 2025
Dana-Farber Cancer Institute (Licensed Beds)	1,004	1,045	9,529	18	18	
Dana-Farber Cancer Institute (BWH Leased Beds)	4,919	5,136		1,515	1,579	
Beth Israel Deaconess Medical Center - East Campus	4,764	5,089	1,741	889	933	2,530
Massachusetts Total	63,576	68,047	68,047	9,579	10,076	10,076

90. To explore the sensitivity of DFCI's estimated need to shifting demand from the BWH emergency department, FTI estimated demand at the new DFCI facility if just half of emergency department admissions at BWH shifted to DFCI. This condensed demand is still projected to exceed the capacity of the new DFCI facility. Because, as discussed above, the significant majority of DFCI inpatient cancer care patients admitted through the emergency department have a pre-existing relationship with DFCI physicians, the estimated utilization of the new facility beds (i.e., full capacity utilization from its inception) is not sensitive to a proportion of these patients not shifting to the new DFCI facility.
91. These projections of shifted care show 10% of new DFCI facility utilization will come from Medicaid patients (similar to the share served by DFCI now). The projected utilization model shows no diversion of resources away from existing safety net providers.
92. The ICA Questions asked FTI to analyze DFCI's projected need by bed type (i.e., ICU beds versus medical/surgical beds). DFCI's projected inpatient bed demand methodology set out in the Application estimates bed demand by bed type. To estimate ICU bed demand, the DFCI analysis reviewed Medicare cost report data from "peer comprehensive cancer centers" and determined their ICU census ranged between 7%-14% of the total ADC.⁶⁸ Data on bed types for existing DFCI patients was not available to FTI. The projections of shifted care above assume that current acuity levels are projected to stay the same. DFCI's estimate of an average ICU daily census of 18.0 in 2032 makes

⁶⁷ Though DFCI currently draws its patients from across Massachusetts, including through referrals from other providers, and is projected to continue to do so, the capacity constraint of the new DFCI facility is projected to limit any increase in this diversion from other facilities to DFCI.

⁶⁸ Application Narrative, p. 20.

up a relatively small proportion of both its overall projected demand and FTI's projected total utilization.⁶⁹ Thus, the estimated need calculations (including the estimate that the new facility will be capacity constrained from inception) is not dependent on any ICU bed demand, though that demand may well form a part of the new DFCI facility utilization.

93. The ICA Questions asked FTI to evaluate the potential for the Proposed Project to lead to “supply-induced demand” for healthcare services. The foregoing analysis shows that there is essentially no scope for supply-induced demand at the new DFCI facility because it is projected to be immediately capacity constrained. However, projected shifts in utilization away from BWH and (to a lesser degree) from BIDMC would leave a significant number of unused beds at those facilities. The scenarios presented above do not model any changes in utilization at BWH or BIDMC. In each scenario above, BWH and BIDMC are projected to experience a decrease in utilization and, correspondingly, an increase in available bed capacity. These scenarios implicitly assume these systems will not change their behavior in response to the Proposed Project. However, each hospital system might reasonably be expected to respond strategically to this change in available capacity. For example, each might realign or consolidate services, systematize, or induce demand through competition with other systems for existing inpatient discharges (including for non-cancer care discharges) or through new patients that would otherwise not receive inpatient care (i.e., supply-induced demand).
94. Supply-induced demand has been widely studied in the economics and health services academic literature. The literature shows mixed evidence on extent of supply-induced demand, yet includes indications of financial incentives influence in physician behavior.⁷⁰ To investigate the extent to which potential supply-induced demand could impact utilization and total medical spending due to the Proposed Project, FTI estimated “maximal-impact” scenarios in which 100% of newly available capacity at BWH and BIDMC is “backfilled” by new, general acute care inpatient patients or, alternatively, by cancer care patients.⁷¹ This scenario is equivalent from a cost impact perspective to

⁶⁹ See Application Narrative, p. 21. DFCI estimates an ICU ADC of 18.0, 5.6% of its total ADC projection of 321.6 in 2032.

⁷⁰ See, for example, Van Dijk, Christel E., Bernard Van Den Berg, Robert A. Verheij, Peter Spreeuwenberg, Peter P. Groenewegen, and Dinny H. De Bakker. “Moral hazard and supplier-induced demand: Empirical evidence in general practice.” *Health Economics* 22, no. 3 (2013): 340-352.; McGuire, T.G. (2000) “Physician Agency,” Chapter 9 in *Handbook of Health Economics*, Eds. A.J. Culyer and J.P. Newhouse, Amsterdam: North-Holland; Gruber, Jonathan, and Maria Owings. “Physician financial incentives and cesarean section delivery.” (1994); J. Sørensen, Rune, and Jostein Grytten. “Competition and supplier-induced demand in a health care system with fixed fees.” *Health Economics* 8, no. 6 (1999): 497-508; Auster, Richard D., and Ronald L. Oaxaca. “Identification of supplier induced demand in the health care sector.” *Journal of Human Resources* (1981): 327-342; and Conrad, Douglas A., Anne Sales, Su-Ying Liang, Anoshua Chaudhuri, Charles Maynard, Lisa Pieper, Laurel Weinstein, David Gans, and Neill Piland. “The impact of financial incentives on physician productivity in medical groups.” *Health Services Research* 37, no. 4 (2002): 885-906.

⁷¹ The scenario wherein only inpatient cancer care were to be induced by the two hospitals is economically equivalent to DFCI inducing a full hospital's worth of new cancer patients from the Massachusetts population (10% more cancer patients than the status quo). As shown below, the differences in cost impacts between the cancer-only induced demand and general inpatient care alternatives are minimal.

no patients shift from BWH or BIDMC to the new DFCI facility and the new DFCI beds are filled by patients not currently receiving inpatient care. Similarly, this is cost-equivalent to any combination of DFCI, BWH, and BIDMC diverting patients from other academic medical centers and community hospitals into the newly available beds and then those hospitals filling their available beds with new patients.

95. These scenarios estimate the maximum cost impact in the sense that they are more costly than any competitive reallocation of patients across hospitals that is not accompanied by full offset of capacity availability with patients that would otherwise be untreated in an inpatient setting.⁷² While this approach likely overstates the extent of any supply-induced demand impact and is not based in economic evidence (and therefore not meant to represent actual predicted outcomes of the Proposed Project), it bounds the maximum possible impact of supply-induced demand. To simulate this scenario, FTI generated new “synthetic” patient discharges matching the average existing acuity, payor mix, and prices of inpatient care for these two hospitals and used these patients to replace lost discharges at BWH and BIDMC one-for-one. The cost implications of this bounding exercise are reported in Section XII.C below.

XI. PRICES FOR INPATIENT CANCER CARE SERVICES IN RELEVANT SERVICE LINES

96. The ICA Questions and analysis involve evaluation of current pricing by service line and potential impact of the Proposed Project on prices and medical spending. This section evaluates estimates of DFCI’s and other facilities’ pricing by payor type (commercial, Medicare, and Medicaid) and service line.⁷³ These estimates are used in conjunction with utilization projections to project total healthcare costs in Section XII.
97. Because the new DFCI facility will provide exclusively adult cancer care, this analysis restricts attention to adult patients (age eighteen and above) with a non-benign neoplasm diagnosis who were treated with an inpatient stay. This approach is consistent with the nature of the Proposed Project, the typical services observed in the claims data for DFCI physicians, and with DFCI’s own approach for characterizing its services.⁷⁴ Specifically, cancer care diagnoses were identified in inpatient claims data and inpatient case mix data using the methodology described in Section VI above.

⁷² The cost impacts of these scenarios are also overstated because they do not incorporate any cost decreases from care being diverted from other settings (e.g., outpatient care).

⁷³ See Appendix Section II.C for a listing of insurance product codes used to identify each payor type.

⁷⁴ Application Narrative, p. 19.

98. The price estimation methodology employed closely mirrors the approach used by CHIA in its Relative Price and Provider Price Variation in the Massachusetts Commercial Market reports.⁷⁵ To isolate relevant prices, a number of restrictions were implemented in accordance with previous empirical work using CHIA's claims data. Claims fitting the following criteria were dropped: denied claims; claims associated with professional fees; payments made on a capitated, bundled, or per-episode basis (among others); duplicate claims; claims with negative or zero allowed amount; and claims where the allowed amount was less than 10% or more than 100% of the charged amount.
99. After these restrictions were applied, average price was calculated as the average of allowed amounts (weighted by case mix index in the case of inpatient discharges).⁷⁶ Each price was then divided by the average statewide price in that service line to present prices on a relative basis. Thus, a relative average price of 1.20 is interpreted as a price 20% above the statewide average price.
100. As shown in Table 15, DFCI's relative prices in 2021 were estimated at 1.41 (commercial), 1.01 (Medicare), and 0.92 (Medicaid).

Table 15: Estimated Relative Prices by Hospital and Payor, 2021⁷⁷

System Name	Hospital Name	Relative Price		
		Commercial	Medicare	Medicaid
Baystate Health	Baystate Medical Center	1.29	0.99	0.82
Beth Israel Lahey Health	Beth Israel Deaconess Medical Center - East Campus	1.76	1.00	0.62
Boston Medical Center	Boston Medical Center - Menino Pavilion Campus	1.54	1.52	0.81
Dana-Farber Cancer Institute	Dana-Farber Cancer Institute	1.41	1.01	0.92
Mass General Brigham	Brigham and Women's Hospital	1.77	1.06	0.83
Mass General Brigham	Massachusetts General Hospital	2.01	1.07	0.81
South Shore Health System	South Shore Hospital	1.04	0.73	0.61
Tufts Medicine	Tufts Medical Center	2.05	1.19	1.01

101. DFCI is classified by the Centers for Medicare & Medicaid Services (CMS) as a PPS-Exempt Cancer Hospital (PCH) and is exempt from the usual Acute Inpatient Prospective Payment System and Outpatient Prospective Payment System.⁷⁸ The U.S. Government Accountability Office found that PCHs received, on average, 42% more in Medicare inpatient payments relative to what they would

⁷⁵ See Center for Health Information and Analysis. "Relative Price and Provider Price Variation in the Massachusetts Commercial Market: Methodology Report." (July 2024). <https://www.chiamass.gov/assets/docs/r/pubs/2024/Relative-Price-Methodology-2022.pdf>.

⁷⁶ Weighting by case mix index, a measure of patient acuity, controls for variation in patient mix across providers, allowing for appropriate comparisons between hospitals and health systems.

⁷⁷ Source: 2021 CHIA Massachusetts APCD and 2021 Medicare Inpatient Claims Data.

⁷⁸ Centers for Medicare & Medicaid Services. "PPS-Exempt Cancer Hospitals (PCHs)," accessed October 23, 2024. <https://www.cms.gov/medicare/payment/prospective-payment-systems/acute-inpatient-pps/pps-exempt-cancer-hospitals-pchs>.

have otherwise been paid under the typical reimbursement approach.⁷⁹ However, this report also found that the increased payments to DFCI were much smaller (7.8%).⁸⁰

102. Because the Proposed Project is predicted to shift medical utilization of care from BWH and BIDMC to DFCI and surgical utilization from BWH to BIDMC, the relative prices between these three entities are relevant for estimating changes in total healthcare spending. DFCI's commercial prices are, on average, lower than BWH (-20.6%) and BIDMC (-19.8%). Medicare reimbursement is similar between DFCI and BIDMC, with BWH having somewhat higher average Medicare reimbursement. Medicaid reimbursement is lower than for other payors across all hospitals. DFCI's average, acuity-adjusted Medicaid reimbursement is marginally higher than at BWH; BIDMC has significantly lower estimated Medicaid reimbursement.

XII. FORECASTED IMPACTS OF THE PROPOSED PROJECT ON INPATIENT CANCER CARE SHARES, PRICES, AND SPENDING

A. Projected Changes in Shares

103. The next step in the empirical analysis of impact on pricing, competition, utilization, and spending is to estimate the change in market share for DFCI and other relevant providers due to shifts in patients between facilities. These estimates are provided for each relevant service line in the relevant service areas. Because government prices are set administratively rather than by negotiation, market shares for commercially-insured patients were evaluated. Because these changes in shares are used to evaluate changes in competition and bargaining leverage at the facility level, DFCI discharges in BWH-licensed beds were allocated to BWH for purpose of this calculation. These shares, therefore, differ from the physician-based approach discussed above.
104. Table 16 reports the status quo and projected 2025 shares of inpatient cancer care services for commercially-insured patients in Massachusetts for the baseline scenario under which the DFCI facility is constrained by capacity limits. DFCI's facility share of commercial inpatient cancer care discharges is forecast to increase by 15.9%, while BWH's share is forecast to decrease by 15.3% and BIDMC's share is forecast to decrease by 0.6%. Because shifts in the projections only implicate DFCI, BWH, and BIDMC, shares for other hospitals and health systems are forecast to remain unchanged.⁸¹

⁷⁹ United States Government Accountability Office. "Medicare: Payment Methods for Certain Cancer Hospitals Should Be Revised to Promote Efficiency." (February 2015). <https://www.gao.gov/assets/gao-15-199.pdf>.

⁸⁰ United States Government Accountability Office. "Medicare: Payment Methods for Certain Cancer Hospitals Should Be Revised to Promote Efficiency." (February 2015). <https://www.gao.gov/assets/gao-15-199.pdf>, p. 21.

⁸¹ See Appendix Table A5 for a full listing of projected 2025 commercial shares by hospital. See also Appendix Table A4 for 2025 all-payor shares by hospital.

Table 16: Projected Statewide Inpatient Cancer Care Commercial Shares by Hospital

Hospital	Status Quo 2025 Share	Projected 2025 Share	Change
Dana-Farber Cancer Institute	2.3%	18.1 %	15.9%
Brigham and Women's Hospital	20.6%	5.3%	-15.3%
Beth Israel Deaconess Medical Center - East Campus	8.9%	8.4%	-0.6%
<i>Herfindahl-Hirschman Index</i>	2,261	1,493	-768

105. Table 17 shows the projected market shares for 2025-2040 by payor type. The shares do not materially change from those projected for 2025, with the change in DFCI shares declining somewhat over time. These “out-year” estimated changes are driven by trends in patient population demographics, not by utilization or facilities. Commercially-insured patients are most relevant when assessing impacts on changes in health expenditures both through redistribution among differentially-priced facilities and changes, if any, in hospital negotiating power. Analysis for patients covered by Medicare and Medicaid in Table 17 show substantially similar results, suggesting that the effect of the Proposed Project would be similar for these patients as for commercial patients. The medical spending estimates that follow incorporate shifts in shares across all payors, including Medicare and Medicaid.

Table 17: Projected Inpatient Cancer Care Shares for DFCI by Payor Type, 2025-2040

Payer	2025 Status Quo Share	Projected Share			
		2025	2030	2035	2040
Commercial	2%	18%	18%	18%	17%
Medicaid	2%	14%	13%	13%	13%
Medicare	1%	10%	10%	10%	10%

B. Changes in Prices

106. The ICA Questions include estimated or predicted changes in prices due to the Proposed Project based on forecasted changes in DFCI's price levels, its negotiating leverage, sites of care, and the mix of services utilized. Average prices for inpatient cancer care may change due to changes in DFCI's price levels, its negotiating leverage, competition, sites of care, or the mix of services utilized.
107. As demonstrated above, DFCI's current prices in relevant service lines are significantly below other market providers (e.g., BWH, MGH, and BIDMC). While increased hospital bed capacity under its direct control (as opposed to leased from BWH) does not necessarily imply that it will command additional economic influence in negotiating with payors, FTI sought to address the possibility that increased costs of providing care in the new facility and/or additional bargaining leverage will lead to increased DFCI inpatient cancer care prices. Consequently, we analyzed three pricing benchmarks

as potential DFCI commercial inpatient cancer care price levels: (1) status quo prices, (2) BIDMC prices, and (3) weighted average DFCI-BWH prices (i.e., the average prices of DFCI and BWH, weighted by the number of DFCI discharges occurring in DFCI-licensed beds and BWH-leased beds respectively). Table 18 presents these pricing benchmarks. The primary impact of using either scenario (2) or (3) prices is to increase DFCI’s projected commercial prices by more than 20%. This captures a possible scenario under which DFCI’s additional capacity and patient populations lead to greater commercial prices.

108. Though government administered (Medicare and Medicaid) prices will not be impacted by changes in bargaining leverage from increased DFCI bed capacity, DFCI’s PCH status ties its Medicare reimbursement to its reported costs (see Section XI above). Pricing scenario (1) incorporates this reimbursement status based on DFCI’s existing costs, with scenarios (2) and (3) changing Medicare reimbursement to the BIDMC and BWH-DFCI average levels. Were DFCI’s cost-per-discharge for Medicare patients to change due to the Proposed Project (including potentially due to increased incurred costs from operating as a standalone facility compared to its current costs operating in conjunction with BWH), its Medicare reimbursement and cost of care could also increase. To account for this possibility, as shown in Table 18, FTI modeled a fourth scenario under which commercial and Medicaid prices were modeled as in scenario (3), but relative Medicare prices increased to match the median reimbursement increase over estimated IPPS payments among other PPS exempt cancer hospitals.⁸² Estimated medical spending impacts for the four pricing scenarios are presented below.

Table 18: Alternative Projected DFCI Pricing Scenarios

Payor	DFCI Pricing Scenario			
	(1)	(2)	(3)	(4)
Commercial	1.41	1.76	1.73	1.73
Medicare	1.01	1.00	1.06	1.12
Medicaid	0.92	0.62	0.84	0.84

109. In order to respond to the ICA questions concerning the impact of changes in market share on price, FTI referred to the economic literature on healthcare that considers price increases associated with changes in market shares with the HHI measure of concentration. This literature covers a wide range

⁸² A Government Accountability Office report estimated the median Medicare reimbursement for PCH’s (not including DFCI) above the otherwise applicable IPPS reimbursement was estimated to be 20.05%, while DFCI was estimated to receive reimbursements 7.8% above the IPPS. Medicare reimbursement in pricing scenario (4) was determined by increasing DFCI’s Medicare reimbursement by a factor of 1.113 (1.2005/1.078) from a baseline relative price of 1.01 to 1.124. See United States Government Accountability Office. “Medicare: Payment Methods for Certain Cancer Hospitals Should Be Revised to Promote Efficiency.” (February 2015). <https://www.gao.gov/assets/gao-15-199.pdf>, p. 21 and Application Narrative p. 1.

of factors involved in assessing bargaining power in healthcare but provides a means subject to these assumptions to construct empirical estimates of the relationship between changes in HHI and price for purposes of evaluation of the ICA Questions.⁸³ As shown in Table 16 above, based on the forecasted changes in shares of commercially-insured patients, HHI, a measure of market concentration, is estimated to decrease by 768 from 2,261 to 1,493.⁸⁴ The decrease comes from a splitting of patients currently treated in BWH-licensed beds into a less concentrated split between DFCI and BWH. Because HHI is estimated to decline due to the Proposed Project, there is no indication that prices will be pressured upward due to changes in market concentration; rather, there may be downward pressure on prices. Furthermore, the Proposed Project will not place any limitations on other market participants, including BWH and MGB more broadly, from responding and competing with DFCI and BIDMC. Because of the numerous caveats and uncertainty regarding the relationship between HHI, market concentration, and commercial prices in the literature, we provide a conservative estimate of price impacts on healthcare costs and do not incorporate any price decreases from concentration changes into the estimates below.

110. In addition to the changes in provider-specific prices discussed above, the average market price may change due to changes in the distribution of patients between higher and lower-cost providers and services. Because the Proposed Project is estimated to primarily shift inpatient discharges to lower-priced providers (DFCI and, to a lesser extent, BIDMC) from a higher-priced provider (BWH), the average price for inpatient cancer care is projected to decline. There is no projected impact on price due to changes in the mix of services provided.

C. Changes in Total Medical Spending

111. To project the impact of the Proposed Project on total healthcare costs, FTI combined the estimated utilization demand from Sections IX and X and the price analysis described in Section XI. Projected prices (including the benchmark prices for DFCI) were matched to each inpatient discharge in each

⁸³ There are many caveats to this literature, including about estimating effects from concentration and share measures, and about inferences to be drawn regarding bargaining power or price effects from changes in structural measures for the services subject to negotiation. See, for example, Garmon, Christopher. "The accuracy of hospital merger screening methods." *The RAND Journal of Economics* 48, no. 4 (2017): 1068-1102. Healthcare also is characterized by differentiated products, where many factors make price comparisons complex. As noted by Haas-Wilson and Garmon, "In a market with differentiated products, different price levels are neither necessary, nor sufficient, to demonstrate the exercise of market power." See Deborah Haas-Wilson and Christopher Garmon, "Hospital Mergers and Competitive Effects: Two Retrospective Analyses," *International Journal of the Economics of Business* 18, no. 1 (2011): 17-32. Additional discussion of competitive effects modeling in healthcare provided at Guerin-Calvert, Margaret E. "Competitive effects analyses of hospital mergers: Are we keeping pace with dynamic healthcare markets?" *The Antitrust Bulletin* 59, no. 3 (2014): 505-513; Capps, Cory S. "From Rockford to Joplin and back again: The impact of economics on hospital merger enforcement." *The Antitrust Bulletin* 59, no. 3 (2014): 443-478; and May, Sean, and Monica Noether. "Unresolved questions relating to market definition in hospital mergers." *The Antitrust Bulletin* 59, no. 3 (2014): 479-503.

⁸⁴ Based on available information regarding the agreement between DFCI and BIDMC, the ICA analysis was conducted under the assumption that DFCI and BIDMC will not jointly negotiate reimbursement rates for physicians or facilities with payors.

service line, service area, and utilization scenario. Total healthcare costs were totaled by summing costs for each service line in its relevant service area.

112. Table 19 presents estimated projected changes in healthcare costs for inpatient cancer care from 2025-2040 for each DFCI price scenario. With status quo DFCI prices, the Proposed Project is forecast to decrease total medical spending for inpatient cancer care for Massachusetts residents by 1.8% (\$28.4 million) in 2025. Even if DFCI were able to raise its prices to the level of BIDMC prices or closer to BWH prices, medical spending is forecast to decrease or remain essentially flat. If Medicare reimbursement were to also increase substantially, total medical spending is forecast to increase by 0.7% (\$10.9 million). These effects are forecast to persist from 2025 through 2040. These estimates may understate projected cost savings from the Proposed Project due to failure to incorporate impacts of decreased market concentration and potentially increased competition, overstating potential price increases by DFCI following the construction of its new facility, or underestimation of DFCI's ability to accommodate excess demand.

Table 19: Estimated Changes in Inpatient Cancer Care Costs

Forecast Year	DFCI Pricing Scenario				DFCI Pricing Scenario			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
2025	-1.8%	-0.5%	0.1%	0.7%	-\$28,426,978	-\$8,617,109	\$1,531,061	\$10,899,772
2030	-1.6%	-0.5%	0.1%	0.7%	-\$28,386,425	-\$9,458,406	\$1,705,125	\$12,408,841
2035	-1.5%	-0.5%	0.1%	0.7%	-\$28,356,757	-\$10,035,570	\$1,901,478	\$13,522,711
2040	-1.5%	-0.5%	0.1%	0.7%	-\$28,694,836	-\$10,338,613	\$2,063,742	\$14,135,142

113. To investigate the extent to which cost increases from supply-induced demand could offset estimated cost savings from the Proposed Project, FTI estimated the upper bound of any impact on medical spending, as described above, in which 100% of newly available capacity is filled by new, general inpatient care (or, alternatively, inpatient cancer care) at BWH and BIDMC. Table 20 describes the inpatient total medical spending impacts for the general acute care scenario and Table 21 presents the inpatient cancer care scenario. Even in these scenarios, the potential for the Proposed Project to lead to supply induced demand related cost increases is bounded by an estimated 2.7%-3.3% (\$239M-\$329M) cost increase for inpatient care in Massachusetts.⁸⁵ This exercise also bounds the influence of other, non-supply induced demand realignments in care between hospitals, including realignments between hospitals within a system (e.g., BWH and MGH) and changes in competition for non-cancer

⁸⁵ Depending on the exact nature of the hypothetical backfill (e.g., diseases, medical versus surgical, acuity, etc.), the cost and market impacts could be different. Determination and projection of the exact patients that could backfill available capacity at BWH and BIDMC is beyond the scope of this report.

care between hospitals. These estimates likely overstate the potential influence of supply-induced demand because the scope for supply-induced demand will significantly diminish over time as demand naturally grows (including the large projected growth in cancer care from an aging population).⁸⁶ Supply-induced demand effects, if any, are therefore likely to be a transitory phenomenon rather than persistent as modeled here.

Table 20: Estimated Changes in Inpatient Care Costs with Supply-Induced Demand, GAC Backfill

Forecast Year	DFCI Pricing Scenario				DFCI Pricing Scenario			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
2025	2.7%	2.9%	3.0%	3.1%	\$239,264,431	\$259,074,304	\$269,222,464	\$278,591,200
2030	2.7%	2.9%	3.1%	3.2%	\$259,517,833	\$278,445,856	\$289,609,376	\$300,313,088
2035	2.8%	3.0%	3.1%	3.2%	\$275,147,938	\$293,469,120	\$305,406,176	\$317,027,424
2040	2.9%	3.0%	3.2%	3.3%	\$286,320,770	\$304,676,992	\$317,079,360	\$329,150,752

Table 21: Estimated Changes in Inpatient Care Costs with Supply-Induced Demand, Cancer Care Backfill

Forecast Year	DFCI Pricing Scenario				DFCI Pricing Scenario			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
2025	2.8%	3.0%	3.1%	3.1%	\$250,527,469	\$270,337,338	\$280,485,508	\$280,485,508
2030	2.8%	3.0%	3.1%	3.1%	\$266,241,838	\$285,169,857	\$296,333,389	\$296,333,389
2035	2.8%	3.0%	3.1%	3.1%	\$277,978,094	\$296,299,281	\$308,236,329	\$308,236,329
2040	2.9%	3.0%	3.2%	3.2%	\$286,801,701	\$305,157,924	\$317,560,279	\$317,560,279

114. The empirical analyses indicate essentially a flat impact or moderate decrease in medical spending for commercial payors. Medicare-specific increase in DFCI reimbursement rates would accrue to the federal government due to DFCI’s cancer hospital exempt status under existing federal regulations. FTI considered the potential impacts across stakeholders in Massachusetts from this change and concludes that the allocation among stakeholders and the overall impact depends on several factors. The economics and healthcare literature, including the extensive industry and government studies on impact and allocation of healthcare expenditure changes, indicate some difficulty in assigning with any precision the specific impact on each of the stakeholders involved in commercial insured care. Standard economic literature on commercial health plans indicates that increased healthcare costs can impact commercial health plans, employers, employees or enrollees. These can be reflected in increased premiums, out-of-pocket (deductibles, co-pays) and co-insurance, as well as other costs.⁸⁷

⁸⁶ The average daily census of inpatient cancer care in Massachusetts is projected to grow by 249 by 2030, nearly by the full 255 average daily census capacity of the proposed new DFCI facility. This growth in demand that will occur regardless of the Proposed Project all but eliminates the scope for supply-induced demand by that 2030.

⁸⁷ See, for example, the 2024 Kaiser Family Foundation annual health benefits survey, “2024 Employer Health Benefits Survey.” Kaiser Family Foundation (October 2024). <https://www.kff.org/report-section/ehbs-2024-summary-of-findings/>.

Cost effects can be direct or indirect, including compensation or other effects; and vary by the nature and mechanisms affecting any cost-pass through. Cost increases or savings may result in shorter or longer-term impacts, depending on specific structures of plans and benefits, and whether and where cost changes are absorbed, and these affect the impact across stakeholders.

XIII. SPECIALIZED CANCER CARE: CAR T AND BI-SPECIFIC ANTIBODY THERAPIES

115. The ICA Questions asked FTI to examine “highly specialized inpatient oncology care (CAR T Cell Therapy and Bispecific Antibodies)” in connection with the Proposed Project. Although use of CAR T and bi-specific antibody therapies are likely to expand in the coming years, the proposed DFCI facility is projected to reach capacity without any increase in the utilization of these specialized cancer treatments.
116. CAR T and bi-specific antibody therapies are novel treatments for cancer. Rather than targeting all rapidly dividing cells as seen in traditional chemotherapy, these treatments attack cancer cells by targeting specific proteins on the surface of these cells.⁸⁸ Clinical trials of these treatments have shown complete response rates ranging from 36%-60% for bi-specific antibodies⁸⁹ and 39%-84% for CAR T-cell therapy.⁹⁰
117. Because of their relative efficacy and expanding applications, these therapies are expected to significantly grow in prevalence over time. Aside from use of these medicines to treat cancer, expanded application of these treatments are expected to include treatment of autoimmune and inflammatory diseases, pathogen-induced infections, and myocardial fibrosis, among other

⁸⁸ Uscanga-Palomeque AC, Chávez-Escamilla AK, Alvizo-Báez CA, et al. CAR-T Cell Therapy: From the Shop to Cancer Therapy. *Int J Mol Sci.* 2023;24(21):15688. doi:10.3390/ijms242115688; Sun Y, Yu X, Wang X, et al. Bispecific antibodies in cancer therapy: Target selection and regulatory requirements. *Acta Pharm Sin B.* 2023;13(9):3583-3597. doi:10.1016/j.apsb.2023.05.023.

⁸⁹ Moreau P, Garfall AL, Donk NWCJvd, et al. Teclistamab in Relapsed or Refractory Multiple Myeloma. *New England Journal of Medicine.* 2022;387(6):495-505. doi:10.1056/NEJMoa2203478; Siddiqi T. CARs vs bispecifics: the race is on! *Blood.* 2024;144(6):592-593. doi:10.1182/blood.2024025130; Budde LE, Sehn LH, Matasar M, et al. Safety and efficacy of mosunetuzumab, a bispecific antibody, in patients with relapsed or refractory follicular lymphoma: a single-arm, multicentre, phase 2 study. *Lancet Oncol.* 2022;23(8):1055-1065. doi:10.1016/S1470-2045(22)00335-7.

⁹⁰ Anderson LD, Munshi NC, Shah N, et al. Idecabtagene vicleucel (ide-cel, bb2121), a BCMA-directed CAR T cell therapy, in relapsed and refractory multiple myeloma: Updated KarMMa results. *JCO.* 2021;39:8016-8016. DOI:10.1200/JCO.2021.39.15_suppl.8016; Berdeja JG, Madduri D, Usmani SZ, et al. Ciltacabtagene autoleucel, a B-cell maturation antigen-directed chimeric antigen receptor T-cell therapy in patients with relapsed or refractory multiple myeloma (CARTITUDE-1): a phase 1b/2 open-label study. *Lancet.* 2021;398(10297):314-324. doi:10.1016/S0140-6736(21)00933-8; Jacobson C, Hemmer MT, Hu ZH, et al. S223: REAL-WORLD EARLY OUTCOMES OF AXICABTAGENE CILOLEUCEL FOR RELAPSED OR REFRACTORY FOLLICULAR LYMPHOMA. *Hemasphere.* 2023;7(Suppl):e31464ce. doi:10.1097/01.HS9.0000967804.31464.ce; Abramson JS, Solomon SR, Arnason J, et al. Lisocabtagene maraleucel as second-line therapy for large B-cell lymphoma: primary analysis of the phase 3 TRANSFORM study. *Blood.* 2023;141(14):1675-1684. doi:10.1182/blood.2022018730.

conditions.⁹¹ The US CAR T market is estimated to grow from \$2 billion in 2023 to \$23-\$35 billion by 2033,⁹² while the growth of the global bi-specific antibody market (approximately \$5 billion in 2023) is anticipated to reach upwards of \$100 billion by 2031.⁹³

118. Due to the technical requirements of administering these treatments, only a limited set of hospitals currently provide either therapy. CAR T therapy requires T-cells to be isolated from the patient's blood and altered to target tumor-associated antigens, a process individualized to each patient, introducing technical difficulty and logistical challenges into the manufacturing process.⁹⁴ Manufacturing of bi-specific antibodies raises challenges surrounding identification of appropriate target antigens and immunogenicity, among other obstacles.⁹⁵ The complexities associated with these treatments have, thus far, been barriers to widespread adoption.
119. Going forward, provision of CAR T and bi-specific antibody therapies could potentially expand to other hospitals. The need for patient-specific manufacturing of T-cells makes the production of CAR T more complex and expensive than that of bispecific antibodies, which are not patient-specific and could potentially be sold as an "off-the-shelf" treatment.⁹⁶ While there are still concerns surrounding transitioning patients to an outpatient setting and management of adverse events in the introduction of bi-specific antibodies in smaller practices, the less costly nature of the treatment's manufacturing

⁹¹ Wang JY, Wang L. CAR-T cell therapy: Where are we now, and where are we heading?. *Blood Sci.* 2023;5(4):237-248. doi:10.1097/BS9.0000000000000173; Oslund RC, Holland PM, Lesley SA, Fadeyi OO. Therapeutic potential of cis-targeting bispecific antibodies. *Cell Chemical Biology.* 2024/08/15/ 2024;31(8):1473-1489. doi:https://doi.org/10.1016/j.chembiol.2024.07.004.

⁹² Precedence Research. CAR T-Cell Therapy Market Size, Share, and Trends 2024 to 2033. 2023. <https://www.precedenceresearch.com/car-t-cell-therapy-market>; Nova One Advisor. CAR T-Cell Therapy Market (By Drug Type: Axicabtagene Ciloleucel, Tisagenlecleucel, Brexucabtagene Autoleucel, Others; By Indication: Lymphoma, Acute Lymphocytic Leukemia, Chronic Lymphocytic Leukemia (CLL), Multiple Myeloma (MM), Others; By End User: Hospitals, Cancer Treatment Centers))- Global Industry Analysis, Size, Share, Growth, Trends, Regional Outlook, and Forecast 2024-2033. 2024. <https://www.novaoneadvisor.com/report/car-t-cell-therapy-market>.

⁹³ Precedence Research. Bispecific Antibodies Market (By Indication: Cancer, Inflammatory & Autoimmune Disorder, Others; By Distribution Channel: Hospital Pharmacies, Retail Pharmacies, Drugstores, Online Pharmacies) - Global Industry Analysis, Size, Share, Growth, Trends, Regional Outlook, and Forecast 2024-2034. 2024. <https://www.precedenceresearch.com/bispecific-antibodies-market>; Grand View Research. Bispecific Antibodies Market Size, Share & Trends Analysis Report By Indication (Cancer, Inflammatory & Autoimmune disorders), By Region (North America, Europe, Asia Pacific), And Segment Forecasts, 2023 – 2030. <https://www.grandviewresearch.com/industry-analysis/bispecific-antibodies-market-report#:~:text=Bispecific%20Antibodies%20Market%20Size%20%26%20Trends,44.0%25%20from%202023%20to%202030>.

⁹⁴ Dagar G, Gupta A, Masoodi T, et al. Harnessing the potential of CAR-T cell therapy: progress, challenges, and future directions in hematological and solid tumor treatments. *J Transl Med.* 2023; 21(1):449. <https://doi.org/10.1186/s12967-023-04292-3>.

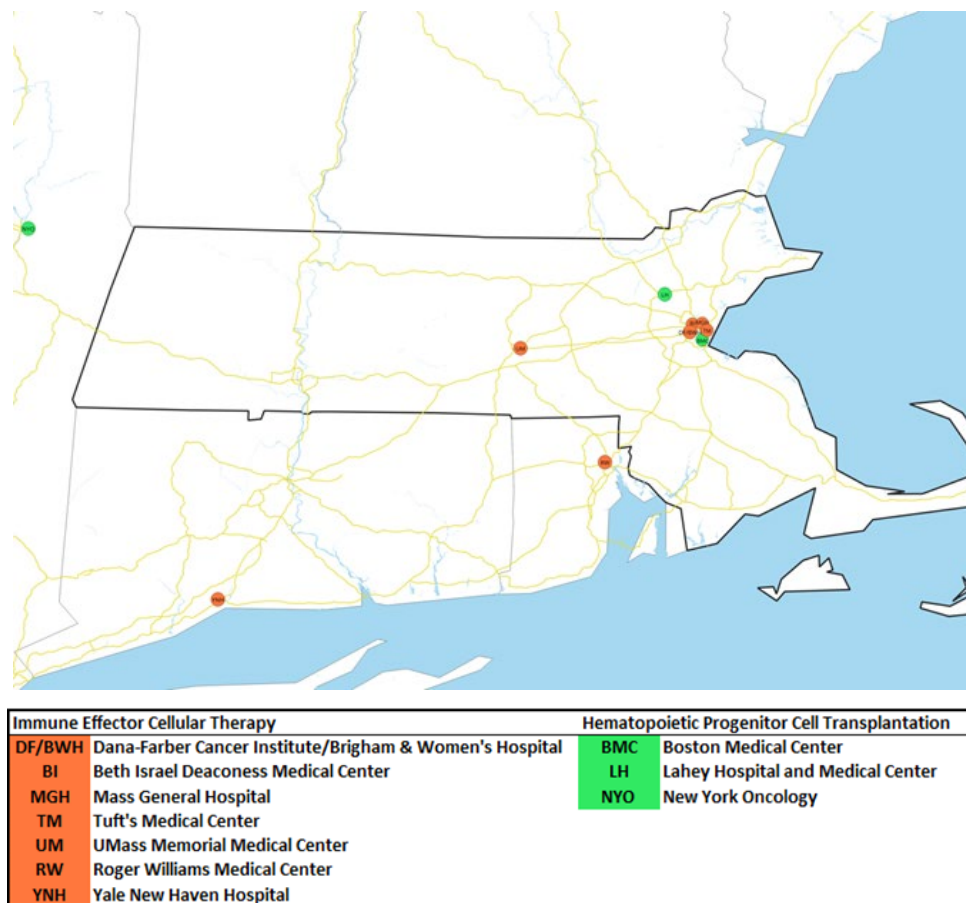
⁹⁵ Gera, N. The evolution of bispecific antibodies. *Expert Opinion on Biological Therapy.* 2022; 22(8), 945–949. <https://doi.org/10.1080/14712598.2022.2040987>; Goebeler ME, Stuhler G, Bargou R. Bispecific and multispecific antibodies in oncology: opportunities and challenges. *Nat Rev Clin Oncol.* 2024;21:539–560. <https://doi.org/10.1038/s41571-024-00905-y>.

⁹⁶ Association of Community Care Centers. Bringing CAR T-Cell Therapies to Community Oncology. 2022. https://www.accc-cancer.org/docs/projects/bringing-car-t-cell-therapies-to-co/bringing-car-t-cell-therapies-to-co.pdf?sfvrsn=304cf153_0; Lei M, Li, Q, O'Day K, et al. Practice efficiency and total cost of care with bispecifics and CAR-T in relapsed/refractory diffuse large B-cell lymphoma: an institutional perspective. *Future Oncology,* 2024; 1–13. <https://doi.org/10.1080/14796694.2024.2354157>.

and implementation of best practices for expanding access to this therapy may open the door for other hospitals and community care centers to adopt bi-specific antibody therapy.⁹⁷

120. Massachusetts has an existing network of facilities providing CAR T services, including DFCI. As of 2024, six providers in Massachusetts were accredited by the Foundation for the Accreditation of Cellular Therapy to perform immune effector cellular therapy (i.e., CAR T). Boston Medical Center and Lahey Hospital and Medical Center were accredited to perform hematopoietic progenitor cell transplantation (e.g., bone marrow transplants) but not CAR T; these represent potential entrants into CAR T services going forward. Figure 3 displays the location of these CAR T accredited facilities and potential future entrants.

Figure 3: Current and Potential CAR T Providers in and around Massachusetts⁹⁸



⁹⁷ Killmurray C. Utilization Challenges Hold Back the Adoption of Bispecific Therapies. Targeted Oncology; 2024;2(3). February 23. Accessed October 16, 2024. <https://www.targetedonc.com/view/utilization-challenges-hold-back-the-adoption-of-bispecific-therapies>; Association of Community Care Centers. Best practices in expanding access to bispecific antibodies and adverse event management. 2022. <https://www.accc-cancer.org/docs/projects/bispecific-antibodies/bispecific-antibodies-brief.pdf>.

⁹⁸ Source: Foundation for the Accreditation of Cellular Therapy, 2024.

121. In the most recently available Massachusetts data, there were no recorded bi-specific antibody therapy procedures and only 152 CAR T procedures. The lack of bi-specific antibody procedures in 2022 is consistent with current FDA approvals, as all but two bispecific antibodies gained FDA approval in or after 2022.⁹⁹ The CAR T procedures identified had an average length of stay of 18.7 days and average reimbursement of \$347,020; the majority of these patients were covered by Medicare.

XIV. IMPACTS ON DIAGNOSTIC IMAGING SERVICES

122. DFCI has proposed need for CT, MRI, and PET-CT imaging resources to support its new inpatient hospital and to consolidate outpatient imaging currently being referred to other providers. This section provides detailed analysis of the patients, providers, and payors for each of the relevant service lines. These apply standard methodologies and a standard basis for estimating shares based on volumes in a geography and by provider.

A. Defining Diagnostic Imaging Service Lines

123. Service lines used in this analysis include inpatient MRI, inpatient CT, inpatient PET-CT, outpatient CT, outpatient PET-CT, and the combination of the two outpatient imaging modalities.¹⁰⁰ Because cancer patients are not restricted to receiving imaging services from only cancer providers, the service lines were not restricted to patients with cancer diagnoses or exclusively to cancer care providers.

124. Inpatient diagnostic imaging was identified using revenue and procedure codes in the CHIA Case Mix Data. Outpatient diagnostic imaging was identified by all claim lines associated with relevant CPT codes in the CHIA Massachusetts APCD¹⁰¹ or the Medicare Outpatient Claims file.¹⁰² Similar restrictions to the outpatient claims file as outlined in Section XI were employed for this analysis as well.

B. Geographic Areas of Coverage

125. To assess the geographic scope of outpatient diagnostic imaging services provided by DFCI and competition between outpatient imaging providers, FTI generated a service area for the combination of both relevant imaging modalities (CT and PET-CT).¹⁰³ The service area analysis evaluated data

⁹⁹ “Bispecific Antibodies: An Area of Research and Clinical Applications.” U.S. Food & Drug Administration, Updated February 14, 2024, 2024, accessed October 15, 2024, <https://www.fda.gov/drugs/spotlight-cder-science/bispecific-antibodies-area-research-and-clinical-applications>.

¹⁰⁰ In its Application, DFCI indicated that it anticipates using the entirety of the new MRI machines to service inpatients (Application Narrative, pp. 23-24).

¹⁰¹ The CHIA Massachusetts APCD outpatient data do not contain race or ethnic patient information, self-pay patients, or out-of-state patients.

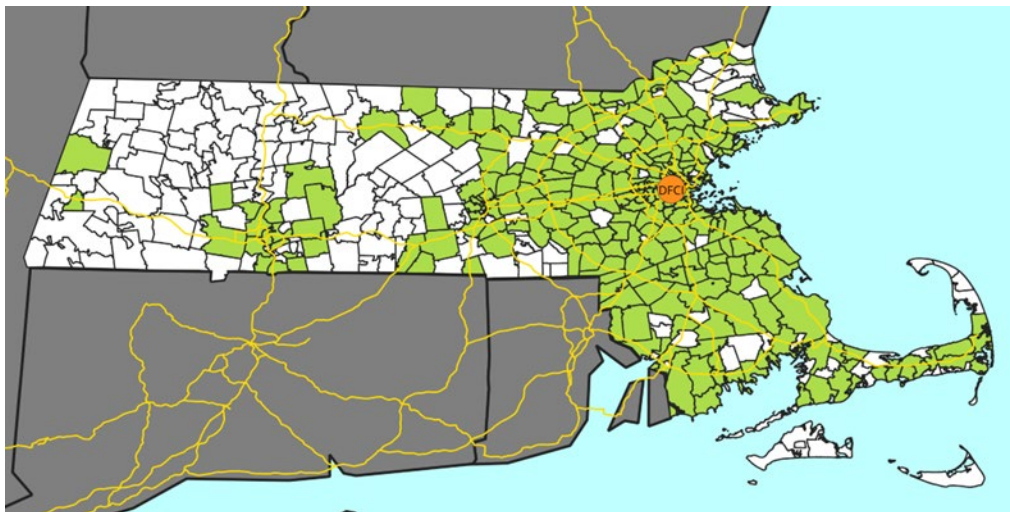
¹⁰² The codes used to identify these service lines are provided in Appendix Section II.B.

¹⁰³ Evaluation of need calculations and forecasted impacts of the Proposed Project on total spending are presented separately for each modality.

based on current utilization patterns (derived from outpatient claims data) of patients located in Massachusetts. The service area for DFCI outpatient imaging was generated by identifying the set of Massachusetts ZIP codes from which 90% of the imaging service line's 2021 visits originated.

126. Figure 4 depicts the 90% PSA for DFCI outpatient imaging services in 2021. The service area encompasses a broad set of ZIP codes centered around DFCI's outpatient facilities as well as additional ZIP codes expanding into other areas of the state. Because DFCI draws patients from every population center of Massachusetts, FTI conducted its ICA analysis of outpatient imaging on a statewide basis.

Figure 4: DFCI Outpatient Diagnostic Imaging Primary Service Area (90%), 2021¹⁰⁴



127. Inpatient diagnostic imaging is derivative of the inpatient care analyzed above, so separate geographic service areas were not required for this analysis.

C. Current Provision of Outpatient Imaging Services in Massachusetts

128. Table 22 sets out demographic information for patients receiving outpatient imaging services at DFCI in 2021 by the number CT scans, number of PET-CT scans, and the combined count. DFCI provided 36,325 outpatient CT scans and 5,312 PET-CT scans in 2021. DFCI's outpatient patient panel for imaging is, on average, older and more likely to have Medicare insurance than its inpatient patient panel. Consequently, the payor mix for these services is more heavily weighted toward Medicare (58%) and commercial coverage (20%) than the statewide averages.

¹⁰⁴ Source: 2021 CHIA Massachusetts APCD and 2021 Medicare Outpatient Claims Data.

Table 22: Demographic Characteristics of DFCI Outpatient Imaging Patient Panel, 2021¹⁰⁵

		CT		PET-CT		Combined	
		Total	%	Total	%	Total	%
Age	18-34	799	2%	113	2%	912	2%
	35-54	3,993	11%	437	8%	4,430	11%
	55-64	6,196	17%	734	14%	6,930	17%
	65-74	14,410	40%	2,030	38%	16,440	39%
	75+	10,848	30%	1,995	38%	12,843	31%
Gender	Female	20,176	56%	2,636	50%	22,812	55%
	Male	15,965	44%	2,661	50%	18,626	45%
Payor Type	Medicare	20,831	57%	3,285	62%	24,116	58%
	Commercial	7,373	20%	947	18%	8,320	20%
	Medicaid	4,175	11%	630	12%	4,625	11%
	Other	3,946	11%	450	8%	4,576	11%
Total	Total	36,325	100%	5,312	100%	41,637	100%

129. In response to the ICA Questions regarding price and competition for outpatient imaging services, FTI analyzed the current shares of DFCI and alternative providers of outpatient imaging services in Massachusetts. Table 23 provides procedure volume and shares for outpatient CT scans, PET-CT scans, and all imaging procedures (the combination of CT and PET-CT) by health system and hospital for 2021. DFCI accounted for 3% of CT scan and 23% of PET-CT scan statewide totals in 2021. Beth Israel Lahey Health and MGB have the highest system-level shares (19% and 18% for all imaging, respectively), and each has a more than 20% share of PET-CT scans. MGH is the largest single hospital provider of outpatient imaging procedures (6%), while BIDMC has 4% share. The distribution of outpatient imaging services across Massachusetts is disperse, with thousands of CT scan providers in the state and all major hospitals providing some amount of outpatient CT scans. The landscape of PET-CT providers is more concentrated than for CT with Beth Israel Lahey Health, DFCI, and MGB collectively providing three-quarters of all procedures.

¹⁰⁵ Source: 2021 CHIA Massachusetts APCD and 2021 Medicare Outpatient Claims Data.

Table 23: Massachusetts Outpatient Diagnostic Imaging Procedures by Provider, 2021¹⁰⁶

System	Hospital	CT Procedures	CT Shares	PET-CT Procedures	PET-CT Shares	All Imaging Procedures	All Imaging Share
Beth Israel Lahey Health	Total	241,088	19%	7,072	31%	248,160	19%
Beth Israel Lahey Health	Beth Israel Deaconess Medical Center	45,099	4%	3,353	15%	48,452	4%
Beth Israel Lahey Health	Lahey Hospital Medical Center	44,426	3%	1,837	8%	46,263	4%
Mass General Brigham	Total	230,333	18%	4,514	20%	234,847	18%
Mass General Brigham	Massachusetts General Hospital	75,768	6%	317	1%	76,085	6%
Mass General Brigham	Brigham and Women's Hospital	56,483	4%	4,027	18%	60,510	5%
Other Health Systems	Total	124,779	10%	2,112	9%	126,891	10%
UMass Memorial Health Care	Total	79,399	6%			79,399	6%
UMass Memorial Health Care	UMass Memorial Medical Center	45,547	4%			45,547	4%
Steward Health Care System	Total	76,800	6%	*	*	76,801	6%
Tufts Medicine	Total	61,530	5%			61,530	5%
Tufts Medicine	Lowell General Hospital	30,630	2%			30,630	2%
Southcoast Health System	Total	58,551	5%	1,069	5%	59,620	5%
Baystate Health	Total	59,221	5%			59,221	5%
Cape Cod Healthcare	Total	52,249	4%			52,249	4%
Cape Cod Healthcare	Cape Cod Hospital	36,721	3%			36,721	3%
Dana-Farber Cancer Institute	Total	36,325	3%	5,312	23%	41,637	3%
Dana-Farber Cancer Institute	Dana Farber Cancer Institute	36,325	3%	5,312	23%	41,637	3%
South Shore Health System	Total	36,888	3%			36,888	3%
South Shore Health System	South Shore Hospital	36,888	3%			36,888	3%
Berkshire Health Systems	Total	33,731	3%	*	*	33,732	3%
Tenet Healthcare	Total	28,227	2%			28,227	2%
Boston Medical Center	Total	23,987	2%	1,332	6%	25,319	2%
Boston Medical Center	Boston Medical Center	23,987	2%	1,332	6%	25,319	2%
Milford Regional Medical Center	Total	23,138	2%	1,017	4%	24,155	2%
Trinity Health	Total	20,441	2%	*	*	20,443	2%
Signature Healthcare	Total	18,203	1%			18,203	1%
Emerson Hospital Health System	Total	16,002	1%	173	1%	16,175	1%
Sturdy Health	Total	15,648	1%			15,648	1%
Cambridge Health Alliance	Total	15,032	1%			15,032	1%
Heywood Healthcare	Total	13,734	1%			13,734	1%
Valley Health Systems	Total	11,423	1%			11,423	1%
Boston Children's Hospital	Total	1,143	0%	29	0%	1,172	0%

¹⁰⁶ Source: 2021 CHIA Massachusetts APCD and 2021 Medicare Outpatient Claims Data. A * indicates the number of discharges is less than 11 and has been redacted to comply with data confidentiality requirements.

D. Forecast of Future Demand for Outpatient Imaging Services

130. This section presents the results of the demand projection methodology outlined above for each relevant service line in outpatient imaging. As described in Section IX, utilization projections were developed by area, service, and payor. Because the outpatient imaging service lines are not restricted to cancer care, only demographic-based growth was incorporated into these projections. Table 24 and Table 25 show projected demand growth for CT and PET-CT procedures by payor type. Application of the methodology results in initial projections that the CT procedures in the service area will increase by 17.2% from 1,340,895 in 2025 to 1,571,442 in 2040 and PET-CT procedures will increase by 17.7% from 24,225 in 2025 to 28,507 in 2040.

Table 24: Projected Demand for CT Procedures by Payor Type, 2025-2040

Payor	Projected Procedures				Growth (2025-2040)
	2025	2030	2035	2040	
Medicare	725,000	817,611	887,739	923,761	27.4%
Medicaid	283,233	286,113	287,759	290,155	2.4%
Commercial	217,256	214,210	211,351	211,229	-2.8%
Self-Pay/Other	115,406	130,081	141,135	146,297	26.8%
Total	1,340,895	1,448,015	1,527,984	1,571,442	17.2%

Table 25: Projected Demand for PET-CT Procedures by Payor Type, 2025-2040

Payor	Projected Procedures				Growth (2025-2040)
	2025	2030	2035	2040	
Medicare	14,812	16,765	17,999	18,398	24.2%
Medicaid	2,704	2,767	2,805	2,846	5.3%
Commercial	3,829	3,784	3,720	3,724	-2.7%
Self-Pay/Other	2,881	3,251	3,486	3,538	22.8%
Total	24,225	26,566	28,010	28,507	17.7%

E. Evaluation of DFCI Need for Imaging Equipment

131. DFCI estimates that the Proposed Project will have associated demand for inpatient and outpatient diagnostic imaging requiring two CT scanners, two MRI scanners, and one PET-CT scanner.¹⁰⁷ DFCI calculated this need by (1) estimating its typical inpatient and outpatient throughput by imaging modality based on its historical information, (2) estimating demand for imaging from its inpatient patients based on scanning propensity, and (3) incorporating incremental outpatient imaging demand

¹⁰⁷ Application Narrative, p. 25.

based on imaging referrals DFCI currently makes to other providers. This section evaluates DFCI's need for imaging equipment in connection with the Proposed Project, including assessing these calculations and predicting shifts in utilization across providers.

132. Without access to DFCI's referrals, medical record data, or scanner throughput data, FTI could not directly evaluate throughput or outpatient demand estimates. Available data do not allow for identification of DFCI patients with outpatient imaging procedures at non-DFCI facilities. Accordingly, FTI requested additional information from DFCI regarding its imaging referrals to other facilities. In its response, DFCI stated, "Based on available FY23 data on completed orders for imaging ordered by DFCI providers (all modalities; orders from Longwood and Chestnut Hill; volume from regional campuses was not included), at least 38% of DFCI imaging orders are performed outside of DFCI. Among those completed outside of DFCI, up to 74% are completed at Brigham and Women's Hospital. DFCI's ability to estimate completed imaging orders outside of DFCI and MGB is limited, due to the fact that DFCI is not able to consistently capture the volume and completion status of imaging orders referred to institutions outside of the Epic instance DFCI shares with MGB institutions."¹⁰⁸ DFCI further estimated that, of the patients it is able to track through its electronic medical records, 62% of its patients' imaging occurs at DFCI facilities, 28% at BWH facilities, and 10% at other MGB facilities.¹⁰⁹ Based on these representations and other information in the Application, FTI projected shifts in outpatient imaging utilization in line with DFCI's stated estimates.
133. To evaluate DFCI demand for imaging equipment, FTI incorporated incremental demand from inpatient patients and shifts in DFCI outpatient patient utilization of non-DFCI facilities into the new proposed facility. Projected growth from both sources of demand (as described in Section IX and Section XIV.D above) were also accounted for in determining forecasted demand.
134. FTI estimated projected demand for inpatient diagnostic imaging based on projected inpatient discharges multiplied by the number of imaging scans per discharge for each modality. FTI calculated the number of scans per discharge using inpatient claims data (i.e., CHIA Massachusetts APCD inpatient claims and Medicare Inpatient Claims Data). Because inpatient scans could only be imperfectly identified in the claims data (especially for PET-CT), FTI conducted robustness checks by also employing the scans-per-discharge ratios reported in the Application.¹¹⁰

¹⁰⁸ Letter from Caroline Powers to Lisa O'Connor, dated August 14, 2024.

¹⁰⁹ Letter from Caroline Powers to Lisa O'Connor, dated August 14, 2024.

¹¹⁰ Application Narrative, p. 25 (see Tables 14-16).

135. DFCI reported total hypothetical capacity (throughput) of each scanner type for inpatient and outpatient settings based on their historical data. FTI independently verified the reasonableness of these estimates based on existing literature and throughput assumptions used in other settings.¹¹¹ The weighted average throughput for each modality was calculated as the average between inpatient and outpatient scanner throughputs, weighted by projected inpatient and outpatient utilization.
136. Table 26 reports projected demand for CT procedures and CT scanners in 2025. Using inpatient claims data, the average CT scan to inpatient discharge ratio was calculated to be 1.24, twice as large as the ratio calculated by DFCI of 0.62. These ratios predict demand of 5,902-11,805 CT scans by inpatients in the new proposed facility in 2025. The estimated number of DFCI outpatient patient scans occurring at non-DFCI facilities is 7,612 for a total of 13,514-19,417 total projected CT scans in 2025. DFCI's calculation of 2032 projected CT demand is 18,400 (8,269 inpatient and 10,131 outpatient).¹¹² Based on weighted average throughputs, FTI's projected CT scanner need is between 1.3-1.9 CT scanners in 2025.

Table 26: Projected CT Scanner Demand, 2025

	Claims Data	Application
CT Scan to Inpatient Discharge Ratio	1.24	0.62
Projected Inpatient CT Scans	11,805	5,902
Projected Unmet Outpatient CT Scans	7,612	7,612
Total Projected CT Scans	19,417	13,514
Weighted Average Throughput	10,035	10,081
Projected CT Scanner Need	1.9	1.3

137. Table 27 reports projected demand for MRI procedures and MRI scanners in 2025. Using inpatient claims data, the average MRI scan to inpatient discharge ratio was calculated to be 0.44, similar to the ratio calculated by DFCI of 0.36. These ratios predict demand of 3,427-4,189 MRI scans by

¹¹¹ See, for example, Sun YC, Wu HM, Guo WY, Ou YY, Yao MJ, Lee LH. Simulation and evaluation of increased imaging service capacity at the MRI department using reduced coil-setting times. PLoS One. 2023 Jul 27;18(7):e0288546. doi: 10.1371/journal.pone.0288546. PMID: 37498942; PMCID: PMC10374078; Michigan Department of Health and Human Services. "Certificate of Need (CON) Review Standards for Computed Tomography (CT) Scanner Services." (December 2023) https://www.michigan.gov/-/media/Project/Websites/mdhhs/Doing-Business-with-MDHHS/Health-Care-Providers/Certificate-of-Need/CON-Review-Standards/CT_Standards.pdf; Michigan Department of Health and Human Services. "Certificate of Need (CON) Review Standards for Magnetic Resonance Imaging (MRI) Services." (September 2023) https://www.michigan.gov/mdhhs/-/media/Project/Websites/mdhhs/Doing-Business-with-MDHHS/Health-Care-Providers/Certificate-of-Need/CON-Review-Standards/MRI_Standards.pdf; Michigan Department of Health and Human Services. "Certificate of Need (CON) Review Standards for Positron Emission Tomography (PET) Scanner Services." (September 2023) https://www.michigan.gov/mdhhs/-/media/Project/Websites/mdhhs/Doing-Business-with-MDHHS/Health-Care-Providers/Certificate-of-Need/CON-Review-Standards/PET_Standards.pdf; North Carolina Department of Health and Human Services Division of Health Service Regulation. "2024 State Medical Facilities Plan" (January 2024), pp. 335-366 https://info.ncdhhs.gov/dhsr/ncsmfp/2024/01%202024_SMFP_amendment_complete_v2_final.pdf.

¹¹² Application Narrative, p. 25.

inpatients in the new proposed facility in 2025. DFCI's Application states that "because the Applicant anticipates using the entirety of the new MRI machines to service inpatients, outpatient volume projections were not incorporated into the demand calculations."¹¹³ Consistent with this approach, FTI did not incorporate any outpatient demand into its forecast of MRI scanner need. DFCI's calculation of 2032 projected MRI demand is 4,928.¹¹⁴ Based on weighted average throughputs, FTI's projected MRI scanner need is between 1.1-1.3 MRI scanners in 2025.

Table 27: Projected MRI Scanner Demand, 2025

	Claims Data	Application
MRI Scan to Inpatient Discharge Ratio	0.44	0.36
Projected Inpatient MRI Scans	4,189	3,427
Projected Unmet Outpatient MRI Scans	0	0
Total Projected MRI Scans	4,189	3,427
Weighted Average Throughput	3,103	3,103
Projected MRI Scanner Need	1.3	1.1

138. Table 28 reports projected demand for PET-CT procedures and PET-CT scanners in 2025. Inpatient PET-CT procedures could only be imperfectly identified in the claims data, resulting in an average PET-CT scan to inpatient discharge ratio of 0.001, significantly below the ratio calculated by DFCI of 0.04. Regardless of the ratio, estimated inpatient demand was estimated to be relatively low (13-381 scans in 2025). On the other hand, estimated outpatient demand for PET-CT scans occurring at non-DFCI facilities is 1,817 for a total of 1,830-2,198 total projected PET-CT scans in 2025. DFCI's calculation of 2032 projected PET-CT demand is 3,010 (555 inpatient and 2,455 outpatient).¹¹⁵ Based on weighted average throughputs, FTI's projected PET-CT scanner need is between 0.4-0.5 PET-CT scanners in 2025.

Table 28: Projected PET-CT Scanner Demand, 2025

	Claims Data	Application
PET-CT Scan to Inpatient Discharge Ratio	0.001	0.04
Projected Inpatient PET-CT Scans	13	381
Projected Unmet Outpatient PET-CT Scans	1,817	1,817
Total Projected PET-CT Scans	1,830	2,198
Weighted Average Throughput	4,114	4,017
Projected PET-CT Scanner Need	0.4	0.5

¹¹³ Application Narrative, pp. 23-24.

¹¹⁴ Application Narrative, p. 25. In a communication to FTI, DFCI indicated that it had subsequently estimated that it will have 9,199 unmet outpatient MRI scans as of 2032. To be conservative in estimating need, FTI did not incorporate this demand into its projections. Letter from Caroline Powers to Lisa O'Connor, dated August 14, 2024.

¹¹⁵ Application Narrative, p. 25.

F. Prices for Outpatient Diagnostic Imaging

139. The ICA Questions and analysis involve evaluation of current pricing by service line and potential impact of the Proposed Project on prices and medical spending. This section evaluates estimates of pricing for commercial claims for DFCI and other relevant providers offering outpatient diagnostic imaging services.
140. The methodology employed for analyzing outpatient diagnostic imaging prices is similar to that used for analysis of inpatient prices as outlined in Section XI. Prices were estimated for commercial, Medicare, and Medicaid payor categories.¹¹⁶ These prices are used in conjunction with the volume predictions to project total healthcare costs in Section XIV.G.
141. Using 2021 claims data for the outpatient diagnostic imaging service line as defined above, allowed amounts were used to determine the total price of an imaging service. The average allowed amount for all claim lines associated with a given service was then determined for each provider-payor category combination. Prices were normalized and reported relative to the average statewide service line price (i.e., the average allowed amount for all claim lines associated with a given service across all Massachusetts providers and payors).
142. As shown in Table 29, DFCI's relative prices for CT in 2021 were 2.31 (commercial), 1.49 (Medicare), and 2.43 (Medicaid). DFCI's relative prices for PET-CT in 2021 were estimated at 2.23 (commercial), 0.82 (Medicare), and 1.45 (Medicaid).

Table 29: Estimated Relative Outpatient CT and PET-CT Prices by Hospital and Payor, 2021¹¹⁷

Imaging Modality	Hospital	Relative Price		
		Medicare	Commercial	Medicaid
CT	Beth Israel Deaconess Medical Center	0.86	1.42	0.60
	Dana-Farber Cancer Institute	1.49	2.31	2.43
	Brigham and Women's Hospital	1.17	2.04	1.34
PET	Beth Israel Deaconess Medical Center	0.85	2.00	1.15
	Dana-Farber Cancer Institute	0.82	2.23	1.45
	Brigham and Women's Hospital	0.97	2.02	0.97

143. Because the Proposed Project is predicted to shift utilization of outpatient imaging from BWH to DFCI, the relative prices between these entities is relevant for estimating changes in total healthcare expenditures. DFCI's commercial prices are estimated to be higher on average than BWH for

¹¹⁶ See Appendix Section II.C for a listing of insurance product codes used to identify each payor type.

¹¹⁷ Source: 2021 CHIA Massachusetts APCD and 2021 Medicare Outpatient Claims Data.

outpatient imaging (except for Medicare reimbursement of PET-CT).¹¹⁸ Because of capitated and global payment reimbursement arrangements used in the outpatient setting, especially by DFCI, these relative prices may be subject to bias. However, the ICA analysis uses these as a benchmark. As shown below, the relative prices between these facilities is not a significant driver of estimated cost impacts.

G. Forecasted Impacts of the Proposed Project on Outpatient Diagnostic Imaging Shares, Prices, and Spending

144. The Proposed Project will not meaningfully impact shares, or competition for outpatient imaging. DFCI reports that a substantial number of its unmet outpatient imaging (CT and PET-CT) scans are currently met by MGB facilities (especially by BWH). Therefore, the Proposed Project is projected to shift share away from MGB to DFCI and BIDMC. Based upon the estimated unmet outpatient demand estimates above, the projected shifts away from MGB to DFCI are 0.8% of total outpatient CT scans and 9.1% of outpatient PET-CT scans. These shifts do not meaningfully affect market concentration (as measured by HHI).
145. Given DFCI's existing presence in outpatient imaging and the lack of meaningful change in market concentration, facility-level prices are not projected to change. The dynamic described above for inpatient cancer care prices whereby DFCI could gain bargaining leverage by virtue of its expanding capacity is not applicable to DFCI's diagnostic imaging prices. Unlike in the inpatient cancer care facility setting, DFCI is already established with significant capacity in the relevant service lines. Therefore, its bargaining position will not materially change from the incremental increases in equipment availability envisioned in the Proposed Project.
146. FTI's estimated changes in total medical spending for outpatient imaging was derived by combining forecasted changes in overall demand, utilization by provider, prices, and shares. Table 30 presents estimated outpatient imaging costs impacts for each outpatient imaging modality. The projected shifts in utilization between MGB and DFCI are estimated to increase total medical spending for outpatient CT scans in Massachusetts by 0.3% (\$1.7 million) in 2025, with similar but decreasing impacts in the following years, and to increase total medical spending for outpatient PET-CT scans in Massachusetts by 0.1% (\$28,038) in 2025, again with similar but decreasing impacts in the following years. These cost impacts are driven primarily by patients moving to a relatively higher priced DFCI, but this price effect may be overstated for the reasons described above. The projections show little to no scope for shifts between freestanding outpatient to hospital-based outpatient settings.

¹¹⁸ Because DFCI is a PCH, its relative Medicare price for CT imaging is higher than BWH and BIDMC. The impacts of this relative price difference are incorporated into the cost estimates below.

Table 30: Estimated Changes in Outpatient Imaging Costs, 2025-2040

Year	CT		PET-CT	
	Baseline Projection	With Supply-Induced Demand	Baseline Projection	With Supply-Induced Demand
2025	0.3%	1.1%	0.1%	7.7%
2030	0.3%	1.1%	0.0%	7.5%
2035	0.3%	1.1%	-0.1%	7.3%
2040	0.3%	1.0%	-0.1%	7.2%

Year	CT		PET-CT	
	Baseline Projection	With Supply-Induced Demand	Baseline Projection	With Supply-Induced Demand
2025	\$1,709,787	\$6,252,872	\$28,038	\$3,697,295
2030	\$1,822,226	\$6,652,852	-\$7,878	\$3,884,621
2035	\$1,878,157	\$6,841,650	-\$30,288	\$3,958,735
2040	\$1,881,615	\$6,839,643	-\$31,999	\$3,944,841

147. As with shifts in inpatient cancer care, shifts in outpatient imaging away from existing providers to the new DFCI facility will leave behind available capacity, raising the potential for supply-induced demand. If MGB were to replace all the scans projected to shift to DFCI with new scans (i.e., scans that would otherwise not have occurred rather than with scans pulled from other competitors), this increased utilization would lead to increases in total medical spending for outpatient imaging. As shown in Table 30, the estimated impact of this increased utilization (combined with the increased cost estimates predicted in the baseline scenario) would be to increase outpatient CT imaging costs by 1.1% (\$6.3 million) in 2025 and to increase outpatient PET-CT imaging costs by 7.7% (\$3.7 million) in 2025. The percentage impact on PET-CT spending is relatively higher because the estimated number of DFCI’s “unmet” PET-CT scans is larger as a proportion of the overall market.

XV. IMPACTS ON RADIATION THERAPY SERVICES

148. DFCI has proposed need for linear accelerators (LINACs) and CT simulators to provide radiation therapy services currently being referred to other providers in its proposed new facility. This section provides detailed analysis of the patients, providers, and payors for each of the relevant service lines. These apply standard methodologies and a standard basis for estimating shares based on volumes in a geography and by provider.

A. Defining Radiation Therapy Service Lines

149. Service lines used in this analysis include outpatient LINAC procedures, CT simulation procedures, and the combination of these procedures. Because radiation therapy is primarily provided on an

outpatient basis, inpatient utilization was not measured. Because these treatments are primarily used to provide cancer care by specialized cancer treatment providers, no additional restrictions were applied to the service lines for specific diagnoses.

150. Radiation therapies were identified by all claim lines associated with relevant CPT codes in the CHIA Massachusetts APCD¹¹⁹ or the Medicare Outpatient Claims file.¹²⁰ Similar restrictions to the outpatient claims file as outlined in Section XI were employed for this analysis as well.

B. Geographic Areas of Coverage

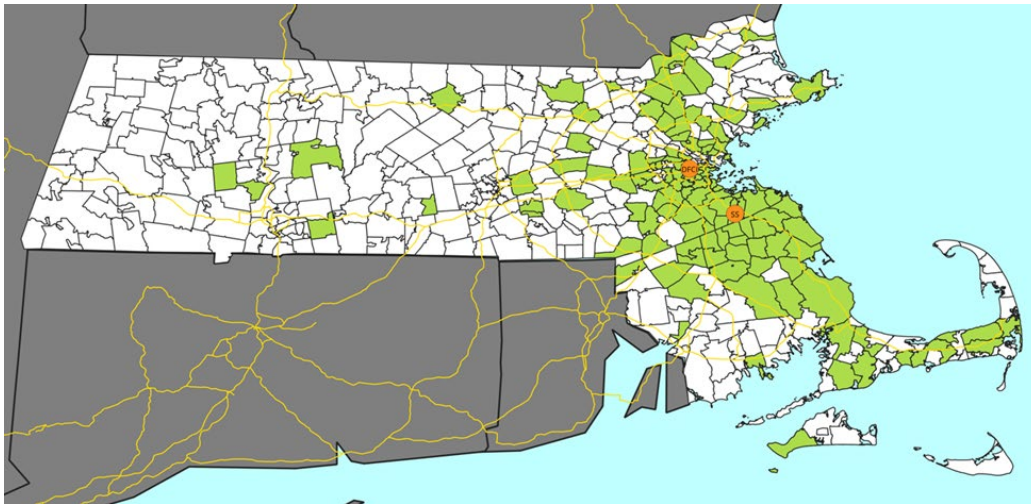
151. To assess the geographic scope of radiation therapy services provided by DFCI and competition between outpatient radiation therapy providers, FTI generated a service area using the methodology described above combining both LINAC and CT simulator procedures.¹²¹ The service area analysis evaluated data based on current utilization patterns (derived from outpatient claims data) of patients located in Massachusetts. The service area for DFCI radiation therapy was generated by identifying the set of Massachusetts ZIP codes from which 90% of the radiation therapy service line's 2021 visits originated.
152. Figure 5 depicts the 90% PSA for DFCI radiation therapy services in 2021. The service area encompasses a broad set of ZIP codes centered around DFCI's outpatient facilities, with some additional ZIP codes expanding into other areas of the state.
153. Outpatient CHIA data do not allow for delineation between DFCI radiation therapy locations. LINAC license records provided by DPH indicate that DFCI has LINACs in Milford (1), South Weymouth at South Shore Hospital (2), Boston (3), and Weymouth (1). The service area mapping demonstrates that DFCI primarily draws its patients from the areas near its Boston and South Shore Hospital locations. This indicates that patient draw areas are relatively local to radiation oncology providers. Consequently, FTI conducted its ICA analysis of radiation therapy for the Boston region (the region in which DFCI proposes to expand its radiation therapy equipment capacity), as defined by the Massachusetts Executive Office of Health & Human Services.

¹¹⁹ The CHIA Massachusetts APCD outpatient data do not contain race or ethnic patient information, self-pay patients, or out-of-state patients.

¹²⁰ The codes used to identify these service lines are provided in Appendix Section II.B.

¹²¹ Evaluation of need calculations and forecasted impacts of the Proposed Project on total spending are presented separately for each modality.

Figure 5: DFCI Radiation Therapy Services Primary Service Area (90%), 2021¹²²



C. Current Provision of Radiation Therapy Services in Massachusetts

154. Table 31 sets out demographic information for patients receiving outpatient radiation therapy at DFCI in 2021 separated by procedure type (LINAC and CT simulation). FTI estimated that DFCI provided 38,515 LINAC procedures and 974 CT simulations in 2021 across all of its Massachusetts locations. The payor mix of DFCI's radiation therapy patient panel consists of a majority of Medicare patients (58%) and approximately 20% commercially-covered patients. Similar to its outpatient imaging patient panel, DFCI's radiation therapy patient panel is, on average, older and more likely to have Medicare insurance than its inpatient patient panel.

Table 31: Demographic Characteristics of DFCI Radiation Therapy Patient Panel, 2021¹²³

		LINAC		CT Simulator	
		Total	%	Total	%
Age	18-34	553	1%	12	1%
	35-54	3,965	10%	127	13%
	55-64	5,899	15%	159	16%
	65-74	15,089	39%	409	42%
	75+	12,990	34%	266	27%
Gender	Female	19,569	51%	789	81%
	Male	18,733	49%	181	19%
Payor Type	Medicare	22,638	59%	530	54%
	Commercial	7,336	19%	208	21%
	Other	4,550	12%	121	12%
	Medicaid	3,991	10%	115	12%
Total	Total	38,515	100%	974	100%

¹²² Source: 2021 CHIA Massachusetts APCD and 2021 Medicare Outpatient Claims Data.

¹²³ Source: 2021 CHIA Massachusetts APCD and 2021 Medicare Outpatient Claims Data.

155. In response to the ICA Questions regarding price and competition for radiation therapy services, FTI analyzed the current shares of DFCI and alternative providers of radiation therapy in Massachusetts. Table 32 provides procedure volume and shares for LINAC procedures, CT simulation procedures, and the combined count by health system and hospital for 2021. DFCI accounted for 10% of statewide LINAC procedures and 4% of statewide CT simulation procedures in 2021. MGB had the largest share (26%) of both radiation therapy categories in 2021, and MGH had the highest shares for any single hospital (19% of LINAC procedures and 17% of CT simulations). Beth Israel Lahey Health accounted for more than 15% of these radiation therapy procedures in 2021 with those procedures being distributed among several facilities. Although some systems have notable shares of these radiation therapy procedures, these markets are characterized by many small-share providers.

Table 32: Massachusetts Radiation Therapy Procedures by Provider, 2021¹²⁴

System	Hospital	LINAC Procedures	LINAC Share	CT Simulator Procedures	CT Simulator Share
Mass General Brigham	Total	96,951	26%	6,753	26%
Mass General Brigham	Massachusetts General Hospital	68,715	19%	4,440	17%
Mass General Brigham	Brigham and Women's Hospital	19,616	5%	1,731	7%
Beth Israel Lahey Health	Total	54,605	15%	4,819	19%
Beth Israel Lahey Health	Beth Israel Deaconess Medical Center	19,429	5%	1,690	7%
Beth Israel Lahey Health	Lahey Hospital Medical Center	17,660	5%	1,886	7%
Dana-Farber Cancer Institute	Total	38,515	10%	974	4%
Dana-Farber Cancer Institute	Dana Farber Cancer Institute	38,515	10%	974	4%
UMass Memorial Health Care	Total	28,762	8%	1,639	6%
UMass Memorial Health Care	UMass Memorial Medical Center	28,762	8%	1,639	6%
Cape Cod Healthcare	Total	19,792	5%	2,146	8%
Cape Cod Healthcare	Cape Cod Hospital	19,791	5%	2,146	8%
Other Health Systems	Total	20,139	5%	1,504	6%
Tufts Medicine	Total	18,793	5%	1,513	6%
Steward Health Care System	Total	18,132	5%	548	2%
Baystate Health	Total	16,881	5%	1,121	4%
Southcoast Health System	Total	12,995	4%	1,493	6%
Tenet Healthcare	Total	12,956	4%	1,084	4%
Berkshire Health Systems	Total	8,923	2%	618	2%
Boston Medical Center	Total	8,256	2%	826	3%
Trinity Health	Total	7,466	2%	475	2%
Signature Healthcare	Total	5,375	1%	376	1%

D. Forecast of Future Demand for Radiation Therapy Services

156. This section presents the results of the demand projection methodology outlined above for each relevant service line in radiation therapy services. As described in Section IX, utilization projections were developed by area, service, and payor. Because the radiation therapy service lines are not

¹²⁴ Source: 2021 CHIA Massachusetts APCD and 2021 Medicare Outpatient Claims Data.

directly restricted to cancer care, only demographic-based growth was incorporated into these projections. Table 33 and Table 34 show projected demand growth for LINAC and CT simulator procedures by payor type. Application of the methodology results in initial projections that the LINAC procedures in the service area will increase by 17.4% from 36,003 in 2025 to 42,283 in 2040 and CT simulator procedures will increase by 14.8% from 2,541 in 2025 to 2,918 in 2040. Growth in both service lines is concentrated among Medicare patients, consistent with the demographic trends and aging population shown above.

Table 33: Projected Demand for LINAC Procedures by Payor Type, 2025-2040

Payor	Projected Procedures				Growth (2025-2040)
	2025	2030	2035	2040	
Medicare	20,056	23,068	24,557	24,846	23.9%
Medicaid	7,034	7,268	7,412	7,538	7.2%
Commercial	5,397	5,444	5,480	5,567	3.2%
Self-Pay/Other	3,515	4,050	4,302	4,331	23.2%
Total	36,003	39,829	41,751	42,283	17.4%

Table 34: Projected Demand for CT Simulator Procedures by Payor Type, 2025-2040

Payor	Projected Procedures				Growth (2025-2040)
	2025	2030	2035	2040	
Medicare	1,323	1,503	1,589	1,603	21.1%
Medicaid	542	561	573	582	7.4%
Commercial	452	454	457	466	3.2%
Self-Pay/Other	224	252	265	267	18.9%
Total	2,541	2,769	2,884	2,918	14.8%

E. Evaluation of DFCI Need for Radiation Therapy Equipment

157. DFCI estimates that the Proposed Project will have associated demand for radiation therapy services requiring the addition of three LINACs and two CT simulators to the existing stock operated by DFCI and BIDMC in the Boston area.¹²⁵ Because of confidentiality restrictions related to BWH information, DFCI calculated this need by (1) estimating demand for LINAC procedures by disease center at its South Shore Hospital facilities, (2) estimating an adjustment factor to account for demand differences between its urban and community hospital locations, (3) estimating its demand for LINAC procedures in the Longwood Medical Area by applying the South Shore Hospital demand and adjustment factor to its count of Longwood Medical Area outpatient patients by disease center, (4) estimating CT

¹²⁵ Application Narrative, pp. 26-27.

simulator demand by dividing LINAC demand by its estimate of treatments per unique patient (assuming each patient will require one CT simulation appointment at the outset of their sequence of radiation therapy treatments), and (5) estimating typical LINAC and CT simulator throughput based on its historical information. This section evaluates DFCI's need for radiation therapy equipment in connection with the Proposed Project, including assessing these calculations and predicting shifts in utilization across providers.

158. DFCI reported total hypothetical capacity (throughput) of each radiation therapy modality based on their historical data. FTI independently verified the reasonableness of these estimates based on existing literature and throughput assumptions used in other settings.¹²⁶
159. DFCI reported it had 25,356 Longwood Medical Area LINAC procedures in 2022 and a total need of 47,456 Longwood Medical Area LINAC procedures, implying 22,100 procedures referred to BWH.¹²⁷ DFCI also reported BIDMC had 18,080 LINAC procedures in 2022.¹²⁸ Because the claims data lack reliable disease center information or referral information and without the ability to separately identify DFCI's South Shore Hospital versus Longwood Medical Area procedures, FTI was unable to directly evaluate these demand estimates.
160. Instead, FTI evaluated these estimates indirectly using outpatient claims data. FTI identified 38,515 DFCI LINAC procedures in 2021 across all DFCI care locations in Massachusetts. Assuming DFCI's estimate of 25,356 LINAC procedures in Longwood Medical Area for that year is accurate, this implies 13,159 procedures performed at its other locations. DFCI has four LINACs in three locations outside of Boston with a theoretical maximum capacity of between 7,000 and 28,000 procedures (based on throughput assumptions), giving some credence to DFCI's self-reported number of procedures. FTI estimates BIDMC facilities performed 19,429 LINAC procedures in 2021, somewhat more than DFCI's estimate for 2022 (18,080). BWH facilities performed 19,616 LINAC procedures in 2021—somewhat less than DFCI's implied estimate of its patients receiving radiation therapy from BWH and others for 2022. Each of these data points are broadly consistent with DFCI's demand

¹²⁶ See, for example, M. Washington, W. Chin, V. Patel, K.A. Higgins, C. Gartin, L. Jackson, N. Stafford, P. Chambers, E. Ebrahimdoost, L. Gill, Understanding Process Breakdowns During CT-Simulation Encounters, *International Journal of Radiation Oncology*Biophysics*, Volume 111, Issue 3, (Supplement, 2021) <https://doi.org/10.1016/j.ijrobp.2021.07.1384>; Michigan Department of Health and Human Services. "Certificate of Need (CON) Review Standards for Megavoltage Radiation Therapy (MRT) Services/Units." (June 2024) https://www.michigan.gov/mdhhs/-/media/Project/Websites/mdhhs/Doing-Business-with-MDHHS/Health-Care-Providers/Certificate-of-Need/CON-Review-Standards/MRT_Standards.pdf; North Carolina Department of Health and Human Services Division of Health Service Regulation. "2024 State Medical Facilities Plan" (January 2024), pp. 315-327 https://info.ncdhhs.gov/dhsr/ncsmfp/2024/01%202024_SMFP_amendment_complete_v2_final.pdf.

¹²⁷ Application Narrative, pp. 14, 26.

¹²⁸ Application Narrative, p. 26.

estimates. To check robustness of this methodology, FTI evaluated DFCI LINAC need both based on DFCI's estimates and 2021 claims data.

161. As shown in Table 35, both approaches to forecasting demand yield similar projected LINAC demand estimates for 2025. FTI projects that the combined demand from DFCI and BIDMC patients for LINAC sessions in 2025 will be between 46,347-47,786 with an additional demand of 20,930-23,581 sessions from patients currently receiving care at BWH facilities (some or many of which may be DFCI patients). Based on estimated throughputs, FTI projects that the combined demand of existing DFCI, BIDMC, and BWH LINAC procedures will require approximately ten LINACs in 2025. Excluding LINAC sessions currently performed by BWH LINACs, the need will be approximately seven LINACs between DFCI and BIDMC in 2025. DFCI's Application indicates it will have access to six existing LINACs in the Boston area (DFCI's current three LINACs operating in its existing Boston facilities and three that it plans to acquire by lease from BIDMC).¹²⁹ These demand estimates, therefore, are consistent with need for between one and four additional LINACs in the Boston area in 2025, with demand increasing in future years.

Table 35: Projected LINAC Demand, 2025

	Claims Data	Application
Projected DFCI LINAC Sessions	27,055	27,055
Projected BIDMC LINAC Sessions	20,731	19,292
Projected BWH LINAC Sessions	20,930	23,581
Projected Total LINAC Sessions	68,716	69,928
Throughput	7,000	7,000
LINAC Need	9.8	10.0
LINAC Need less BWH Sessions	6.9	7.2

162. The methodology for estimating total projected 2025 CT simulator need follows the methodology for LINAC need. Table 36 lists estimated demand for CT simulator treatments by source in 2025. FTI projects that the combined DFCI/BIDMC demand for CT simulator treatments in 2025 will be 2,487 with an additional demand of 1,877 sessions from patients currently receiving care at BWH facilities (some or many of which may be DFCI patients). Based on estimated throughputs, FTI estimates that the combined demand of existing DFCI, BIDMC, and BWH LINAC procedures will require the equivalent of 2.1 CT simulators in 2025 or 1.2 equivalent CT simulators without BWH treatments.

¹²⁹ Application Narrative, p. 26.

Table 36: Projected CT Simulator Demand, 2025

	Total
Projected DFCI CT Simulator Treatments	684
Projected BIDMC CT Simulator Treatments	1,803
Projected BWH CT Simulator Treatments	1,877
Projected Total CT Simulator Treatments	4,364
Throughput	2,125
CT Simulator Need	2.1
CT Simulator Need less BWH Treatments	1.2

163. Because CT simulator procedures are somewhat more difficult to identify in claims data than LINAC procedures, FTI also estimated need using the approach used by DFCI in its application.¹³⁰ Under this approach, CT simulator treatments are estimated by dividing the projected LINAC sessions by the average number of LINAC sessions per patient (with the assumption that each patient will receive one CT simulator treatment at the outset of their sequence of radiation therapy sessions). DFCI reports two different numbers apparently representing the average number of LINAC sessions per patient: 11.0 (see Application Narrative Table 20) and 21.3 (see Application Narrative Appendix Table A-3).¹³¹ As shown in Table 37, FTI used both averages to project CT simulator demand requiring either 1.5 or 2.9 CT simulators (including BWH demand) and either 1.1 or 2.0 CT simulators (without BWH demand).

Table 37: Projected CT Simulator Demand Based on Forecasted LINAC Demand, 202

	Table 20 Estimate	Table A-3 Estimate
Projected LINAC Sessions	68,716	68,716
Average LINAC Sessions per Patient	11.0	21.3
Projected CT Simulator Treatments	6,247	3,226
Throughput	2,125	2,125
CT Simulator Need	2.9	1.5
CT Simulator Need without BWH	2.0	1.1

164. BIDMC currently has one CT simulator to which DFCI proposes adding two machines.¹³² FTI estimates that total demand estimates, therefore, are consistent with need for between one and two additional LINACs in the Boston area in 2025, with demand increasing in future years.

¹³⁰ Application Narrative, pp. 26-27.

¹³¹ Application Narrative, pp. 27, A-3.

¹³² Application Narrative, p. 27.

165. In its Application, DFCI indicated that it aims to consolidate care of its patients into its new facility. “Radiation therapy services are an essential component of a designated cancer hospital and critical to the Applicant’s desire to defragment the delivery of cancer care to cancer patients.”¹³³ Were that consolidation to occur, estimated need for additional LINACs and CT simulators would be at the higher end of the ranges estimated above. However, this shift from existing BWH capacity to the new DFCI facility raises the prospect for potential backfill at BWH discussed above in the context of inpatient cancer care and outpatient diagnostic imaging services. The implications of this potential backfill is discussed further in Section XV.G below.

F. Prices for Radiation Therapy Services

166. The ICA Questions and analysis involve evaluation of current pricing by service line and potential impact of the Proposed Project on prices and medical spending. This section evaluates estimates of pricing for commercial claims for DFCI and other relevant providers offering radiation therapy services.
167. The methodology employed for analyzing radiation therapy prices is similar to that used for analysis of inpatient prices as outlined in Section XI. Prices were estimated for commercial, Medicare, and Medicaid payor categories.¹³⁴ These prices are used in conjunction with the volume predictions to project total healthcare costs in Section XV.G.
168. Using 2021 claims data for the radiation therapy service line as defined above, allowed amounts were used to determine the total price of each radiation therapy service. The average allowed amount for all claim lines associated with a given service was then determined for each provider-payor category combination. Prices were normalized and reported relative to the average statewide service line price (i.e., the average allowed amount for all claim lines associated with a given service across all Massachusetts providers and payors).
169. As shown in Table 38, DFCI’s relative prices for LINAC in 2021 were 2.34 (commercial), 0.96 (Medicare), and 1.39 (Medicaid). DFCI’s relative prices for CT Simulation in 2021 were estimated at 1.61 (commercial), 1.40 (Medicare), and 1.56 (Medicaid).

¹³³ Application Narrative, p. 26.

¹³⁴ See Appendix Section II.C for a listing of insurance product codes used to identify each payor type.

Table 38: Estimated Relative LINAC and CT Simulator Prices by Hospital and Payor, 2021¹³⁵

Modality	Hospital	Relative Price		
		Medicare	Commercial	Medicaid
Linear Accelerator	Beth Israel Deaconess Medical Center	0.97	1.65	0.66
	Dana-Farber Cancer Institute	0.96	2.34	1.39
	Brigham and Women's Hospital	1.11	4.09	1.04
CT Simulator	Beth Israel Deaconess Medical Center	0.67	1.40	0.50
	Dana-Farber Cancer Institute	1.40	1.61	1.56
	Brigham and Women's Hospital	N/A	3.39	2.02

170. Because the Proposed Project is predicted to shift utilization of radiation therapy from BWH to DFCI, the relative prices between these entities is relevant for estimating changes in total healthcare expenditures. DFCI's commercial prices are estimated to be lower on average than BWH for radiation therapy (except for Medicaid reimbursement of LINAC treatment). Because of capitated and global payment reimbursement arrangements used in the outpatient setting, especially by DFCI, these relative prices may be subject to bias. However, the ICA analysis uses these as a benchmark.

G. Forecasted Impacts of the Proposed Project on Radiation Therapy Services Shares, Prices, and Spending

171. The Proposed Project will not meaningfully impact shares, competition, or prices for radiation therapy services. DFCI reports that its patients "receiving LINAC therapy on the Longwood Medical Campus do so at facilities operated by [DFCI] or facilities operated by BWH, depending on the particular patient's disease center."¹³⁶ The Proposed Project, therefore, is projected to shift share away from BWH (and the MGB system) to DFCI. Based upon the estimated unmet outpatient demand estimates above, the projected shifts away from MGB to DFCI are 12.4% of total LINAC procedures and 13.6% of CT simulator procedures in the Boston area. These shifts have a downward, but not economically meaningful, influence on market concentration (i.e., less concentration) in the relevant geography as measured by HHI.

172. Given DFCI's existing presence in radiation therapy services and the lack of meaningful change in market concentration, facility-level prices are not projected to change. The dynamic described above for inpatient cancer care prices whereby DFCI could gain bargaining leverage by virtue of its expanding capacity is not applicable to DFCI's radiation therapy services prices. Unlike in the inpatient cancer care facility setting, DFCI is already established with significant capacity in the

¹³⁵ Source: 2021 CHIA Massachusetts APCD and 2021 Medicare Outpatient Claims Data.

¹³⁶ Application Narrative, p. A-1.

relevant service lines. Therefore, its bargaining position will not materially change from the incremental increases in equipment availability envisioned in the Proposed Project.

173. FTI's estimated changes in total medical spending for radiation therapy services was derived by combining forecasted changes in overall demand, utilization by provider, prices, and shares. Table 39 presents estimated radiation therapy cost impacts for each modality. The projected shifts in utilization between BWH and DFCI/BIDMC are estimated to decrease total medical spending in the Boston area for LINAC procedures by 2.4% (\$0.7 million) in 2025, with similar but diminishing cost decreases in the following years, and to decrease total medical spending in the Boston area for CT simulator procedures by 7.3% (\$0.1 million) in 2025, with cost decreases of more than 7.0% (\$0.1 million) through 2040. These cost impacts are driven by patients moving to a relatively lower priced DFCI. The projections show little to no scope for shifts between freestanding outpatient to hospital-based outpatient settings.

Table 39: Estimated Changes in Radiation Therapy Services Costs, 2025-2040

Year	LINAC		CT Simulator	
	Baseline Projection	With Reallocation to BWH	Baseline Projection	With Reallocation to BWH
2025	-2.4%	4.9%	-7.3%	5.9%
2030	-2.3%	4.7%	-7.3%	6.0%
2035	-2.3%	4.5%	-7.2%	6.0%
2040	-2.2%	4.5%	-7.1%	5.9%

Year	LINAC		CT Simulator	
	Baseline Projection	With Reallocation to BWH	Baseline Projection	With Reallocation to BWH
2025	-\$679,606	\$1,372,402	-\$124,498	\$100,636
2030	-\$707,496	\$1,412,691	-\$132,266	\$109,605
2035	-\$714,997	\$1,428,216	-\$135,450	\$113,321
2040	-\$716,374	\$1,430,130	-\$135,171	\$113,358

174. Due to the nature of radiation therapy, FTI found limited scope for supply-induced demand to increase the total number of patients receiving radiation therapy. However, there may be offsets to projected cost savings were BWH to compete for patients with DFCI and other radiation therapy providers. To model the maximum impact of this potential economic dynamic, FTI estimated the impact of BWH replacing all of its lost patients with other patients in the Boston area. This approach reduces cost savings from shifts to DFCI as patients are drawn into BWH from lower-priced surrounding providers. As shown in Table 39, the maximum cost increase under these scenarios is between 4.5%-4.9%

(\$1.3M-\$1.4M) for LINAC procedures and 5.9%-6.0% (\$100,636-\$113,358) for CT simulator procedures, with the cost increases decreasing over time.