STAFF REPORT TO THE COMMISSIONER of PUBLIC HEALTH FOR A DETERMINATION OF NEED	
Applicant Name	UMass Memorial Health Care, Incorporated
Applicant Address	One Biotech Park 365 Plantation Street Worcester, Ma 01605
Filing Date	February 16, 2022
Type of DoN Application	DoN Required Equipment
Total Value	$3,832,862.00
Project Number	UMMHC-21120810-RE
Ten Taxpayer Group (TTG)	None
Community Health Initiative (CHI)	$191,643.10
Staff Recommendation	Approval
Public Health Council	Delegated

Project Summary and Regulatory Review

UMass Memorial Health Care, Inc. (UMMHC System or the Applicant), located at One Biotech Park, 365 Plantation Street, Worcester, MA, 01605, filed a Notice of Determination of Need (DoN) Application for the acquisition of one computed tomography (CT) unit to be located in the emergency department of the UMass Memorial Medical Center's (UMMMC) University Campus at 55 Lake Avenue North, Worcester, MA 01655.

This DoN application falls within the definition of DoN-Required Equipment, which is reviewed under the DoN regulation 105 CMR 100.000. The Department must determine that need exists for a Proposed Project, on the basis of material in the record, where the Applicant makes a clear and convincing demonstration that the Proposed Project meets each Determination of Need Factor set forth within 105 CMR 100.210. This staff report addresses each of the six factors set forth in the regulation.

Applicant Background and Application Overview

The Applicant, UMass Memorial Health Care, Incorporated (UMMHC), located at One Biotech Park, 365 Plantation Street Worcester, MA 01605 is the largest health care system in Central Massachusetts. It is comprised of one academic medical center and three community hospitals. All four of these acute care hospitals are designated by the Center for Health Information and Analysis (CHIA) as High Public Payer Hospitals (HPP).[1, 2] Table 1 shows the percent of total public payments for each hospital.

Table 1: Percent of Total Public Payments per UMMHC Acute Care Hospitals

Acute Care Hospitals in UMMHC System	Type (Per CHIA Category)[1]	% of Public Payments[2]
Harrington Memorial Hospital	Community High Public Payer	67.8%
HealthAlliance Hospital	Community High Public Payer	71.8%
Marlborough Hospital - UMASS Memorial Health Center	Community High Public Payer	65.0%
UMass Memorial Medical Center	Academic Medical Center,[3] HPP	66.5%

The UMMHC system[4] provides the full continuum of care including trauma and tertiary care, behavioral health services (through CommunityHealthlink), primary care, a full range of medical specialists, urgent care (through CareWell Urgent Care), home health, and hospice. In addition, the Applicant has several joint ventures including: 1) Hospital for Behavioral Medicine (HBM), a 120-bed mental health treatment facility in Worcester County 2) The Surgery Center (ASC), an outpatient surgical facility in collaboration with Reliant Medical Group and Shields Health Care Group, and 3) Pharmacy Ventures, which assists in developing and managing 340B programs for third parties, as well as for UMMH's specialty drug program at the University campus.

UMass Memorial Medical Center (UMMMC), the Applicant's academic medical center (AMC), includes three campuses: Hahnemann, Memorial, and University. The University Campus site is

[1] Center for Health Information and Analysis. Massachusetts Hospital Profiles. Technical Appendix. https://www.chiamass.gov/assets/docs/r/hospital-profiles/2019/FY19-Massachusetts-Hospital-Profiles-Technical-Appendix.pdf

[2] Includes all Medicare, Medicaid and other government payments for healthcare. https://www.chiamass.gov/high-public-payer-hospitals/

[3] Center for Health Information and Analysis. Massachusetts Hospital Profiles. Technical Appendix. https://www.chiamass.gov/assets/docs/r/hospital-profiles/2019/FY19-Massachusetts-Hospital-Profiles-Technical-Appendix.pdf

[4] UMMHC has been recognized by the Lown Institute as part of its Hospital Index[4] which emphasizes civic leadership, value of care and patient outcomes. Three UMMHC hospitals, including UMMMC, have achieved top ratings in the state: (comparing 55 hospitals):#1 HealthAlliance-Clinton Hospital, #3 UMMMC, , #9 Marlborough Hospital. Further it received high national rankings as well: (comparing 3,282 hospitals): #8 HealthAlliance-Clinton Hospital, #24 UMMMC, #94 Marlborough Hospital

licensed to operate 421 inpatient beds and provides a full spectrum of tertiary acute care, emergency department (ED) care[5], inpatient and outpatient medical and surgical services, including cardiology, neurology, oncology, and radiology.

The DoN Application to add a fourth CT unit is proposed to expand capacity at the University campus to meet the needs of current and future patients by improving its CT service and providing timely access. The additional unit will be located in the ED, the second largest ED in the Commonwealth, resulting in two dedicated CT units serving emergency patients. The site of the Proposed Project is the only Level 1 trauma center for adults and pediatric patients in Central Massachusetts,[6] and is also a designated stroke center and therefore needs to ensure timely access to CT for all ED patients in the service area. Currently, the University Campus' ED's existing CT unit is operating above capacity resulting in significant patient delays, and increased CT unit downtime leading to suboptimal ED throughput.

While renovation of 1,539 gross square feet (GSF) is required, there is no new construction associated with this Proposed Project.

Factor 1

In this section, we assess if the Applicant has sufficiently addressed patient panel need, public health value, competitiveness and cost containment, and community engagement for the expansion of the CT service.

Patient Panel[7]

UMass Memorial Health Care. Inc. and UMMMC

The Applicant reports the UMMHC system serves a large and diverse Patient Panel, caring for over 370,000 patients each year at its hospitals, urgent care clinics, and physician groups. Table 2 shows the Patient Panel of UMMHC and the subset of people who utilize UMMMC (to be referred to as UMMMC's patient population henceforth in this report) for the 36-month period FY 2019-2021. Note the following:

- The University site comprises ~75% of overall UMMHC patients in the system.

[5] a Level 1 Trauma Center and Stroke Center

[6] https://www.mass.gov/service-details/trauma-hospital-destinations and Primary Stroke Service (PSS) https://www.mass.gov/info-details/designated-primary-stroke-services-hospitals#region-2

[7] As defined in 105 CMR 100.100, Patient Panel is the total of the individual patients regardless of payer, including those patients seen within an emergency department(s) if applicable, seen over the course of the most recent complete 36-month period by the Applicant or Holder. Patient Panel also means:
(1) If the Applicant or Holder has no patient panel itself, the Patient Panel includes the Patient Panel of the health care facilities affiliated with the Applicant; or
(2) If the Proposed Project is for a new facility and there is no existing patient panel, Patient Panel means the anticipated patients;

- Over the three years, both UMMHC's Patient Panel and UMMMC's patient population grew nearly 6%.
- During the 2020 fiscal year, there was ~ 7% decline in patients at both UMMHC and UMMMC that the Applicant attributes to the Covid 19 emergency.

Table 2: Patient Panel Data for UMMHC System and Patient Population Data for UMMMC "Hospital"

	# of Patients FY19	# of Patients FY20	# of Patients FY21
UMMHC	371,488	345,864	393,429
UMMMC University Campus	278,919	257,326	295,417
UMMMC's University Share of Total	75.1%	74.4%	75.1%

The Applicant provided three years of demographic information for UMMHC and for UMMMC. There being no significant changes across the three years other than the growth in the Patient Panel, Table 3 provides the FY 21 demographic profiles of the Applicant and of the UMMMC patients.

Table 3: FY21 Demographic Breakdown of UMMHC System Patient Panel and UMMMC Hospital Patient Population

FY 2021	UMMHC System		UMMMC Hospital	
	Count	%	Count	%
Total Patients	393,429	100%	295,417	100%
GENDER				
Female	218,434	55.5%	164,339	55.6%
Male	174,530	44.4%	130,911	44.3%
Unknown	465	0.1%	167	0.1%
Total Gender	393,429	100%	295,417	100%
AGE				
0-17	72,425	18.4%	55,748	18.9%
18-64	237,664	60.4%	173,745	58.8%
65+	83,332	21.2%	65,919	22.3%
Unknown	8	0.0%	5	0.0%
Total Age	393,429	100%	295,417	100%
RACE				
American Indian or Alaska Native	894	0.2%	762	0.3%
Asian	15,024	3.8%	11,852	4.0%
Black or African American	23,378	5.9%	19,195	6.5%

Declined	3,275	0.8%	2,850	1.0%
Multi-Racial	0	0.0%	0	0.0%
Native Hawaiian or Other Pacific Islander	190	0.0%	153	0.1%
Other/Unknown	52,988	13.5%	40,327	13.7%
White	297,680	75.7%	220,278	74.6%
Total Race	393,429	100.0%	295,417	100.0%
ETHNICITY				
Decline to Answer	6,472	1.6%	5,528	1.9%
Hispanic or Latino	59,041	15.0%	43,675	14.8%
Not Hispanic or Latino	317,480	80.7%	239,526	81.1%
Unknown	10,436	2.7%	6,688	2.3%
Total Ethnicity	393,429	100.0%	295,417	100.0%
PATIENT ORIGIN				
Central Mass	352,496	89.6%	262,968	89.0%
Eastern Mass	19,587	5.0%	13,865	4.7%
Western Mass	8,881	2.3%	8,519	2.9%
Out of State	12,465	3.2%	10,065	3.4%
Total Patient Origin	393,429	100.0%	295,417	100.0%

Gender: The UMMHC patient panel and the UMMMC patient population during FY21[8] were both 56% female and 44% male for each of the three years.

Age: Of UMMHC patients, 19% are aged 0-17, 60% were ages 18-64, and 21% are aged 65 and older. Similarly, for UMMMC, 19% were ages 0-17, 59% were ages 18-64, and 22% were 65 and older.

Race and ethnicity: As self-reported by UMMHC patients, the predominant race served by UMMHC hospitals is White (approximately 76%) 15% identified as Hispanic/Latino, 6% as Black/African American and ~4% as Asian These are self-reported figures and accordingly there is a significant percentage of patients in FY21 (13.5%) that either chose not to report or reported in a category not included by the Applicant here. For UMMMC there is a similar mix though its population includes 0.6% more (6.5%) Black/African Americans being served than is represented in the overall UMMHC Patient Panel.

Patient Origin: The majority of patients (approximately 90%) reside in Central Massachusetts, nearly 5% reside in Eastern Massachusetts, and less than 4% come from out of state. There is a generally similar distribution of geographic origin of patients for UMMMC.

[8] Please note UMMHC's Patient Panel data does not include Harrington Health Care System, which was acquired by UMMHC effective July 1, 2021.

Table 4: Payor Mix FY21

Payor Type	UMMHC System	UMMMC Hospital
Commercial PPO/Indemnity	3.0%	3.4%
Commercial HMO/POS	26.7%	27.0%
MassHealth	17.5%	18.1%
Managed Medicaid	6.4%	6.1%
Commercial Medicare	14.8%	14.1%
Medicare FFS	28.4%	28.3%
All other (e.g. HSN, self-pay, TriCare)	3.2%	3.1%
Total	100.0%	100.0%

Payor Mix: The Applicant provided three years of data demonstrating the payor mix for the Patient Panel and the UMMMC patient population which showed little fluctuation over that time frame. Table 4 shows that at UMMMC there is a slightly higher percentage of patients using MassHealth or with commercial insurance coverage than within the system overall. UMMHC has slightly higher percentages of patients with Managed Medicaid and Commercial Medicare than UMMMC.

Factor 1a): Need

The Applicant attributes need for the proposed service at the University Campus to the following:

1. Need to accommodate existing ED and CT scan volume
2. Growth in the Patient Panel and in UMMMC's patient population.

1. **Need to Accommodate Existing ED and CT Scan Volume**

The Applicant states that the University Campus serves over 100,000 patients in its ED annually and with its dual designation as a Level 1 trauma and a stroke center, the ED must balance competing needs for emergent access to CT to ensure timely access to CT imaging for all patients who need it. Clinical guidelines for stroke recommend that patients receive CT imaging within 25 minutes of arrival at the ED.[9] The state's EMS protocols automatically send trauma and stroke patients to the University Campus' ED.

9 https://www.mass.gov/doc/pss-time-target-recommendations-0/download; Get With the Guidelines – Stroke Fact Sheet. https://www.heart.org/-/media/files/professional/quality-improvement/get-with-the-guidelines/get-with-the-guidelines-stroke/strokefact-sheet_-final_ucm_501842.pdf?la=en&hash=7FA33C71D753DF7AB1D4850451C95BBE25BEA622

CT is highly utilized for emergency patients because of its ability to rapidly provide reliable imaging data for many conditions. Among the top reasons for CT imaging at the ED are head injury, sepsis, abdominal pain, neurological conditions such as stroke, syncope and collapse, headache, dizziness and giddiness, and altered mental state, as well as cardiac conditions including chest pain. The Applicant asserts that with adequate CT capacity, the ED can reduce ED length of stay and decrease avoidable admissions caused by the deterioration of a patient's condition while waiting for diagnosis and treatment in the ED.

Insufficient CT capacity can hamper the University Campus' ability to efficiently operate the ED by creating backlogs in ED patient flow. Patients who occupy ED bays while waiting for CT imaging experience delays in their treatment and discharge from the ED. Also other ED patients who await an available bay experience delays in diagnosis and treatment. For example, the University Campus performs CT angiography[10] (CTA) on ED patients to expedite diagnosis and treatment of coronary disease, often reducing the need for cardiac catheterization or admission. However, since the CTA scans take longer, they can cause delays in CT access for other ED patients or necessitate the transport of those requiring CTs to the radiology department.

The Applicant notes that the capacity for a CT unit is 17,520 (based on an average 30 minute scan time operating 24/7, 365 days per year).[11] As shown in Table 5, the University Campus had a total of 37,648 emergency scans ordered by an ED physician in FY21. A total of 30,728 scan were performed by the one dedicated ED CT machine and nearly 7,000 emergency patients required transport to the radiology department.

Over the past three years, more than 60% of CT scans have been emergent scans and the sole CT unit in ED cannot meet the demand. In addition, while emergent CT volume experienced an increase of 2.7% between FY19 and FY21 the non-emergent CT demand has increased 17.0% from FY19 to FY21.[12] Thus, in addition to the delays of transporting ED patients to radiology for a scan, scheduled scans have experienced growth in demand which is expected to continue (see discussion of population growth below).

Table 5: Historical University Hospital CT Volume

Scans	FY19	FY20	FY21
CT's Ordered by ED Physicians	36,628	37,172	37,648
Total CT Service Volume	54,020	55,246	58,002
% of Total CT Volume for ED Use	67.8%	62.3%	64.9%

[10] Scheduled outpatient CTA's are performed using the other CTs

[11] The current hours of operation of the University CT are the following: Inpatient CT Machine: 24/7; ED CT Machine: 24/7; OP CT Machine: 7am to 7pm M-F; 8am to 3pm S-S.

[12] This volume represents over three scans per hour, including room turnover.

Another effect of the limited CT capacity is that overutilization of the CT unit can lead to more frequent and unplanned repairs. When this occurs, emergency patients are transported out of the ED to the radiology department, causing delays that can adversely impact the patient experience and care delivery. Consequently, other patients[13] who have scheduled CT scans are also delayed or rescheduled which can cause a negative experience, discomfort, and deferred care.

The Applicant found that wait-times associated with increased volume that have has been growing, thereby affecting all emergency patients, regardless of acuity, and leading to delays in diagnosis and treatment. The average time from the physician order to beginning to scan ("order to begin time") has increased 41% from FY 19 - FY 21 from 114 to 161 minutes over the three years.

- in FY19 it was 114 minutes,
- in FY20 it was 121 minutes, and
- in FY21 it was 161 minutes. (2 hours and 41 minutes)

To resolve the adverse impacts of the high CT utilization, the University Campus determined that adding a second CT unit in the ED would have the greatest benefit for all patients. This would address the continued increase in CT scan demand, the increasing wait times, and the backlog in the ED, thereby improving overall ED patient flow and reducing the number of patients who are transported out of the ED area to the main radiology department for their CT scans.

2. **Growth in the Patient Panel and the UMMMC Hospital's Patient Population**

From FY19 to FY21, number of patients served by both the Applicant and UMMMC increased by about 6%. This is in part attributable to the population growth experienced in Central Massachusetts. The UMass Donohue Institute projects that the population of Central Massachusetts will grow by 2.3% between 2020 and 2025 and another 2.0% between 2025 and 2030.

The Applicant anticipates long-term population growth in central Massachusetts to continue to place demands on the University Campus' overall and CT capacity. Sg2, a proprietary market demand tool used by the Applicant,[14] projects overall outpatient CT growth in the Medical Center's service area of about 1.2% per year over the next 5 to 10 years. The Applicant states it bases need for the ED CT unit on the current emergent excess demand for CT in the ED which, as described above, well exceeds current capacity.

In Summary, the Applicant asserts that with the existing units operating above capacity, the University Campus requires an additional CT to provide redundancy in its ED and ensure timely access for stroke and trauma patients and reduce wait times for all ED patients. This access will

[13] Both inpatients and outpatients on the schedule

[14] Commonly used by many Applicants.

improve care delivery for all ED patients and allow the University Campus to avoid unnecessary disruption for scheduled out- and inpatients requiring CT. Overall access to diagnosis and treatment and health outcomes will be improved by adding a unit in the ED. Without an additional unit, the University Campus will not be able to meet future projected CT demand.

Analysis

Staff has reviewed the Applicant's explanations for the need for an additional CT for the ED. The University Campus' designation as a Stroke center and Level I trauma center for both Adults and Pediatric patients underscores the necessity for one additional CT dedicated to ED patients. Based on its current volume, the second unit is justified as it would be utilized at capacity within the first year.[15] Staff notes that the existing units have been operating over capacity. Of the emergency scans conducted in FY21, 6,920 (18.4%) required transporting the patient to one of the other Hospital Units; the majority being performed on the inpatient unit to reduce the downstream impact of having to reschedule outpatients. Additionally, historic wait times have increased 41% over three years, which has potential adverse impact on patients who require emergent scans. Moreover, overuse of the existing unit leads to more downtime and repairs, resulting in backlogs, further exacerbating an already problematic shortage of capacity, and potentially shortening the lifespan of the existing unit. Upon review of the Applicant's historical volume and using that as the basis for the need for a second dedicated CT in the ED, Staff finds that the Applicant has made a credible argument for the need for an additional CT, and has met the standards of Factor 1(a).

Factor 1: b) Public Health Value, Improved Quality of Life and Health Outcomes, Assurances of Health Equity

The Applicant asserts that the Proposed Project aims to improve health outcomes and quality of life through the provision of timely CT imaging, which will reduce length of stay in the ED and lead to earlier diagnosis and treatment, thereby improving quality of life. To demonstrate improved public health value and quality of life, the Applicant provided a brief description of well documented clinical utility of CT technology overall, and why it is the preferred imaging modality in the ED as summarized below.

CT is a form of x-ray that creates a series images in "slices" from which detailed 3D internal images[i] of soft tissue and blood vessels, internal organs, and bone are developed.[ii] The 3-dimensional image can be rotated and the slices viewed in succession in order to precisely pinpoint the location of an abnormality.[iii] CT is used to diagnose such abnormalities as cancerous tumors or the type of stroke a patient is experiencing.[iv] The level of detail provided in a CT image and the speed at which the scan can be completed, has made CT integral to both in- and outpatient care.[9]

Since CT imaging is an important diagnostic tool because of its speed, accuracy,[v] and high diagnostic confidence within a short period of time,[11] it is the ED's preferred diagnostic

[15] Current volume 37,648/Unit capacity 17520=2.15 CT units needed

modality. Because of CTs ability to expedite intervention and treatment, it is the essential imaging modality for diagnosing trauma and stroke in the ED. Additionally, to detect blockages in the coronary arteries, a coronary CTA can be performed much faster than a cardiac catheterization, potentially with less risk and discomfort, and may require less recovery time.[vi] Since CT imaging can improve patient outcomes,[vii] the Applicant asserts that in order to ensure timely diagnosis, treatment and improved public health outcomes, the University Campus, as a Level I trauma center, needs to have adequate CT capacity in the ED setting by adding an additional CT unit.

To assess the impact of the proposed Project, the Applicant developed quality metrics and a reporting schematic, as well as metric projections for quality indicators that will measure patient satisfaction and quality of care. The measures are presented in Appendix I and will be reported to DPH on an annual basis following implementation of the Proposed Project.

Public Health Value /Health Equity-Focused:

The Applicant states that the ED frequently serves as the entry point to health care in the US. Utilization of the ED for primary care services is often higher among Limited English Proficiency (LEP) and non-English speakers as well as publicly insured patients. As a result, providing improved, timely access to CT in the ED will improve health outcomes as well as the patient experience for underserved patient populations within the Applicant's Patient Panel and the community at large. Therefore, the Applicant anticipates that the Proposed Project will result in improved patient care experiences and quality outcomes while promoting health equity.

A large part of a patient's experience is influenced by the ability to communicate with and understand their providers. Currently UMMMC provides qualified medical interpreters, 24 hours a day, seven days a week, to patients and families free of charge in person, over the phone or via remote video interpretation to ensure support for over 100 languages spoken by its patient population. For patients who are deaf or hard of hearing, UMMMC ensures the availability of ASL interpreters 24/7 for all services. Video Remote Interpreter (VRI) Solution, which consists of a mobile device (e.g., iPad) secured to a cart with a speaker is used to enable LEP patient and family users to connect to readily available, qualified medical interpreters enabling language access. The VRI Solution offers 34 video language interpreters on demand, and 250 telephonic-only relay interpreters. VRI is available across the ED, ambulatory clinics, inpatient areas, as well as patient service areas, radiology, and procedure areas. In addition to on-site capabilities, the Interpreter Services can help respond to calls from patients for both medical and nonmedical issues (e.g., medication refills, urgent visits, billing, financial services, appointment scheduling, etc.). The Applicant asserts this existing comprehensive language access will contribute to the ability of the Proposed Project to improve health outcomes and patient experience through access to timely CT.

The Applicant has demonstrated its ongoing commitment to actively addressing the social determinants of health as part of its mission of improving health and promoting comprehensive

patient education. UMMHC and its hospitals demonstrate their commitment to further health and social equity through many initiatives including those outlined below.

The Applicant's hospitals have a track record of treating all patients, regardless of ability to pay and they are experienced in providing access and high-quality care to vulnerable populations. The Applicant asserts that, through the Proposed Project, it will continue to support at risk members of the community. As previously discussed under *Applicant Background and Application Overview*, the Applicant's hospitals are consistently on CHIAs' list of high public paying hospitals. UMMMC public payments account for over 66.5% of its payer mix, which includes a Medicaid payor rate of ~25%. It is also a disproportionate share hospital and part of the health care safety net for the most vulnerable populations in the state.

As part of its commitment to health equity, UMMHC has been an early participant in the Healthcare Anchor Network of the Democracy Collaborative, in which it looks at the socio-economic determinants of health and incorporates these into patients' medical records to gain greater understanding of the needs of its patients and its approaches to health care delivery. UMMHC believes that it can work toward improvements in the socio-economic factors of the community through its "Purchasing Pillar, Investment Pillar, and Hiring Pillar" committees that are addressing the needs of its communities in creative ways, by emphasizing local purchasing, investing, and hiring.

UMMHC is in the process of implementing a PCP Fast Track program to facilitate expedited CT scanning outside of the ED. This program seeks to reduce ED utilization while also ensuring patients receive medically appropriate CT imaging. The program will afford patients with same day access to CT to ensure they receive the imaging studies they need to assist with accurate and timely diagnosis and treatment.

Analysis

The Applicant anticipates that the addition of one CT at the University Hospital site will provide its patients with easier access to high quality CT services, which will improve health outcomes and quality of life. Research indicates that delayed access to quality health care negatively affects patient satisfaction as well as health outcomes due to delays in diagnosis and treatment. Accordingly, staff finds that through the Proposed Project, the Applicant is likely to improve access to timely, effective, high-quality imaging services, and thereby enhance patient satisfaction, health outcomes and quality of life for all ED patients in the region.

Staff finds that the Applicant has described a case for improved health outcomes and has provided reasonable assurances of health equity through its LEP program and through its longstanding designation as a HPP Hospital and its desire to serve more patients by reducing wait times for that population. Staff notes that through standard conditions related to language access, the Applicant meets the requirements of the Department's Health Equity Program.

As a result of the above analysis, Staff finds that the Applicant has met the provisions Factor 1(b).

Factor 1: c) Efficiency, Continuity of Care, Coordination of Care

Efficiency and Coordination of Care

The Applicant described programs it has in place to facilitate care coordination that includes having developed a significant infrastructure to support a patient-centric approach to care. Coordination across the continuum of care is the key to successfully impacting the health of patients. To that end, all UMMHC hospitals and campuses utilize an electronic health record (EHR) which enables continuity and coordination of care through shared documentation and shared learning and protocols, which ensures efficiencies, economies of scale, and consistency. Additionally, UMMHC has developed and implemented clinical pathways, collaborative initiatives, and coordinated care which it calls the longitudinal care approach. The Applicant recognizes that to significantly impact the quality, utilization, and patient experience, it must view population health beyond the spectrum of the of UMMHC continuum of care, to include the entirety of the community reaching across the post-acute care settings. Consequently, UMMHC's infrastructure is well-positioned to support care coordination between UMMMC's ED and the entirely of a patient's care team.

Community-Based Care Linkages

The Applicant states it understands that health care alone cannot conquer chronic disease and poor health, and therefore states UMMHC has developed many tools to address its patients' needs. Its commitment to ensuring that care extends beyond its campuses and providers is exemplified in longstanding relationships it has cultivated with community-based organizations (CBOs) that provide excellent resources for its patients that has culminated in the development of a web-based platform (search engine). Called CommunityHELP,[16] the platform provides caregivers, individuals, care managers, and health care teams with resources across the entire spectrum of needs and it enables electronic referrals to the CBOs and can provide immediate translation into over 100 languages. With respect to the Proposed Project, ED case managers and social workers are embedded within the ED to meet with patients and families and connect them with the appropriate services using the aforementioned resources.

Locally, food insecurity, access to dental care, and housing have emerged as consistent stressors. By enhancing CBO collaboration and directly targeting areas such as food pharmacies, free clinics for the population threatened by housing issues, and identifying free dental care are a few examples of how UMMHC has responded to community needs.

Analysis

Staff concurs that with increased CT capacity in the ED, the provision of CT services is more efficient, and delays in diagnosis and initiating treatment can be reduced. We note that as a

16 https://www.communityhelp.net/

level 1 trauma center, it is essential to have adequate capacity to attend to patients who have experienced such events as accidents, and strokes that require timely and efficient access to CT services while not delaying care to in- and out- patients who have scheduled scans.

Integration of care through electronic health records (EHR) systems provide primary care and specialty clinicians across a health system timely access to clinical test results, including imaging. Integration of these tools along with the ED embedded social workers and the CBO's through CommunityHELP can improve efficiency of care delivery for the neediest patients within the population served while ensuring that patients benefit from care coordination, better outcomes, and improved quality of life.

To assess the impact of the Proposed Project, the Applicant has provided evaluation measures, including average time for ED patients requiring CT from order placement to begin time and quality of care, which may indicate improved outcomes. Staff reviewed the suggested measures that will become part of the annual reporting to DPH. The measures are described in Appendix 1 below.

Staff finds that through these initiatives that directly impact patients in the ED, the Applicant has met Factor 1(c).

Factor 1: d) Consultation

The Applicant has provided evidence of consultation, with all government agencies that have licensure, certification, or other regulatory oversight, which has been done and will not be addressed further in this report.

Factor 1: e) Evidence of Sound Community Engagement

The Department's Guideline for community engagement defines "community" as the Patient Panel and requires that, at minimum; the Applicant must "consult" with groups representative of the Applicant's Patient Panel. Regulations state that efforts in such consultation should consist of engaging community coalitions statistically representative of the Patient Panel. The Applicant community and Patient Panel focus broadly across neighborhood and community stakeholders of the proposed catchment areas.

To involve patients and families more fully in the Proposed Project, the Applicant engaged the community presenting to Proposed Project and soliciting feedback. First, the Proposed Project was presented to UMMMC's Community Benefits Advisory Committee (CBAC) on December 7, 2021, with seven (7) individuals in attendance, including four (4) members of the community and three (3) representatives from UMMMC. Hospital representatives spoke about the need for the Proposed Project and how it will positively impact the University Hospital's patients.

Analysis

Staff finds that through these initiatives that directly impact patients in the ED, the Applicant has met Factor 1(e).

Factor 1: f) Competition

The Proposed Project will compete on the basis of price, total medical expenses, provider costs, and other recognized measures of health care spending because it will enable the University Campus to provide more timely access to emergency CT imaging, in turn improving health outcomes, reducing ED backlogs and maximizing overall hospital efficiency. As the only Level 1 Trauma Center in Central Massachusetts, the ED must have sufficient capacity to provide urgent and immediate diagnosis and treatment. Through the Proposed Project, the Applicant seeks to ensure timely access to an emergency service without negatively impacting overall health care costs.

First, the Applicant stresses that it is imperative for Level I trauma centers to be equipped with the appropriate diagnostic tools to diagnose and treat their community in a timely manner, when treatment is the most likely to be successful. Delayed diagnosis and treatment lead to longer lengths of stay, and poor patient experience. Improving access to CT imaging in the ED will reduce ED overcrowding and improve hospital throughput which is necessary for reducing overall hospital costs.

The colocation of imaging in the emergency departments is key to workflow efficiency. By adding a second unit, the University Campus will further maximize costs through operational efficiencies. The additional unit will be reimbursed at the same rate as the existing CT units so there will be no increase in TME to insurers or patients who receive imaging through the Proposed Project.

Analysis

Staff concurs with the Applicant assertions regarding the cost containment impact of improved emergency access to CT through the proposed project. Specifically, reduced wait times can maximize hospital workflow, improve efficiencies, and reduce lengths of stay, thereby contributing to containment of health care costs through timely diagnosis and care. Staff further notes that the UMMMC's costs have historically been lower than most in its peer group of six Academic Medical Centers with a Statewide Relative Price of 1.09 (range: 1.07-1.43).[17] As a result, the Proposed Project will not negatively impact overall health care costs.

As a result of information provided by the Applicant and additional analysis, staff finds that the Applicant has demonstrated that the Proposed Project has met Factor 1(f).

[17] Center for Health Information and Analysis, FY 19 pages A1-A6 https://www.chiamass.gov/assets/docs/r/hospital-profiles/2019/FY19-Massachusetts-Hospital-Profiles-Compendium.pdf

Factor 2: Health Priorities

For Factor 2 the Applicant must demonstrate that the Proposed Project will meaningfully contribute to the Commonwealth's goals for cost containment, improved public health outcomes, and delivery system transformation beyond the Patient Panel.

Cost Containment:

The Applicant asserts the Proposed Project will meaningfully contribute to, and further the Commonwealth's goals for, cost containment. Expected benefits are timely and equitable access to high-quality imaging services, reduced wait-times for CT leading to earlier diagnosis and treatment which in turn can save costs through gained efficiencies, and reduced length of stay in the ED. As a result, the Proposed Project will meaningfully contribute to the Commonwealth's goals of cost containment by having a neutral impact on overall TME.

Public Health Outcomes

The Applicant anticipates the Proposed Project will improve public health outcomes by ensuring timely emergency access to CT imaging. As noted above, UMMMC operates the second largest ED in the Commonwealth, is the only Level 1 Trauma Center in Central Massachusetts and is designated by DPH as a Primary Stroke Service. Given the importance of early intervention, CT imaging for trauma, stroke, cardiac and other emergency patients, the University Campus must have adequate capacity to provide timely CT imaging through its ED. In addition to reducing poor health outcomes due to delayed diagnosis and intervention for those requiring CT, the Applicant anticipates that the Proposed Project will further improve health outcomes for all ED patients by reducing wait times.

Delivery System Transformation

The Applicant notes that generally SDOH screening occurs in the primary care setting and referrals to appropriate community resources are provided. As described in Factor 1(e), case managers embedded within the emergency department to perform a screening and referrals to community services. The Applicant continues to work with patients and primary care providers to ensure patients are connected to services as needed.

ANALYSIS

Throughout the Application the Applicant has emphasized the burden the lack of adequate CT resources has on the patients and on the ED. These issues stem from long wait times, the need to transport patients to the radiology department or at times reschedule patients. Having sufficient capacity for a Level I trauma center at an Academic Medical Center to treat high acuity patients with the most appropriate resources is paramount to their ability to provide the most effective, timely care and to continue to compete at the AMC level.

Staff concurs with the Applicants assertion that it is imperative that as the only Level I trauma center in central Massachusetts, it must have sufficient capacity to initiate diagnosis and treatment in an expeditious manner. Additionally, as the second largest ED in Massachusetts,

the Applicant only operates one (1) CT in the ED at its University campus which means that there is no proximate back-up in the event of a large traumatic regional event.

Ultimately, cost savings are achieved through efficient, timely access to those in the ED needing immediate exams for traumatic events.[18] Staff affirms that it is unlikely that the proposed project will raise costs to the health care system when balanced against increased costs associated with potential delayed treatments for trauma patients and backlogs for other less emergent cases in the ED. As noted in Factor 1, all of UMMC's hospitals are HPP hospitals such that any increased costs associated with delays in treatment are transferred to the public.

As a result of information provided by the Applicant and additional analysis, staff finds that the Applicant has demonstrated that the Proposed Project has met Factor 2.

Factor 3: Relevant Licensure/Oversight Compliance

The Applicant has provided evidence of compliance and good standing with federal, state, and local laws and regulations and will not be addressed further in this report.

Factor 4: Demonstration of Sufficient Funds as Supported by an Independent CPA Analysis

Under factor 4, the Applicant must demonstrate that it has sufficient funds available for capital and operating costs necessary to support the Proposed Project without negative effects or consequences to the existing patient panel. Documentation sufficient to make such finding must be supported by an analysis by an independent CPA.

The CPA report is an analysis of the Applicant's six-year projections and the following supporting documentation:

1. The Applicant's Financial Model for the FY 2022, through FY 2027.
2. Finance Committee proposed FY 2022 the budget presentation, September 21, 2021.
3. Draft DoN Application Form.
4. Audited Financial Statements: UMass Memorial Healthcare, Inc.: FY 2021, 2020, and 2019.
5. IBIS World and Definitive Healthcare data.

The Projections consider the impact of volume on both projected revenue (i.e., patient days, discharges, cases/procedures, WRVUs, etc.) and operating expenses (i.e., the number of case/procedures, FTEs, etc.) for the projected period (FY 2022 through FY 2027).[19]

[18] Such as stroke, MVAs, and head trauma

[19] The CPA was informed that historically the impact of inflation has been similar for both operating revenue and operating expenses, and that Management discussed this simplifying assumption with staff members from the Massachusetts Department of Public Health prior to preparing the Projections.

The CPA evaluated key metrics, reflecting profitability, liquidity, and solvency which compare the forecasted operating results of the performance of UMMH after the affiliation to market information from IBISWorld and Definitive Healthcare to assess the reasonableness of the Projections.

Revenue includes Net Patient Service Revenue (NPSR) which comprises 90.1% of the cumulative total net revenue from FY 2022[20] through FY 2027. Following a projected 10.6% increase in total NPSR in FY 2022 over FY 2021, no revenue growth is projected. NPSR growth in FY 2022 is due to Management's expectation that operations will return to normal following the COVID-19 pandemic, and to several new initiatives, such as shifting to appropriate site of care according to acuity levels,[21] and telemedicine, that UMMH is implementing. Growth before COVID-19 was between 2.0 to 5.9 percent in FY 2018 and FY 2019, respectively while it increased to 7.9 and 11.1% growth in FYs 2020 and 2021, respectively, which the Applicant attributes to high acuity. As a result, it is the CPA's opinion that the revenue projections are a reasonable estimation of future revenue of UMMH.

Operating expenses include salaries and wages, employee benefits, professional fees, purchased services, pharmacy, medical supplies, non-medical supplies, utilities, insurance, rental leases, other direct expenses, system allocation expenses, depreciation, amortization, and interest expenses. The Projections estimated total expenses will grow 6.6% in FY 2022 compared to the 9.4 percent in FY 2021 with the main drivers being increased pressures on labor expenses due to labor shortages, and supplies due to inflation, supply constraints, similar to but not as high as in 2021. Excepting interest expense,[22] and similar to revenues, operating expenses are expected to remain constant, at 0.0% growth for FY 2023 through FY 2027. As a result, it is the CPA's opinion that the projected operating expenses reflect reasonable estimation of the Applicant's future expenses. The projected total expense as a percentage of total revenue range is consistent with the historical performance.

The expenditures related to the Proposed Project (representing ~0.3% of total) will be funded with cash reserves while allowing for a consistent level of the total cash balance throughout the projection period, according to the Applicant's model. As a result, the CPA concludes that there appears to be sufficient internal resources to finance the Proposed Project without debt financing.

The CPA concludes that following its review of the relevant documents and analysis of the projections, it determined that the anticipated operating EBITDA surplus of ~ 5.2% of cumulative projected revenue is a reasonable expectation that is based upon feasible financial assumptions. It determined that the Projections are reasonable and feasible, and not likely to have a negative impact on the Applicant's patient panel or result in a liquidation of the Applicant's assets.

Analysis

[20] FY 2021 financials include three months of Harrington Hospital's performance; FY 2022 represents a full year.
[21] Including ambulatory, acute, and tertiary
[22] projected based on UMMH's projected level of debt and current terms.

As a result of information provided by the Applicant and additional analysis, staff finds that the Applicant has demonstrated that the Proposed Project has met Factor 4.

Factor 5: Assessment of the Proposed Project's Relative Merit

The Applicant considered and rejected one alternative to the Proposed Project which was to not acquire a CT unit and to continue to serve patients through the existing units on campus. This alternative does not address the need of UMMMC's patient population to have timely access to CT imaging in the ED. This option would further exacerbate wait times for emergency patients, in turn delaying diagnosis and treatment. These consequences will negatively impact health outcomes as well as patient experience. The University Campus' resources will continue to be strained under this alternative, further contributing to diversions and overcrowding. There would be no capital expenses under this alternative. The Applicant asserts operating expenses will increase over time under this alternative attributable to ED diversions, ED overcrowding and backlogs, and delayed diagnosis and treatment.

Analysis:

For all the reasons emphasized throughout this Application, staff agrees with the Applicant's assertions that the status quo will not resolve the stated challenges that have arisen as a result of insufficient capacity. The Proposed Project will improve quality and access and likely reduce costs by alleviating backlogs thereby improving efficiencies and throughput while facilitating earlier diagnoses. We know that delays in treatment in the ED can lead to increased costs and unnecessary admissions and adverse outcomes. [viii] Staff finds this to be a credible argument based on the clinical need to scan stroke and trauma patients in a timely manner in order begin appropriate treatment in a timely manner.

As a result of information provided by the Applicant and additional analysis, staff finds that the Applicant has demonstrated that the Proposed Project has met Factor 5.

Factor 6: Fulfillment of DPH Community-based Health Initiatives

Summary and relevant background and context for this application: This is a Proposed Project for DoN required equipment project that is a Tier 1 CHI. Standard practice is to contribute the full CHI obligation to the statewide fund for DoN-regulated equipment. In this case, the Applicant anticipates submitting a Tier 3 project application in the coming months and requests that the CHI contributions across the two projects, if approved, be combined; subject to DoN project approval of both projects, DPH has agreed to this process to enable local a transparent CHI investment process.

In anticipation of this agreement, to fulfill Factor 6 requirements for this project, the Applicant submitted its existing Community Health Needs Assessment (CHNA), a Self-Assessment, Stakeholder Assessments, and a CHI Narrative.

The Community Health Needs Assessment was conducted in 2021 by the Applicant, UMass Memorial Health in partnership with the Central Massachusetts Regional Public Health Alliance. The final Community Health Assessment utilized analysis of both secondary and primary data gathered through stakeholder interviews, focus groups, and a community survey. The Assessment identifies priority populations and describes key findings and themes from the service area and participating communities. The priority populations are People of Color, Immigrants, refugees, and non-English speakers, Youth and adolescents, Individuals with disabilities and chronic/complex conditions, Individuals and families with limited economic means, and Older adults. The priority areas are Social Determinants of Health, mental health, substance use, and Chronic/complex conditions and risk factors; Racism, discrimination, and health equity are identified as a cross-cutting issue.

The Applicant's Self-Assessment provided a summary of the community engagement processes and socio-demographic information, data and highlights related to topics and themes of community needs. Through data analysis, existing surveys, and primary data collection and community engagement, the participating community groups and residents identified the key concerns outlined in the 2021 Community Health Assessment.

The Stakeholder Assessments submitted provided information on the individuals' engagement levels (e.g. their personal participation and role) and their analysis of how the Applicant engaged the community in community health improvement planning processes. The information provided in these forms were largely consistent with the self-assessment conducted by the Applicant.

The CHI Narrative provided background and overview information for the CHI processes. The narrative also outlines duties for the advisory and allocation committees, planned use of funding for evaluation and administrative activities, and the CHI funds breakdown and the CHI activities anticipated timeline.

The timeline, RFP processes, and use of evaluation and administrative funds are all appropriate and in line with CHI planning guidelines, staff notes. In order to select strategies that meet Health Priority Guideline principles, the Applicant will need to focus on the priority areas in the assessment that allow for implementation at the root cause level including the Social Determinants of Health and the cross cutting area of Racism, Discrimination, and Health Equity. Based on strategies in the Applicant's ongoing community benefit work, staff have determined the if Applicant agrees to address community conditions and root causes while engaging in ongoing work with the DoN Advisory Committee, CHI investment will align appropriately with the Health Priorities Guideline. The Applicant has recruited for the missing constituencies on their Advisory Committee, and DPH will continue to work with them to ensure the group's make up is sufficient to ensure their decision-making is in line with CHI and Health Priority principles. The Applicant will also need additional touchpoints with DPH staff to establish processes for planning and implementation work. Specifically, if this and the upcoming projects are approved, DPH will work with the Applicant on the timeline, investment strategy, and project planning. For implementation of specific CHI strategies, DPH can work with the

Applicant in moving upstream, and identifying needs at the root cause to support sustainable systems level solutions.

The anticipated timeline for CHI activities includes a meeting of the Advisory Committee six weeks post approval, identifying the Health Priorities Strategies 3 months post approval, and releasing an RFP six months post approval, with funding awarded to successful RFP applicants 3-4 months thereafter.

With the administrative funds, the applicant's early plans are to support participation in planning processes and to develop and disseminate communication materials.

Summary Analysis: As a result of information provided by the Applicant and additional analysis, staff finds that with the ongoing communication on items outlined above, and the conditions outlined below, the Applicant will have demonstrated that the Proposed Project has met Factor 6.

Findings and Recommendations

As outlined in the Project description and patient population need discussion, the Proposed Project will improve existing CT services by ensuring that ED patients in central Massachusetts, including vulnerable patients in need of CT have timely access to essential proven imaging services from a historically lower cost AMC provider of equal quality services to AMC peer group. To determine need for the Proposed Project, the Applicant looked at historical usage data, capacity, and patient wait times, which confirm the need for the CT.

Based upon a review of the materials submitted, Staff finds that, with the addition of the recommended conditions detailed below, the Applicant has met each DoN Factor for the Proposed Project and recommends that the Department approve this Determination of Need, subject to all applicable standard and Other Conditions.

Conditions to the DoN

1. Of the total required CHI contribution of $191,643.10
   a. $18,397.74 will be directed to the CHI Statewide Initiative
   b. $165,579.64 will be dedicated to local approaches to the DoN Health Priorities
   c. $7,665.72 will be designated as the administrative fee.

2. To comply with the Holder's obligation to contribute to the Statewide CHI Initiative, the Holder must submit a check for $18,397.74 to Health Resources in Action (the fiscal agent for the CHI Statewide Initiative).
   a. The Holder must submit the funds to HRiA within 30 days from the date of the Notice of Approval.
   b. The Holder must promptly notify DPH (CHI contact staff) when the payment has been made.

Appendix I

1. **Patient Experience/Satisfaction:** Patients who are satisfied with care are more likely to seek additional treatment when necessary.
   a. *Measure*: Likelihood to recommend as demonstrated by selection of "Always" on the Press Ganey satisfaction survey.
   b. *Projections*: Baseline: 38.51%; Year 1: 39%; Year 2: 40%; Year 3: 40%

2. **Wait Times**: The Proposed Project seeks to ensure timely access to CT services. Accordingly, UMMMC will track the average time from order placement to begin time for ED patients requiring CT.
   a. *Measure*: Average time interval from when the CT service was ordered to when the scan began.
   b. *Projections*: Baseline: 161 minutes; Year 1: 104 minutes; Year 2: 80 minutes; Year 3: 60 minutes

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i https://www.medicalnewstoday.com/articles/153201#uses

ii https://www.nibib.nih.gov/science-education/science-topics/computed-tomography-ct

iii https://www.nibib.nih.gov/science-education/science-topics/computed-tomography-ct

iv https://www.medicalnewstoday.com/articles/153201#uses ; https://www.envrad.com/how-ct-scans-mris-used-to-diagnose-strokes/ [9] https://pubmed.ncbi.nlm.nih.gov/20924012/

v Diagnostic imaging trends in the emergency department: an extensive single-center experience. Gunnar Juliusson , Birna Thorvaldsdottir, Jon Magnus Kristjansson and Petur Hannesson. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6669846/ [11] Pandharipande PV, Reisner AT, Binder WD, et al. CT in the Emergency Department: a real-time study of changes in physician decision making. Radiology 2016;278:812–821. https://pubmed.ncbi.nlm.nih.gov/26402399/

vi https://my.clevelandclinic.org/health/diagnostics/16899-coronary-computed-tomography-angiogram

vii Evaluation of Early Abdominopelvic Computed Tomography in Patients With Acute Abdominal Pain of Unknown Cause: Prospective Randomized Study; https://jamanetwork.com/journals/jama/fullarticle/1697967

viii Gabor D. Kelen, MD, Richard Wolfe, MD, Gail D'Onofrio, MD, MS, Angela M. Mills, MD, Deborah Diercks, MD, Susan A. Stern, MD, Michael C. Wadman, MD, Peter E. Sokolove, MD, Emergency Department Crowding: The Canary in the Health Care System Downloaded from catalyst.nejm.org on March 18, 2022.