BOSTON PUBLIC HEALTH COMMISSION

The Boston Health Equity Measure Set Report

February 12, 2024

This report outlines the findings of the Boston Health Equity Measure Set (BHEMS), a centralized data analysis approach to collect and analyze city-wide electronic health data from Boston-area hospitals and community centers to investigate progress towards health equity across the city.

Background

The Boston Public Health Commission (BPHC) faces challenges in accessing community-level data essential for the design and implementation of programs to improve the health of Boston residents, and particularly those residents historically marginalized by structural racism and systems of oppression that have had negative health impacts. Under the HIPAA Privacy Rule, 45 CFR 164.512(b), BPHC is authorized to receive protected health information to execute their public health mission. To augment existing population data and surveys, in 2006, BPHC launched the Disparities Project which led to the enactment of the Data

Collection.[1] The Regulation required acute care hospitals and community health centers (CHCs) in Boston to collect demographic data on all inpatient, outpatient observation, and emergency department visits during the registration process. Further, the Regulation required the hospitals to share this data through a program known as the Boston Health Equity Measure Set (BHEMS) with BPHC. While the hospitals were mandated to share data, this was optional for the CHCs. In 2020, the guidelines for the implementation, interpretation, and enforcement of BPHC's data collection regulation.[2]

The purpose of BHEMS was to:

- Enable BPHC to identify health inequities and report in real-time on health status of residents
- Promote partnership with hospitals/CHCs and promote and/or implement interventions to reduce these health inequities and improve health across a number of domains
- Improve BPHC and partners' ability to respond to community needs and demands
- Improve precision of interventions

Throughout the 17 years since BHEMS was launched, BPHC worked closely with hospital and CHC partners (see appendix) to address the numerous challenges that arose in attempting to assemble the relevant patient health information. Some highlights of this journey included:

- Formation of an Advisory Council and Equity and Technical Committees
- Development of 19 Health Equity Measures based on HEDIS measures (2016-2018)
- Contracting with HealthEC as a third-party data partner for submission of data (2017)
- Data Sharing Agreements signed with participating institutions
- Data collection on 3 Health Equity Measures (2020-2023) BHEMS Model – a Centralized Health Equity Measures Database

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[1] https://www.boston.gov/sites/default/files/file/2021/03/Data_Collection_Regulation.pdf

[2] https://www.boston.gov/sites/default/files/file/2021/03/RevisedImplementationGuidelinesForTheDataCollectionRegulation.pdf

BHEMS was designed to create a centralized database of agreed upon health equity measures that would be updated on a monthly basis. Because of HIPAA and legal concerns, it was agreed that a third-party, HealthEC, would be contracted to collect, clean, collate, analyze, and pseudonymize the data (Figure 1).

Figure 1. Overview of the BHEMS original model
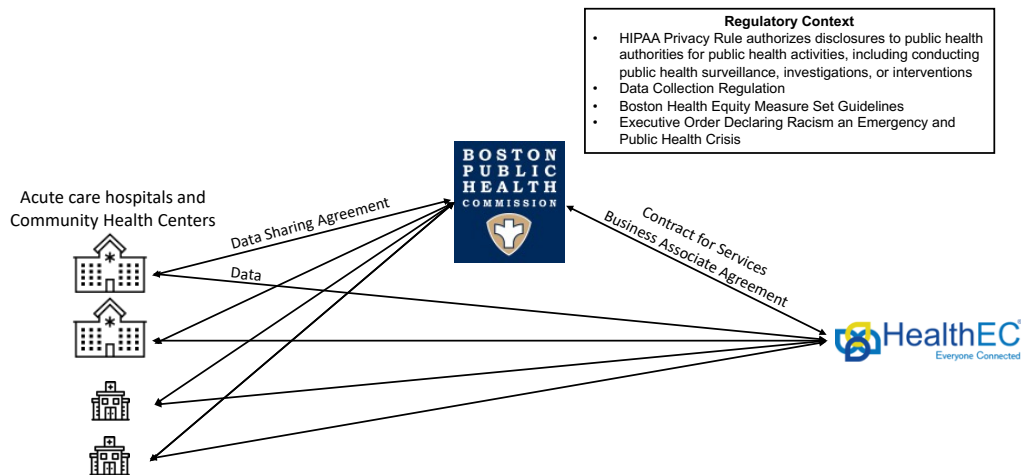
The three pilot measures reported here were a subset of the larger list of measures proposed in 2006 and the 19 measures more recently sought to fulfill the mission of BHEMS (see appendix). The criteria for patients eligible for the screening measures was specified by the BHEMS Equity Committee. The first three measures (see appendix for criterion) to be examined were:

- Breast Cancer Screening (BCS) – NQF #0031
- Childhood Immunization Status (CIS) – NQF #0038
- Depression Screening (DSF) – NQF #0418

HealthEC collected data for three health equity measures between 2021-2023 from five acute care hospitals and one community health center. HealthEC created pseudonymized data and prepared summary descriptive reports on behalf of BPHC. In total, 308,615 patient encounters were represented in the database (Table 1).

Table 1. Patient data submitted to the BHEMS database by hospital or CHC

Hospital / CHC	Patient Count	Male	Female	Other	Unknown
Beth Israel Deaconess Medical Center	111980	50110	61732	64	74
Boston Medical Center	71105	19496	51600		9
Boston Children's Hospital	5910	2524	3386		
Dana Farber Cancer Institute	2124		2124		
Geiger Gibson CHC	78	38	40		
Mass General Brigham Hospital	117418	38744	78673	1	

Results

Breast cancer screening

Women 51 - 74 years of age who were eligible for breast cancer screening served as the denominator for this measure (exclusion criteria are listed in the appendix). Of the 185,867 patients submitted for this measure, 5% were excluded. The distribution of eligible women by race/ethnicity were similar for 2021 and 2022 and was representative of the Black, White and Latinx population in Boston (Table 2). However, the Asian population was underrepresented.

Table 2. Patients eligible for breast cancer screening by race/ethnicity compared to Boston population

Race/ethnicity	Year	BHEMS Distribution	Boston Distribution
Asian	2021	4%	9.7%
	2022	4%	
Black	2021	26%	23.3%
	2022	26%	
Latinx	2021	16%	19.6%
	2022	18%	
White	2021	38%	43.6%
	2022	37%	
Unknown	2021	8%	-
	2022	7%	
Declined	2021	7%	-
	2022	7%	

In the BHEMS dataset, the percentage of eligible patients screened for breast cancer increased from 2021 to 2022 and was highest among Latinx women (58% and 64% respectively) and statistically significantly higher than White women (52% and 56%), (Table 3). Black (50% and 55%) and Asian (46% and 50%) women had significantly lower rates of screening compared to Latinx women, but not compared to White women.

Table 3. Percent of eligible patients screened for breast cancer by race/ethnicity.

	Year	Cases	Total	Exclusions	% Screened	Sig.	Sig.
Asian	2021	1357	2961	112	46%		*
	2022	1459	2896	94	50%		*
Black	2021	9490	19157	948	50%		*
	2022	9724	17626	839	55%		*
Latinx	2021	7147	12223	570	58%	*	ref.
	2022	7679	12081	520	64%	*	ref.
White	2021	14769	28285	1757	52%	ref.	*
	2022	34040	61087	2877	56%	ref.	*
Unknown	2021	2054	6182	276	33%		
	2022	1840	4562	218	40%		
Declined	2021	2644	5440	177	49%		
	2022	2600	4774	205	54%		

Depression screening

The criteria for patients eligible for depression screening as specified by the Equity Committee was defined as the percent of patients, 12 years of age and older, who were screened for clinical depression using a standardized instrument and, if screened positive, received follow-up care within 30 days of a positive depression screen finding.

Insufficient data was received for 2022 and 2023 and these years are not represented in this report. Of the 305,282 patients submitted for this measure, 8% were excluded (exclusion criteria are detailed in the appendix). The distribution of eligible women by race/ethnicity was representative of Black, White and Latinx residents in Boston (Table 4). However, the Boston Asian population was underrepresented.

Table 4. Distribution of patients eligible for depression screening and Boston population by race/ethnicity.

Race/ethnicity	Year	BHEMS Distribution	Boston Distribution
Asian	2021	5%	11.2%
Black	2021	22%	19.1%
Latinx	2021	18%	18.7%
White	2021	46%	44.6%
Unknown	2021	4%	-
Declined	2021	6%	-

For 2021, Black patients (25%) had the lowest rate of depression screening, and this rate was significantly lower than that reported for White patients (37%) (Table 5). Asian (41%) residents had the highest rates of screening, but this was not significantly different from White or Latinx (37%) patients.

Table 5. Percent of eligible patients screened for depression by race/ethnicity.

	Year	Cases	Total	Exclusions	% Screened	Sig.
Asian	2021	5392	13102	528	41%	
Black	2021	15876	62296	9094	25%	*
Latinx	2021	18806	50314	5148	37%	
White	2021	47786	128548	7978	37%	ref.
Unknown	2021	3252	10128	732	32%	
Declined	2021	7338	16980	434	43%	

Childhood Immunization Status

The criteria for patients achieving recommended immunization status was specified by the Equity Committee and defined as the percent of children 2 years of age who had: 4 Diphtheria, tetanus and acellular pertussis (DTaP); 3 Polio (IPV); 1 Measles, mumps and rubella (MMR); 3 Haemophilus influenza type B (HiB); 3 Hepatitis B (HepB), 1 Chicken pox (VZV); 4 Pneumococcal conjugate (PCV); 1 Hepatitis A (HepA); 2 Influenza (flu) and 2 or 3 Rotavirus (RV) vaccines by their second birthday.

In this small dataset, 2021 and 2022 immunization rates were statistically significantly higher than White (76% and 73%) children for Latinx (85% and 84%) and for Black (82% and 74%) children in 2021 but not 2022. There was no difference between White and Asian (73% and 76%) children.

Table 6. Percent of eligible patients vaccinated by race/ethnicity

	Year	Cases	Total	Exclusions	Screening %	Sig.
Asian	2021	64	88	0	73%	
	2022	45	59	0	76%	
Black	2021	511	622	2	82%	*
	2022	409	549	2	74%	
Latinx	2021	516	607	1	85%	*
	2022	397	474	1	84%	*
White	2021	440	579	1	76%	ref.
	2022	281	386	1	73%	ref.
Unknown	2021	115	149	0	77%	
	2022	99	154	1	64%	
Declined	2021	258	446	0	58%	
	2022	144	249	0	58%	

Summary

Here we report the findings of the first three health equity measures from BHEMS: breast cancer screening, depression screening, and achieving recommended childhood immunization status. Although these measures are important, they by no means sufficiently capture the state of health equity in Boston.

In this small study, we found that in 2021 and 2022, Latinx women had a higher rate of breast cancer screening compared to White, Black, and Asian women. In 2021, Black patients had the lowest rate of depression screening, and this rate was significantly lower than that reported for White patients. Asian patients had the highest rate of depression screening, but this was not significantly different from White or Latinx patients. Finally, rates of recommended immunizations for Latinx and Black children were higher than for White and Asian children.

The years represented in the BHEMS study, 2021 and 2022, coincided with the first two years of the COVID-19 pandemic when there was reduced access to and utilization of in-person care for non-COVID conditions. Without data from previous years, it is not possible to determine here how these results were impacted by the COVID-19 pandemic. Further, the population represented here was limited to people who sought care at three major academic medical centers, two specialty hospitals and one CHC. Hence, the findings are not representative of the Boston population who sought care outside of these facilities or did not seek care at all. Because patient data was deidentified, it was not possible to account for duplication of patients who received care at more than one institution. This was likely most relevant to depression screening.

There were several other strengths and limitations of the BHEMS study reported here. The BHEMS initiative brought together 31 hospitals and CHCs creating a strong working group with a commitment to health equity and successfully executed data sharing agreements between the hospitals and the BPHC. The 19-health equity measures developed addressed the medical/mental/social drivers of health and although the three measures we report on here represent a subset of this original goal, the three measures demonstrated that it is indeed feasible and possible to share representational data between multiple large hospitals for analysis by a local health department.

Future Approaches for Investigating Health Equity in Boston

While BHEMS was highly innovative and ahead of its time when it was initiated in 2006, much has changed in the US sociopolitical and health informatics landscape. In June of 2020, just months after the murder of George Floyd by a police officer, when America was in the throes of a national reckoning around racial justice, Boston declared racism a public health crisis. Concurrently, as the Black Lives Matter movement catalyzed calls to action to address centuries of systemic oppression, the COVID-19 pandemic was disproportionately causing negative health and economic impacts on Black and Latinx populations. Further, healthcare institutions recognizing the impact of structural racism on people of color have implemented local and cross-institution programs to identify and address health inequities.

In addition to BHEMS there are several ongoing initiatives designed to harness data in electronic health records (EHRs) across institutions. Critically there is a move away from creating centralized databases to federated data networks (FDN) in which centralized data queries are sent out to a distributed set of databases or EHRs. Programs like Massachusetts Department of Health's MDPHNet Distributed Data Network | MeHI (masstech.org), the Harvard Medical School based Massachusetts Consortium on Pathogen Readiness (MassCPR) https://masscpr.hms.harvard.edu/about-us,The Boston Medical Center's Health Equity Explorer (H2E) https://www.ohdsi.org/wp-content/uploads/2023/10/403-Gasman-BriefReport-Sarah-Gasman.pdf, and Mass League of Community Centers DRVS

https://massleague.org/Programs/HealthInformationTechnology/ReportingTA.php are developing FDNs that leverage decentralized EHRs and centralized data reporting and analytics solutions to guide and drive care transformation.

Figure 2. Outline of a Federated Network (FDN)
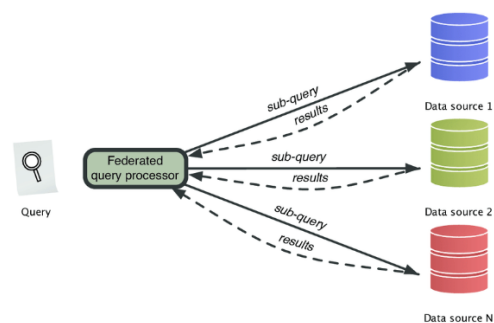
Moving forward, to address Health Equity, BPHC proposes to, in collaboration with Massachusetts Department of Public Health, bring together already existing FDNs to explore and pilot the creation of consolidated broader FDN. Critical next steps for this initiative include reengaging our BHEMS partners, creating a governance structure, developing a use case, agreeing on the computational platforms, and reestablishing data sharing agreements.

Appendix

BHEMS Participating Hospitals and Community Health Centers ………	Table S1
Boston Health Equity Measurement Set ………..…..…………………..	Table S2
Breast Cancer Screening Inclusion and Exclusion Criteria ……………	Table S3
Depression Screening Inclusion and Exclusion Criteria ……………	Table S4
Childhood Immunizations Inclusion and Exclusion Screening ….	Table S5
Links to some relevant documents	

Table S1. Participating and data contributing Acute Care Hospitals and Community Health Centers

	Participating		Data shared		
	Pre-2017	**2023**	**2021**	**2022**	**2023**
Hospitals					
Beth Israel-Deaconess Boston Medical Center	✓	✓	✓	✓	
Boston Children's Hospital	✓	✓	✓	✓	✓
Brigham and Women's Hospital	✓	✓	✓	✓	✓
Dana Farber	✓	✓	✓	✓	✓
Mass Eye and Ear	✓	✓			
Massachusetts General Hospital	✓	✓	✓	✓	✓
Tufts Medical Center	✓	✓			
Steward Medical Group DBA Carney Hospital	✓	✓			
St. Elizabeth's Medical Center	✓	✓			
Community Health Centers					
Boston Healthcare for Homeless	✓	✓			
Bowdoin Street Health Center	✓	✓			
Brookside Community Health Center	✓	✓			
Codman Square Community Health Center	✓	✓			
Dimock Community Health Center	✓	✓			
Dorchester House Multi-Service Center	✓	✓			
East Boston Community Health Center	✓				
Fenway Community Health Center	✓				

Geiger-Gibson Community Health Center	✓	✓	✓	✓	✓
Greater Roslindale Medical & Dental Center	✓	✓			
Harbor Health Services	✓	✓			
Harvard Street Neighborhood Health Center	✓	✓			
Joseph M. Smith Community Health Center	✓				
Martha Eliot Health Center	✓				
Mattapan Community Health Center	✓	✓			
MGH Community Health Association (Charlestown)	✓	✓			
Neponset Health Center	✓				
North End Waterfront Health	✓	✓			
Sidney Borum Jr. Community Health Center	✓				
South Boston Community Health Center	✓	✓			
South Cove Community Health Center	✓				
South End Community Health Center	✓				
Southern Jamaica Plain Health Center	✓	✓			
Uphams Corner Health Center	✓	✓			
Whittier Street Health Center	✓	✓			

Table S2. Original BHEMS Measures

Ambulatory Care Measures				
Measure Name / Description	**BPHC Category**	**CMS#**	**NQF #**	**PQRS #**
Controlling High Blood Pressure	Cardiovascular Disease	165	18	236 *GPRO HTN-2*
Weight Assessment and Counseling for Nutrition and Physical Activity for Children and Adolescents	Obesity	155	24	239
Preventive Care and Screening: Tobacco Use: Screening and Cessation Intervention	Tobacco	138	28	226 *GPRO PREV-10*
Breast Cancer Screening	Cancer screening	125	31	112 *GPRO PREV-5*
Chlamydia Screening for Women	Preventative Health	153	33	310
Colorectal Cancer Screening	Cancer screening	130	34	113 *GPRO PREV-6*
Use of Appropriate Medications for Asthma	Asthma	126	36	311
Childhood Immunization Status	Immunizations	117	38	240
Preventative Care and Screening: Influenza Immunization	Immunizations	147	41	110 *GPRO PREV-7*
Diabetes: Hemoglobin A1c Poor Control	Diabetes	122	59	1 *GPRO DM-2*
Preventive Care and Screening: Screening for Clinical Depression and Follow-Up Plan	Preventative Health	2	418	134 *GPRO PREV-12*
Preventive Care and Screening: Body Mass Index (BMI) Screening and Follow-Up	Obesity	69	421	128 *GPRO PREV-9*

Hospital Measures			
Measure Name / Description	**BPHC Category**	**CMS#**	**NQF #**
Aspirin Prescribed at Discharge Description: Acute myocardial infarction (AMI) patients who are prescribed aspirin at hospital discharge	Cardiovascular Disease	100v2	142
Home Management Plan of Care (HMPC) Document Given to Patient/Caregiver Description: An assessment that there is documentation in the medical record that a Home Management Plan of Care (HMPC) document was given to the pediatric asthma patient/caregiver.	Asthma	26v1	338
Discharged on Antithrombotic Therapy Description: Ischemic stroke patients prescribed antithrombotic therapy at hospital discharge	Cardiovascular Disease	104v2	435
Thrombolytic Therapy Description: Acute ischemic stroke patients who arrive at this hospital within 2 hours of time last known well and for whom IV t-PA was initiated at this hospital within 3 hours of time last known well.	Cardiovascular Disease	91v3	437
Emergency Department (ED)-1 Emergency Department Throughput – Median time from ED arrival to ED departure for admitted ED patients Description: Median time from emergency department arrival to time of departure from the emergency room for patients admitted to the facility from the emergency department.	ED Utilization	55v2	495
ED-3-Median time from ED arrival to ED departure for discharged ED patients. Description: Median time from emergency department arrival to time of departure from the emergency room for patients discharged from the emergency department.	ED Utilization	32v3	496
Discharged on Statin Medication Description: Ischemic stroke patients with LDL greater than or equal to 100 mg/dL, or LDL not measured, or who were on a lipid-lowering medication prior to hospital arrival are prescribed statin medication at hospital discharge.	Cardiovascular Disease	105v2	439

Table S3. Breast Cancer Screening Inclusion and Exclusion Criteria

Denominator: Women 51 - 74 years of age with a visit at the start of measurement period NOTE: The measure's 24-month look back period applies to women ages 51-74. Women ages 50-52 are included in the measure if they had a visit and a mammogram since age 50, but the look back only applies to patients age 52-74.

Numerator: Women with one or more mammograms during the 24 months prior to the end of the measurement period.

Denominator Exclusion:
-Women who had a bilateral mastectomy or who have a history of a bilateral mastectomy or for whom there is evidence of a right and a left unilateral mastectomy   (OR)
 -Patient age 66 and older in Institutional Special Needs Plans (SNP) or residing in long-term care for more than 90 days during the measurement period (OR)
 -Patient age 66 and older with at least one claim/~~encounter~~ for frailty during the measurement period AND a dispensed medication for dementia during the measurement period or the year prior to the measurement period (OR)
 -Patient age 66 and older with at least one claim/~~encounter~~ for frailty during the measurement period AND with a diagnosis of advanced illness during the measurement period or the year prior to the measurement period

Table S4. Depression Screening Inclusion and Exclusion Criteria

DENOMINATOR (Depression Screening): Members who are 12 years and older at the start of the measurement year who met criteria for Continuous enrollment
NUMERATOR (Follow-Up on Positive Screen): Members who received follow-up care on or 30 days after the date of the first positive screen (31 days total)
EXCLUSIONS: Members with any of the following criteria: - Bipolar disorder during the year prior to the measurement period. - Depression during the year prior to the measurement period. - In hospice or using hospice services during the measurement period.

Table S5. Childhood Immunization Screening Inclusion and Exclusion Criteria

DENOMINATOR : Children who turn 2 years of age during the measurement year.

NUMERATOR: Children who have evidence showing they received all the recommended vaccines (four diphtheria, tetanus and acellular pertussis (DTaP); three polio (IPV); one measles, mumps and rubella (MMR); three haemophilus influenza type B (HiB); three hepatitis B (HepB), one chicken pox (VZV); four pneumococcal conjugate (PCV); one hepatitis A (HepA); two or three rotavirus (RV); and two influenza (flu) vaccines) by their second birthday

EXCLUSIONS: Any of the following on or before member's second birthday meet exclusion criteria:

1. Any particular vaccine: Anaphylactic reaction to the vaccine or its components

2. DTaP: Encephalopathy with a vaccine adverse-effect code

3. MMR, VZV and influenza: Immunodeficiency, HIV, Lymphoreticular cancer, multiple myeloma or leukemia, Anaphylactic reaction to neomycin.

4. IPV: Anaphylactic reaction to streptomycin, polymyxin B or neomycin.

5. Hepatitis B: Anaphylactic reaction to common baker's yeast.

6. Rotavirus: Severe combined immunodeficiency, History of intussusception

7. Members in Hospice during the measurement year.

Relevant documents

July 2021 Boston Health Equity Now Plan

06/01/2020 Revised Guidelines for the Implementation, Interpretation, and Enforcement of the Boston Public Health Commission's Data Collection Regulation
07/18/2019 Quality Reporting at the Dawn of FHIR, Presented at NCQA by Mass eHealth Collaborative

Toolkits and Resources
2020: BPHC Equitable Community Engagement Plan 2020-2023
2020: BPHC Equitable Community Engagement Toolkit Section 1
2020: BPHC Equitable Community Engagement Toolkit Section II
2017: Overview Imagine Boston 2030: A Plan for the Future of Boston
2015: The Racial Justice and Health Equity Initiative 2015

Articles
Boston Builds Capacity to Address Racism and Achieve Health Equity
Health in All Policies Success Story: Boston Public Health Commission

Reports
2023 Health of Boston Reports https://www.boston.gov/government/cabinets/boston-public-health-commission/health-data

2019 Community Health Needs Assessment 2019
2016 Health and income: The Impact of Changes to Boston's Living Wage Ordinance on the Health of Living Wage Workers