

**Public Health 2030:
Scenarios for the Boston
Public Health Commission,
Massachusetts**



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Public Health 2030: Scenarios for the Boston Public Health Commission, Massachusetts

by the Boston Public Health Commission
and the Institute for Alternative Futures

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Using These Scenarios

Comparable organizations and communities can use these scenarios as a living tool for strategy formulation by using them to:

1. Test whether current strategies will be effective in the different scenarios.
2. Formulate strategies to more effectively adapt to the changing environment.
3. Assure that strategic plans address the larger picture and longer-term futures for the public health community.

To use these scenarios in your own scenario workshop, visit www.altfutures.org/publichealth2030 for a sample workshop agenda, instructions, worksheets, and presentation materials.

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Introduction

What will public health in the U.S. look like in 2030? What should public health leaders be doing today? The *Public Health 2030: Scenarios for the Boston Public Health Commission, Massachusetts* offer a tool for the Boston Public Health Commission (BPHC) and other comparable local health departments to explore these questions at the level of their own jurisdictions. Scenarios can become a living tool for strategy formulation by allowing organizations to test and design current strategies to be effective in the different scenarios. Using these scenarios can help leaders and their organizations more effectively adapt to the changing environment. The scenarios consider a range of forces, challenges, and opportunities shaping local and national public health. They also offer a plausible set of expectable, challenging, and visionary pathways for how public health in Boston may change over the years to 2030, and what BPHC's role could be within these pathways.

Using preliminary sets of these scenarios, IAF designed and facilitated a scenario workshop with BPHC staff and leaders to explore the four scenarios on December 6, 2013 at BPHC. Together the participants considered potential public health goals and strategies for the future, as well as implications for the “robustness” of their contemporary strategies in light of the various scenarios. The recommendations that they developed for BPHC represent steps toward better public health futures for Boston, and deserve support to promote and develop more effective public health. To use these finalized scenarios in your own workshop, visit www.altfutures.org/publichealth2030 for instructions, sample agendas, and presentation slides.

These Public Health 2030 scenarios for BPHC and others are an important part of a larger project – Public Health 2030 – conducted by the Institute for Alternative Futures (IAF) and supported by the Kresge Foundation and the Robert Wood Johnson Foundation. In addition to developing four sets of scenarios for public health departments from four jurisdictions, including BPHC, IAF developed a set of national public health scenarios available at www.altfutures.org/publichealth2030. Leaders and practitioners in public health and other sectors can consider their own work in the context of these national scenarios by challenging their own assumptions about the future, identifying emerging risks and opportunities, and formulating more robust strategies with greater potential to advance their mission over the decades to come.

Why Scenarios?

The future is uncertain. However, scenarios – different stories describing how the future may unfold – can be used to bound that uncertainty into a limited number of paths. These paths help us think about different probabilities in a larger space of possibilities. Scenarios also force us to consider the systems surrounding our topic and to clarify our assumptions. People who work with scenarios find more creative options than those who plan based only on the past and present. Strategies, plans, and actions can be “future tested” against the different scenarios to assure robust initiatives rather than continued efforts based on outdated assumptions. Scenarios are thus a powerful method for systematically addressing the uncertain future.

Process of Developing These Scenarios

Given the diversity of public health agencies across the U.S., IAF determined that we should develop scenarios for a few state and local public health agencies. In selecting jurisdictions, we sought diversity in size, region, political and economic conditions, and organizational forms. We chose a rural jurisdiction, a mid-sized jurisdiction (population of 250,000 to 750,000) and a large jurisdiction (population over 750,000). With assistance from the National Association of City and County Health Officials (NACCHO), we recruited BPHC as a mid-sized jurisdiction case. We are grateful for the partnership of Barbara Ferrer, executive director of the Boston Public Health Commission.

IAF partnered with BPHC staff to develop the scenarios using the “Aspirational Futures” approach (see **Figure 1** below) which IAF has evolved over the last three decades. The “aspirational futures” approach helps people understand and clarify where current trends may take us, what challenges we face, and what success might look like. This technique develops forecasts and scenarios in three zones:

- A “zone of conventional expectation” reflecting the extrapolation of known trends, a “most likely” or expectable future (scenario 1);
- A “zone of growing desperation” which presents a set of plausible challenges that an organization or field may face, a challenging future (scenario 2); and
- A “zone of high aspiration” in which a critical mass of stakeholders pursues visionary strategies and achieves surprising success (scenarios 3 and 4). Two scenarios are developed in this zone in order to offer two alternative pathways to highly preferable or visionary futures.

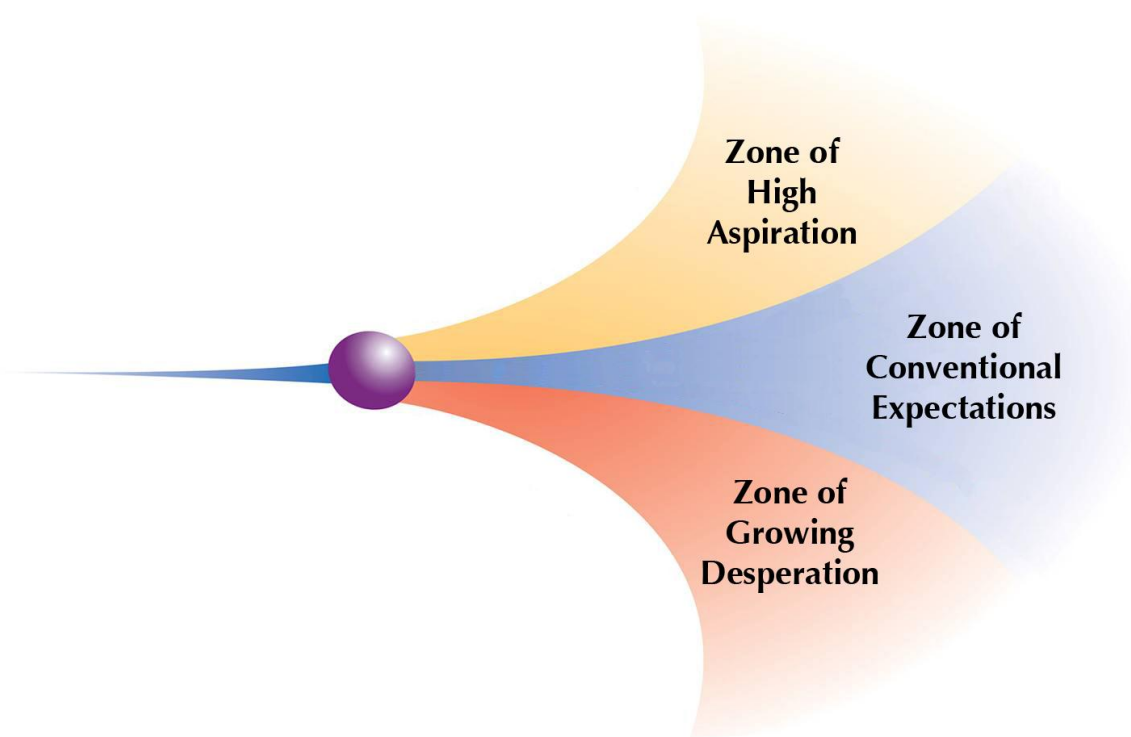


Figure 1: IAF’s “Aspirational Futures” Approach

In developing these scenarios, IAF reviewed key BPHC program areas, plans, and documents; and interviewed individual BPHC program staff using a set of “driver forecasts” related to key factors shaping health. Based on this research, IAF then developed preliminary scenarios for review and discussion. Many of the comments we received during a BPHC scenario workshop held on December 6, 2013, have been incorporated into the final scenarios.

In the next section, we present the finalized scenario narratives, followed by a matrix that allows for side-by-side comparison of the scenarios across multiple categories.

Public Health 2030: Scenarios for the Boston Public Health Commission

Scenario 1: Smarter Public Health, Missed Opportunities

Scenario Overview

Over the years to 2030, funding changes forced the Boston Public Health Commission (BPHC) to do more work but with less funding and fewer staff members. Health care reform, however, enabled BPHC to reduce its role in providing direct clinical services and focus more on assessing and assuring the quality of health care services. In parallel, planning improved as surveillance and environmental monitoring expanded. Yet a hurricane in 2018 dramatically exposed the inequities in disaster recovery, despite BPHC's aggressive stance in preparing for climate change and its effects. Overall, Boston remained a relatively healthy city compared to others in the U.S., but fundamental problems of poverty and social exclusion persisted.

Scenario Narrative

The Boston Public Health Commission (BPHC) evolved with the city in the first decades of the 21st century. The local economy grew in tandem with the national economy, interrupted by only mild national recessions in 2015 and 2022. Health care, education, and financial services remained the leading parts of Boston's economy. In education, however, the institutions of higher learning (ten colleges and universities, six technical schools, four art and music schools, and six junior colleges) located within the city limits were challenged in varying degrees by advances in online learning. As a result, some of these schools saw a drop in residential students over the years. The overall effect was a modest decline in the 130,000 students at those schools. In health care, hospitals were challenged as well – in their case, by health care reform. While they remained among Boston's top ten employers and improved their care, they also had to downsize somewhat over the years.

Over the years, fiscal challenges also limited government spending, including public health financing, at the federal, state, and city levels. All three levels of government implemented periodic cuts and program eliminations, although they were thankfully seldom draconian. Along the way, Boston's Mayors and their administrations periodically shifted BPHC's priorities or added new ones, as did the federal and state governments.

Luckily, some of BPHC's services did at times receive temporary financing increases. These included environmental health and emergency preparedness and response services that experienced higher demand over the years, particularly after extreme weather events. Climate change in New England had led to increased sea-level rise, summer heat waves, and increases in storm intensity and frequency. Boston took an aggressive stance in preparing for climate change and its effects. BPHC expanded trauma support by training front line youth providers and clinicians, community health workers, and BPHC staff in connecting residents to appropriate services and providing support to neighborhoods in the immediate aftermath of a devastating traumatic event. BPHC also sought to coordinate planning and readiness in low-income neighborhoods (particularly low-lying vulnerable ones), linguistically isolated populations, and communities of color. BPHC worked to ensure that people in health care facilities and incarcerated persons would be evacuated when needed; provided additional cooling centers for the medically vulnerable during heat waves; worked to expedite and enhance disaster recovery for low-income areas; and strengthened resilience before events occurred by fostering open and green spaces, opportunities for physical activity, access to fresh nutritious food, and stronger intra-community social connections. BPHC was joined in many of these preparations and responses by large numbers of citizen volunteers, sometimes working through and with BPHC-related apps and information systems. Occasionally, groups spontaneously developed to aid in recovery, much like Occupy Sandy did in New York after Hurricane Sandy in 2012.

Improvements in planning and preparation, however, remained unevenly distributed. Despite BPHC's efforts in disaster recovery for low-income neighborhoods, Hurricane Barbara devastated neighborhoods close to the water in 2018. In fact, Hurricane Barbara became Boston's Hurricane Katrina, dramatically exposing disparities between those who were able to successfully recover and those who could not.

After the disaster, BPHC worked to enhance Boston's emergency preparedness through data analytics and technology. It aggregated and analyzed data from the electronic health record (EHR) network, BPHC's emergency medical services, state disaster response agencies, national and local nonprofits, and the Department of Homeland Security. In the same period, BPHC used games, digital coaches, and simulations to improve health education and emergency preparedness, mitigation, and recovery.

BPHC's expanded efforts in environmental health and emergency preparedness also included augmenting environmental monitoring, especially to facilitate hot spotting (i.e., the identification of health care high-utilizers). Residents themselves contributed to environmental surveillance through smart or nanotech devices integrated into everyday consumer products, such as home smoke and air quality detectors, toxin detectors built into mobile devices, and special wall paints that changed color based on the concentration of noxious chemicals detected in the air. Both private and public sector funding was increasingly made available for the installation of environmental sensors all over Boston in what became known as the "Internet of Things," (IoT) in which a large proportion of devices and appliances could communicate over the Internet. These environmental monitoring enhancements proved valuable, as increasingly frequent, intense, and expensive extreme weather events challenged Boston throughout the 2010s and 2020s. These events led to greater frequencies of outbreaks of water- and vector-borne infectious diseases such as Legionnaires' disease, West Nile virus, and dengue fever.

BPHC was also affected by many changes in health care, such as the personalization of diagnosis and treatment and the expansion to near-universal access to effective health care. With only 2% uninsured in 2010, Massachusetts was already well on its way to universal health care access when national health care reform was implemented. The health care systems and health insurance in Massachusetts,

combined with the Patient Protection and Affordable Care Act (PPACA), had enabled virtually all in Boston to access care by 2015. Demand thus grew for medications and convenient, low-cost treatments. The shift to marijuana and e-cigarette use also contributed to reductions in asthma, lung cancer, and secondhand smoke exposure. Health care became more consolidated and capitated, and was shaped by the ubiquitous use of electronic health records and the pursuit of the Triple Aim (excellent patient experience, lower cost, and improved population health) by most health care providers.

As EHRs became ubiquitous and interoperable, BPHC used the aggregated EHR data to rapidly obtain information on patterns in infectious and chronic disease as well as risk factors. Cloud-based storage of EHRs, along with community data and related analytic capacities, enabled better targeting of individuals in greatest need. The data became more complex over time as the EHRs came to include genomic and biomonitoring data. Low-cost gene reading had allowed inclusion of genetic data to become routine. Moreover, inexpensive smart phones and biomonitoring tools tied to apps from health care providers allowed capture of personal data on a nearly continuous and passive basis. These were in widespread use (even by low-income residents) thanks to the state's subsidized smart phone and data services. Parallel advances in cognitive computing allowed health care providers to use "Doc Watsons" (the first health care application of IBM's cognitive computing research) that analyzed all relevant knowledge on any aspect of health care. Similar cognitive computing advances were built into the practice protocols of Boston health care providers, and were in turn included in "digital health coaches" given to patients. As these tools became a common part of health care, cultural challenges emerged in some populations. The advanced language translation capacities of phones reduced most of the language barriers, and health care providers worked to overcome any remaining cultural barriers to effective use of these systems.

BPHC used data and data analytics in other ways as well. For example, BPHC had long used hospital data to compare allergy seasons and organize emergency and health messaging. BPHC sought to integrate surveillance systems, gain access to more granular data, and concentrate on specific aspects of analysis, interpretation, and response to surveillance findings. To this end, BPHC formed new partnerships with Accountable Care Organizations (ACOs), universities, and private entities. This enabled BPHC to more effectively analyze and target community conditions shaping health, while also providing quality control on the widespread application of digital health coaches by health care providers. ACOs often created their own epidemiology or population health units as well to address the growing amounts of data at the individual and community levels, turning to universities and private companies for the most advanced analytics services.

Advances in technology such as digital health coaches, coupled with the move to capitation, incentivized providers to keep people out of the hospital. Increasingly, people were effectively assessed and even treated at home, yielding health care savings. Even BPHC's emergency medical services received payment for 911 responses where they worked with the patient on their immediate complaint, ensured that they did not need to visit the hospital emergency department, and enabled them to stay at home, thus preventing many hospitalizations.

Access to effective health care thus grew, and prevention and treatments improved as well (including, for example, improved primary care by community health centers). In response to these developments, the federal government reduced funding for its programs in HIV/AIDS, maternal and child health, and cancer screening. With these reductions, BPHC largely moved away from providing direct personal health care services and expanded its role in assessing and assuring the effectiveness, accessibility, and quality of services delivered through health care organizations.

While BPHC ultimately retained its hold on (and earned revenue from) health care and mental health services for the homeless and addiction service clients, health care providers had begun to adopt more public health roles. Capitation was incentivizing many of them to improve population health through various means. For example, all Boston providers incorporated tobacco assessment, counseling, and referral practices into overall wellness and treatment plans. The large health care systems in Boston also routinely provided community benefit programming that improved neighborhood conditions. Some even won national awards for their work focused on reducing substance abuse, domestic violence, and traffic injuries. These efforts became more common, targeted, and effective throughout the 2010s and 2020s, and were accelerated by the PPACA requirement that non-profit hospitals do community needs assessments and report their community benefits activities to the IRS. Particularly ACOs worked to improve community conditions, or supported community groups or BPHC in doing so.

BPHC also continued to provide leadership in the training of community health workers (CHWs). CHWs were increasingly deployed by ACOs as part of primary care teams, reaching out to their communities via social networks, supporting families during a serious crisis, and consulting with patients with questions about their EHRs or digital health coaches (which took social networking data into greater account as analytics improved). As more hospitals trained their own community health workers, BPHC shifted to guiding and instructing the hospital trainers.

In addition to facilitating the training of CHWs, BPHC sought to enhance its services for the homeless and continued to include housing assistance and job training beyond the provision of emergency shelters. In the mid-2010s, BPHC demonstrated that providing housing for the homeless and for high utilizers of emergency departments actually yielded cost savings. With this research, BPHC successfully convinced insurance companies to fund housing. However, BPHC was unable to demonstrate similarly convincing results for other follow-on services such as job training. Periods of budget cuts and crises also limited the ability of other agencies and organizations to sufficiently meet the need for their services, leaving BPHC to essentially function—without fiscal support—as the de facto mental health and criminal justice institution for the most vulnerable.

Although it was a challenge for BPHC to consistently prove its value to health care leaders, or to be recognized for its role as advisor and convener, BPHC did earn recognition in the late 2010s for several of its endeavors. These included BPHC's partnerships with health care, Boston public schools, and other community organizations to reduce rates of obesity, low birth-weights, and chlamydia. BPHC and its partners successfully reduced disparities in these rates among different population groups in the city. BPHC and its partners also effectively implemented better prevention techniques, self-management, and new treatments, all of which delayed the onset and slowed the progression of many chronic diseases.

Overall, the health of many individual Bostonians improved over the years. In 2030, the city government reports significant declines in health disparities for certain racial and ethnic minorities thanks to the combined efforts of BPHC, health care, and community partners in improving care coordination, hot spotting, and community-oriented programming. Advances in environmental monitoring, simulations, and consumer technologies had also improved planning. However, the fundamental problems of poverty, social exclusion, and homelessness remain. Massachusetts had rebounded from the recessions of 2015 and 2022 more quickly than most other states, but many of the new jobs people found were temporary and/or low-wage. Further, economic and environmental challenges throughout the 2010s and 2020s had required BPHC to do more with less funding and fewer staff. Therefore, in 2030, there is still much work to be done to improve the public's health in Boston.

Scenario 2: Under Water

Scenario Overview

The need for public health efforts grew steadily in Boston as climate change brought more frequent and intense storms, hotter summers, and related droughts. Recessions and slow recoveries were exacerbated in Boston as the education sector lost tens of thousands of students and after a superstorm flooded the city. Funding at all levels of government also decreased severely, limiting the Boston Public Health Commission (BPHC) to focus on emergency preparedness, environmental health, and infectious disease control and prevention. Many of the services for and gains made through safety-net health care programming, community prevention, and chronic disease control lost ground compared to previous decades. As a result, the health gaps between the "haves" and "have-nots" widened over the years to 2030.

Scenario Narrative

Beginning in the late 1980s, Boston had seen a boom in financial services, sophisticated high technology industries, and the expansion of the university and health services sectors. All of this growth led to the creation and expansion of businesses and thousands of jobs. The 2008 recession slowed this growth, however, and Boston's economy experienced major setbacks during the 2016 recession, the 2018 superstorm, and the challenges to the post-secondary institutions in the city.

The 2018 superstorm was similar in impact to Hurricane Sandy's direct hit to the New York City area in 2012. This was the worst of ongoing environmental challenges that Boston faced over the years to 2030, which included hotter summers and droughts, more intense storms throughout the year, and increased spread of infectious diseases and mold. In the 2018 superstorm alone, nearly 20,000 homes and 4,000 businesses were flooded. There was significant wind damage as well, and the economic impact was devastating.

The Boston Public Health Commission (BPHC) had helped the city prepare for and lessen the impact, yet it took years to fully recover from the superstorm. Ahead of the storm, BPHC had coordinated resources for low-income waterfront communities to prevent or reduce flooding and storm damage. It had also worked to strengthen community resources (e.g., by fostering stronger neighborhood organizations and intra-community social connections) in order to build resilience to the acute effects of climate change. Before the storm hit, BPHC had effectively managed the evacuation of incarcerated persons and people in medical care facilities, but the backup incarceration and health care facilities were bursting at the seams. The homeless shelter and other operations on Long Island were also evacuated, just in time before the storm destroyed the bridge. BPHC had been working for years to get the Long Island Bridge replaced, but funding for this endeavor had never existed. There were not even funds to provide ferry access to the island using boats.

Aside from the 2018 superstorm, other events and developments also hurt the city's economy. In education, there had been ten colleges and universities along with six technical schools, four art and music schools, and six junior colleges within the city limits, and many more educational institutions in the greater Boston area. Hundreds of thousands of students had traditionally made Boston a lively

place. However, these schools were challenged in varying degrees by advances in online learning, the recession, and the effects of the superstorm. In the mid-2010s, shifts in attitudes by students and parents slowed enrollments at residential colleges, particularly private colleges. Graduates with expensive degrees had been increasingly unable to find jobs. High quality, low-cost alternatives to physical colleges (e.g., massive open online courses and online degree programs) proliferated. The concurrent economic downturns also lowered college and graduate students' willingness and ability to move out of their parents' homes, while parents were increasingly unable and unwilling to contribute to paying high tuitions. As a result, Boston colleges and universities saw declines in their enrollments, as well as significant drops in on-campus study. Several major Boston area schools shifted many of their courses and programs to online-only. Some schools even went out of business. The city's college and graduate student population fell from 130,000 in 2010 to 80,000 in 2025. Demand for housing decreased and property values in some neighborhoods dropped, as did many forms of revenue for the city government.

The city government's revenue difficulties mirrored the debt and deficit challenges of the federal government. Investments in community prevention efforts diminished as the Prevention and Public Health Fund was not funded, and programs funded through CDC and HRSA were cut. Reductions in Medicaid match rates and spending on other programs hurt Massachusetts teachers, law enforcement officials, firefighters, and public health workers. Likewise, state and city expenditures were cut. Layoffs in turn reduced state and municipal services. Thus by 2020, Boston faced serious challenges in financing government operations that had for decades been taken for granted. As whole areas of BPHC's work were eliminated, it was left with: infectious disease control and prevention, emergency preparedness, emergency medical services, and homeless and addiction services. In other program areas, such as violence prevention, BPHC had to compete with other city agencies for already declining funding. Nevertheless, the downturn did have its silver linings. For example, some foundations acquired the facilities of closed colleges, and offered them to the city government for low-income housing and homeless shelters.

Health care was challenged in Boston as well. Because of its 2006 health care reform, only 2% of the people in the state remained uninsured by 2010. Federal health reform, however, was only partially implemented, partially repealed. Progress towards the creation and implementation of Accountable Care Organizations (ACOs) was halted, with little serious movement toward more integration and capitation. Some health care providers – including Boston's largest provider organizations – did focus on population health and provided “community benefit” funding. This provided some support for community prevention programs, but these funds were insufficient to truly address the community's needs.

Further, disparities in health care were exacerbated by payment reductions and provider shortages. This combination greatly hindered vulnerable populations' access to the full range of care needed. Safety-net care providers such as Federally Qualified Health Centers were understaffed and overworked. Early childhood health worsened as mental health problems were frequently missed during ever shorter doctor's office visits, and the effectiveness of early childhood health resources and services varied highly among providers. Poor and minority populations with the highest rates of obesity, diabetes, preventable cancers, and drug-resistant infectious diseases were blamed for their own ill health. Many were reluctant to seek primary and emergency medical care because they could not afford the associated co-pays. Instead, they turned to the growing array of free and ad-supported web- and mobile-based electronic health coaches and “virtual doctor” services, which often provided inadequate diagnoses and only recommended products from their advertisers. High quality digital coaches and virtual doctor

services were only available to members of premium health care insurance plans as well as some Medicare and Medicaid plans.

On the upside, addiction care and prevention services were integrated into primary care and behavioral health. BPHC also became licensed for and increased its involvement in the delivery of mental health services for its addiction and homeless services clients. The demand for mental health services had generally increased in conjunction with Boston's economic decline, higher unemployment, and higher stress levels among the employed. The integration of addiction services into health care settings worked well for patients with good coverage and for individuals subject to increased case management by their provider. However, access to mental health services among the working poor deteriorated as they struggled with growing copays and deductibles, as well as overworked and understaffed providers. Further, new challenges grew with the development of experimental new chemicals that skirted existing substance-control laws. Each new ban drove users to experiment with another new chemical that was not yet illegal and had poorly understood effects.

As the ranks and suffering of the most vulnerable populations thus grew, BPHC strained against its diminishing funding to serve them. Technological advances held promise for improving efficiency and effectiveness, but posed significant challenges to BPHC in integrating and using them. Given the growth and evolution of information and communications technologies, the city government had developed a sophisticated environmental monitoring system of networked sensors. Additionally, more and more residents were using social media and the Internet to communicate and explore health, and personal biomonitoring tools that fed into EHRs became more popular. BPHC drew on these environmental, social, and personal biomonitoring data to improve its ability to forecast and warn about, for example, likely asthma attacks on a neighborhood basis. However, this forecasting and early-warning capability improved only marginally and often did not lead to earlier response and prevention because BPHC's ability to intervene was significantly constrained.

Corporations and some health care provider organizations, however, were able to invest heavily in the advanced analytics required to make sense of the "big data." They scooped up skilled analysts to serve their commercial objectives while BPHC struggled with updating its tools and software. Furthermore, there were large disparities in access to and use of biomonitoring tools. These disparities left BPHC to work with a growing volume of data with significant blind spots for low-income people and people of color, as they were less likely to use biomonitoring tools than whites and the affluent. For the disadvantaged populations and any areas of health beyond what was documented in the citywide network of EHR systems, BPHC was limited to purchasing additional datasets or watering down its analyses when the data was not as granular as required.

Thus, over the years to 2030, BPHC came to focus on emergency preparedness, environmental health, and infectious disease control and prevention while also maintaining emergency medical, homeless, and addiction services. Many of the services for and gains made through safety-net health care programming, community prevention, and chronic disease control, however, lost ground compared to previous decades. The proliferation of communication tools and forms had decreased the effectiveness of traditional public health messaging and marketing strategies, and public health messaging was tuned out among the variety of channels, ads, and communications. Although BPHC and some other organizations maintained an interest in community prevention approaches, their efforts were often stymied by challenges in funding, difficulties in recruiting cross-sectoral partners, and lack of political will. As a result, the health gaps between the "haves" and "have-nots" became more pronounced. In 2030, Boston faces profound challenges in attempting to return to the levels of health seen just two decades earlier.

Scenario 3: Public Health as Chief Health Strategist

Scenario Overview

Over the years to 2030, Boston became a beacon for the rest of the nation in successfully improving health equity and racial justice. The Boston Public Health Commission (BPHC), in its role as the chief health strategist for the city's diverse communities, played an important part in Boston's improved health, promoting diverse collaborations, "Health in All Policies" approaches, and gaming for community engagement. As access to effective health care became nearly universal, BPHC's focus emphasized its role as strategist and the use of advanced analytics to understand and improve community conditions and individuals' health. As a result, the overall health of Bostonians improved significantly over the years to 2030, and in many cases racial and ethnic disparities were significantly reduced.

Scenario Narrative

In the years between 2013 and 2030, the Boston Public Health Commission (BPHC) determined that its most valuable role would be to serve as the chief health strategist for the city, focusing on ensuring health equity and racial justice. For this purpose, BPHC built on many key forces, took on more roles as facilitator and coach, and enhanced the availability and use of advanced analytics and community involvement games over the years to 2030. One aspect of BPHC's progress was the uptake of "Health in All Policies."

The "Health in All Policies" movement took hold across the nation during the 2010s. More and more state and local agencies, legislatures, and city councils were using this lens as initiatives like the National Prevention Strategy, parts of the Patient Protection and Affordable Care Act (PPACA), and Community Transformation Grants promoted actions that sought to improve the conditions for all to be healthy.

Simultaneously, a profound social value shift around health, wellbeing, and equity took place nationally. In Boston, an early indicator of this shift was Boston's Living Wage Ordinance, which since 1998 had covered employees of all vendors contracting with the city government. The statewide health care reforms of 2006 had further expressed an intention to create more equitable opportunities for all of the state's residents. Moreover, the Massachusetts Department of Transportation, Executive Office of Energy and Environmental Affairs, and the Water Resources Authority, all led other non-health state agencies to incorporate health goals into their strategic planning and business practices and policies. This included the passing of a living wage law in Massachusetts by 2016 that increased the minimum wage and provided automatic cost-of-living adjustments. As the incorporation of health considerations into all policies grew, Boston agencies supported these changes through various means. BPHC, for example, supported the new law by including checks on living wages and worker protections in its inspection and regulation activities.

Additionally, a broad coalition of Massachusetts' legislators, civic leaders, and organizations had already called for a sizable and sustainable investment in community-level population health strategies. By July

2012, this had led to the establishment of the state's Prevention and Wellness Trust Fund, which complemented the national Prevention and Public Health Fund that had been established through the PPACA of 2010. Congress—after having initially reduced the appropriations for it—ultimately supported the Prevention and Public Health Fund at the levels originally called for in the PPACA legislation (namely \$2 billion a year). In Boston, under BPHC's leadership, community coalitions repeatedly secured grants from the state and national prevention funds for community-wide efforts.

The city's leaders, particularly within BPHC, took advantage of the growing and strengthened opportunities to improve Bostonians' health and to advance health equity and racial justice. The implementation of the PPACA was one such opportunity. While Massachusetts already had high health insurance coverage rates (98% of Massachusetts residents were covered in 2010) due to the state's 2006 reforms, BPHC took an active role in assuring that all stakeholders understood the PPACA well enough to reap all of its benefits. As a result, the reforms led to near-universal coverage in the state. Nationally, as nearly all gained access to effective, comprehensive, and preventive health care, some federal programs were reduced or eliminated (particularly the Ryan White HIV/AIDS and Maternal and Child Health programs). Thus, as health care coverage expanded and federal funds were cut, BPHC largely moved out of direct clinical service programs. Similarly, as permanent changes toward tobacco and nicotine control were put in place (such as federal and state bans on marketing and distribution of nicotine products to residents under the age of 21, or increasing taxes and aggressive packaging requirements for those products) BPHC tapered its tobacco control and prevention efforts. However, BPHC maintained its Emergency Medical Services (EMS) program as well as programs for two specific populations: those receiving homeless services, and those receiving addiction services. BPHC established itself as the most cost-effective provider for these populations and much of its health services work for them was covered by Medicaid, Medicare, or health insurers.

BPHC leaders continued to build up BPHC's role as chief health strategist for the city. Working with the Mayor, council members, and community leaders, BPHC helped ensure an authentic commitment to optimal health in Boston, including health equity and racial justice. As a result, a citywide, long-term vision for achieving substantial improvements in Boston's health was created in 2016. What played out over the next decade was very much a fulfillment of the ideas that had emerged in this vision.

In seeking to achieve this long-term vision, BPHC better recognized the diverse ways in which communities were seeking to improve their health. BPHC also understood that it could reinforce those endeavors. The Mayor's effort on local food initiatives (which had begun in 2010), age-friendly communities like Beacon Village, and the growth of "time banks" where neighbors traded their services to each other, all represented opportunities to inject environmental and personal health education, and to connect residents to develop neighborhood-specific prevention plans. BPHC provided technical assistance and support to community organizers, and meetings and coalitions with the public grew larger and more diverse. BPHC was brought as equal partners to the table with civic, religious, and business leaders, as well as other agencies and organizations. Guided by the community's vision, BPHC and its partners thus developed and promoted activities to increase population health, community resilience, and more equitable emergency planning and response. BPHC developed targets and metrics to evaluate these community-oriented efforts, whether led by the community or nonprofit groups, by BPHC, or by other city agencies.

BPHC's chief health strategist role also included enhancing intelligence within BPHC's programs and across the community about individual and neighborhood health, as well as improving evaluation of the effectiveness of health promotion efforts. BPHC's contributions were enabled by enhancements in

electronic health records (EHRs), community mapping, games and simulations, and evaluation research. In tobacco use cessation and prevention, for example, the city thus successfully reduced disparities by targeting at-risk populations, utilizing the popularity of consumer technologies (e.g., smartphone apps and digital health coaches that helped reduce stress and improve mental and physical wellbeing), and promoting health in citywide health care, housing, schools, and workplaces.

As EHR systems became ubiquitous and interoperable among health care providers in Boston, they also integrated increasingly more information about each patient. These included consistent and comparable data on the race, ethnicity, preferred language, and socioeconomic status of patients; low-cost genetic analysis integrated with current research on genes, epigenetics, and other factors; and data from various personal biomonitoring tools that provided nearly continuous passive monitoring. Aggregated in secure and cloud-based settings, this data allowed for the creation and analysis of each person's true and personalized "normal" range for critical health indicators, as well as increasingly complex and personalized assessments of individuals. Health care providers used this information to identify and reduce disparities in clinical practice and outcomes, incorporating results into performance assessment and quality improvement activities.

Tracking, monitoring, and assessment tools also began to include pre-disease markers for many conditions. Such personal monitoring was accelerated by those in the "Quantified Self" movement, including many participants in Boston. Partners HealthCare's Center for Connected Health led the effort to help health care providers use this data as well as the emerging tools from cognitive computing. "Doc Watson," the first health care application of IBM's cognitive computing research, had evolved along with big data analytics and both supported more complex and personalized analysis. BPHC worked with health care providers to ensure that these systems were both functionally effective and culturally appropriate for vulnerable or marginalized populations in the city. A wide range of apps also linked individuals, their biomonitoring tools, EHRs, and personalized digital health coaches. Subsidized basic smart phone and data service in Massachusetts insured that all had access to these tools, reducing the digital divide. Health care providers used the increasingly more granular and nuanced patient data to support personalized care and health promotion for consumers. BPHC accessed cloud-based aggregations of this data to identify infectious disease outbreaks, chronic conditions and risk factors, and the wide-ranging set of factors affecting these. BPHC also used this data and analyses in assessing health equity and supporting health care providers and community groups in eliminating health disparities.

This level of deep and targeted analysis was also conducted for environmental monitoring. Sensors placed throughout the city and in personal devices provided granular data on air and water quality, toxin concentrations, housing conditions, waste management, urban agriculture, safety, walkability, and energy use. Social media data was included in this mix as well with natural language ontologies and advanced analytics allowing appropriate interpretations of social media data.

Moreover, all of this data was overlaid on maps of the natural and built environments, giving public health officials, policymakers, and residents a highly sophisticated view of what was going on in the city at any given time. Among other things, this mapping improved targeted emergency preparedness and sped up the response to infectious disease outbreaks, which were becoming more prominent with the growing frequency of large and vicious storms and periodic summer heat waves throughout the 2010s and 2020s. By 2018, this mapping system evolved into health dashboards for each community. Public health researchers and others used them to build virtual simulations of Boston's health, and explored these simulations by playing out different scenarios, considering potential pandemics and extreme

weather events. It even became common for large numbers of Bostonians and their community groups to use games and simulations to consider emergency preparedness (particularly resilience). Based on this engagement, focused efforts emerged to enhance the resilience of low-income communities before extreme weather events occurred.

This increased involvement in community preparedness games reinforced the observation of the role of privilege in shaping individual and collective health outcomes. BPHC used these experiences and developed a game called “Privileged” to engage the public in a discussion on fair access to opportunities for health. The game, which went viral on social networks in 2020, particularly among young people, allowed players to role-play the lives of different hypothetical Bostonians – from the most privileged to the more vulnerable. People could also adjust their character's demographic factors such as race, ethnicity, gender, citizenship status, age, and health status to see the impact on their life course. The game prompted a major public conversation about how the inequities found in Boston could be addressed and eliminated.

To address these inequities, BPHC expanded its efforts to develop benchmarks and secure the commitment of leaders and entire organizations across a range of sectors. BPHC co-developed and led collaborative approaches to integrate and articulate health and health equity considerations into policy making and programming. Inside the Boston government, BPHC coached all agencies on health equity and health promotion. Boston's government thus became a role model of a socially just workplace and health-promoting organization as the 2020s passed. Staff diversity had increased at all organizational levels in city government, particularly as inequities in education were reduced. The diversity of leaders in organizations and governing boards across the city had also increased.

Across the city, emergency preparedness came to better integrate health equity metrics and improvement strategies for low-income or vulnerable neighborhoods as well. Another example of a collaborative approach was the partnership between BPHC and other city agencies to support labor protection laws and regulations. BPHC also aided health care providers in including social determinants-related risks in their screenings and diagnoses of individuals and neighborhoods. These screenings for health and socioeconomic needs led to shared investments and programs for systemic solutions to enhance health and violence prevention.

Individuals were also able to take advantage of the new data and knowledge systems becoming available. Digital health coaches and social network connections guided users toward healthy behaviors, often using games and simulations. BPHC played a critical role in assuring that these knowledge tools were affordable for low-income populations. BPHC also implemented learning interfaces that were appropriate for different cultures within the city.

Improved and digitally-enhanced behavioral health coalesced with the health promotion policies, comprehensive EHRs, and the capacities of providers and digital health coaches. This development ultimately reduced demand for BPHC's EMS services. In addition, EMS shifted its strategy in responding to 911 calls and sought to avoid taking people to the hospital when appropriate. Payments from Medicare, Medicaid, and other insurers/providers to EMS included 911 responses that met the patients' needs in their homes, avoiding hospitalizations. As EMS calls thus declined, EMS workers joined in hot-spotting work with their frequent callers by doing preventive house calls to ensure optimal health and reduce the risk of emergency.

In light of the renewed focus on prevention and equity, BPHC developed health dashboards that each community could use as an informal “progress report,” reflecting a tailored version of the population health metrics already developed for the city. Advances in BPHC’s monitoring and informatics infrastructure boosted its ability to routinely assess and analyze broader community trends and patterns and to build and maintain strong, effective, and meaningful partnerships with all neighborhoods and communities. As a result, BPHC became a vital partner in all planning, which evolved to consider more public input in making Boston a greener and more adaptable city. Public participation thus grew on many fronts (including urban gardening and time banking activities [monitored by BPHC]) that promoted environmental health. Public participation also grew in mitigating the effects of potential environmental disasters through the exploration of options for community resilience. Such options included community co-production, collaborative consumption, and enhanced home and local food production.

In 2030, many people find it hard to believe just how thoroughly the shift to prevention had manifested itself in the improvement of health and the advancement of health equity. Over the 2010s and 2020s, BPHC had successfully used its convening powers, as well as linkages to schools, researchers, businesses, residents, and other partners, to identify and accelerate promising opportunities and evidence-based practices, initiatives, and policies. For its work, BPHC is widely recognized as the city’s chief health strategist and is lauded for its strategic convening of city stakeholders around issues most significantly shaping the public’s health.

Scenario 4: A Renaissance of Civic and Social Responsibility

Scenario Overview

Amidst budget constraints throughout the 2010s and 2020s, the Boston Public Health Commission (BPHC) turned to leveraging the many resources that Boston always had—namely, its people. While the government retained core public health responsibilities, such as surveillance and quarantine and isolation authorities, BPHC fostered the adoption of novel innovations for public health by citizen scientists, community groups, the private sector, and health care organizations. Impressed with the results, other Boston agencies followed BPHC's example. Over the years to 2030, community engagement and entrepreneurialism thus helped to create the conditions for all residents to be healthy and thrive.

Scenario Narrative

In the years following 2014, unemployment remained high and another major recession in 2017 was followed by slow and uneven recovery. Climate change challenged the city through the increasing prominence of floods, hurricanes, stronger winter storms, and heat waves. Yet the Boston Public Health Commission's (BPHC's) preparation and responses to these events were often underfunded. In addition, budget cuts made it increasingly difficult for BPHC to fulfill its public health mission in a rapidly changing world. Civic leaders emphasized being "smarter and leaner" but with the existing methods and approaches that often turned into "slower and less." Many within BPHC sensed a need for a fundamentally new approach to public health. This sense was reinforced by the public's growing ambivalence toward government-launched initiatives that were well-intentioned but too often struggled with funding, inclusivity, and momentum.

This ambivalence stood in stark contrast to the growing excitement around innovative health-improving technologies and the vibrant social movement of "civic hacking." For example, in 2013 Lifeguard Games launched a "virtual pet" app that taught children how to manage their own asthma. By late 2014, the game had proven so successful that non-asthmatic kids who played the game were coaching their asthmatic friends who did not play it. Other apps similarly integrated health education with gaming to improve health, including apps that promoted stress management, vaccinations, physical activity, social and emotional learning, and activities for K-12 children when school was not in session. For BPHC, such innovative approaches suggested a wellspring of engagement in the broader community that was just waiting to be tapped.

As it looked for ways to accelerate these innovations, BPHC settled on the idea of reprogramming some existing funds so that innovators could compete to solve seemingly intractable problems. Such innovation awards had already been used in public and private settings with great success. As a pilot, BPHC converted an existing budget line item of \$23,000 into a public prize to improve on existing tools (e.g., Tracker Maps and Nemesis) that effectively mined social media data for potential food poisoning outbreaks. The winning approach accelerated BPHC's identification of these problems, and the speed

with which the city government could perform inspectional services. Another innovation award focused on a tool for increasing the ability of local data systems to extract public health information from the integrated components of electronic health records (diagnosis and medical treatment history, genomic information, and personal biomonitoring data), social media, local environmental monitoring, crime and safety data, and unemployment. The winning entry helped BPHC to more quickly do the advanced analytics needed on these “big data” fields. A rough analysis suggested that the winning entry would have been several times more costly had traditional procurement models been used. What's more, the winner showed promise for enabling community groups to use the tool to make neighborhoods more active and focused in targeting health efforts. These experiences with innovation awards led BPHC to see prizes as cost-saving opportunities that could have unexpected additional benefits.

Given the success of its first prizes, BPHC looked for ways to partner with stakeholders both within and around the city to create a broader network of public health innovators. In 2016, it negotiated a strategic partnership with MIT to create an innovation funding and organizing platform that would allow diverse parties to come together and coordinate joint projects. Key participants in this network included the Center for Connected Health at Partners HealthCare and the Center for Integration of Medicine and Innovative Technology, a non-profit consortium of Boston's leading teaching hospitals and universities. This innovation funding and organizing platform greatly enhanced BPHC's ability to crowd-source not only innovative web and mobile applications, but also new business models and services from the broader community.

BPHC launched several new innovation prizes in public health areas identified through community meetings and focus groups. To ensure that the community was represented in the innovation process, BPHC stipulated that each team have at least one Boston resident as a member. Furthermore, said team member(s) had to come from the community or population for which the innovation was being created. This approach mirrored the research process that had been advocated by the Patient Centered Outcomes Research Institute (PCORI) since its establishment under the Patient Protection and Affordable Care Act and for decades by Federally Qualified Health Centers requiring a majority of their boards to come from the communities served.

A major shift in public health data analytics also occurred during this period. BPHC mapped the city using the Sustainable Communities Index that had been developed by the San Francisco Department of Public Health. The resulting map showed the location of all community entities that affected health – everything from hospitals and clinics to fast-food outlets and liquor stores. By 2019, the incorporation of new data sources and computational methods allowed BPHC (in collaboration with Accountable Care Organizations [ACOs], universities, and citizen scientists) to convert this map into a real-time virtual simulation of public health in Boston. Interventions could now be effectively modeled and their impacts explored. The simulation used both conventional health data sources, such as aggregated electronic health record (EHR) information, as well as novel data sources, like the city government's “Citizens Connect” phone service and smart sensors embedded in the Internet of Things (IoT). In BPHC's emergency preparedness function, the simulation also mapped the location and nature of Boston's various community organizations that could contribute useful capabilities during an emergency, such as time banks, civic associations, and neighborhood associations. For assessing health care quality, the simulation also drew upon patient-reported outcomes, crowdsourced data (like emergency room wait times), and social networking data, all of which became more representative of the community as low-income Bostonians took advantage of subsidized basic data plans for their smart phones.

One side benefit of real-time simulations of Boston's public health was that it allowed for more sophisticated impact assessment of BPHC's activities. Public health had long had difficulty showing a linear connection between a specific public health activity and its impact on the community. The more complex modeling allowed BPHC to capture the "butterfly effects" of efforts conducted by BPHC, partners, and others, where a seemingly minor action had contributed to a major improvement. This allowed BPHC to develop more sophisticated interventions and policies; to facilitate funding streams such as social impact bonds, shared cost savings or gain shares, and donations; and to justify its own funding, as state and federal funds (which had been reduced for many programs) came to account for populations served and were adjusted for the population's health risks. The more complex modeling was also accessible to residents, citizen scientists, and community-based organizations to identify opportunities for them to contribute to the impact of efforts, whether by direct involvement in delivery or implementation, or by submitting ideas for potential solutions.

Other Boston agencies and organizations were impressed with the complex modeling and the results of BPHC's innovation funding and organizing platform, and wondered how they could use these for their own purposes. In education, Boston Public Schools mapped students' test results to community conditions and identified the neighborhoods where it would be most impactful to develop mentoring, tutoring, after school programming, and other actions in the neighborhood to support students' learning. In community economic development, organizations crowdsourced new ideas for job creation in the most depressed neighborhoods. Energy and environmental efforts focused on community-designed solutions to integrate sustainability and to prevent and mitigate climate change impacts.

The growing use of apps and games did much more than simply facilitate data collection, surveillance, and citizen science. It also became increasingly more effective in offering health education and coaching, including teaching to reduce racial bias and raise awareness of racism. It helped increase access to health, social and economic services, and effectively enhance and increase public engagement in the development of neighborhood-specific prevention plans and goals. The use of apps and games also enabled the local residents to pressure both the public and private sectors to ensure that products and services met their goals.

As new business models emerged and expanded around innovations, BPHC increasingly shifted to emphasize its role in capacity-building, mapping, and incentivizing the development of public and private sector solutions and consumer tools. These included web and mobile applications to address public health challenges and to deliver public health functions. BPHC also monitored the innovations for quality, health equity and racial justice, and effectiveness in community engagement. The city implemented both targeted and general efforts in integrating health promotion into citywide health care, housing, schools, and workplaces. It also took advantage of the growing popularity of apps and digital health coaches that helped users to reduce stress and improve their mental and physical wellbeing. All of these efforts helped to significantly improve the health of all Bostonians, even reducing the prevalence of nicotine dependence and health disparities among Boston residents.

Improving community engagement was helping the city to not only improve health for all residents, but to also effectively minimized the cost and impact of extreme weather events that Boston faced over the years to 2030. Emergent community response groups had become routine since 2012, after Occupy Sandy (an offshoot of Occupy Wall Street) had mobilized volunteers to collect, distribute, and deliver food and supplies, all within hours of Hurricane Sandy's dissipation. BPHC used its pre-event resilience gaming activities to help community groups imagine and practice these "emergent" roles.

While BPHC was actively shifting its own roles in emergency preparedness, its role and services were also influenced by external developments in health care. Virtually all Bostonians gained access to effective health care, aided by digital health coaches and biomonitoring tools. Most providers joined integrated and capitated ACOs that were committed to lowering cost and improving population health. These providers developed expanded care teams (such as community health workers doing home visits) supported by the ACOs' information systems and each patient's digital health coach. The ACOs linked their community needs analysis to targeting of their funding and efforts to improve population health. BPHC joined in their analysis and provided leadership and coaching on the best opportunities and strategies focusing on community conditions. Having established itself as the most cost-effective provider of specific interventions, BPHC even sometimes received ACO funding. Given the increased access to care, and the fact that health care providers now dealt with conditions that used to be addressed by federal programs through public health agencies, BPHC moved largely out of providing direct clinical services. The exceptions were emergency medical, homeless, and addiction services. Fortunately, however, demand for these services declined as care, prevention, and access to health and socioeconomic services improved throughout the city.

In the late 2020s, what had started as an innovation platform had evolved into a sophisticated decision-making tool that was increasingly inclusive of all Bostonians. Through this tool, residents now had the opportunity to discuss and come to agreement on important policy issues that had previously been addressed by a small number of government officials behind closed doors. Candidates for Mayor and the Boston City Council now develop their positions in relation to these community efforts.

Thus, one of BPHC's largest contributions to public health over the years leading to 2030 was to blaze a trail of community engagement that leveraged the many resources that Boston always had but had never brought full to bearing – namely, its people. BPHC supported and led these endeavors with an increasingly smaller yet ever more knowledgeable, multidisciplinary, and fulfilled workforce that mirrored the city's demographics. While conversations in 2013 had focused on the constrained resources of the city government's budget, conversations in 2030 focus on the abundant resource that is the creativity and innovation of Bostonians.

Scenario Matrix

The following pages offer a side-by-side comparison of the scenarios across multiple dimensions. Each column is consistent with but not solely duplicative of the respective scenario.

	Scenario #1	Scenario #2	Scenario #3	Scenario #4
THE MACRO AND OPERATING ENVIRONMENTS				
Economy	<p>Slow U.S. economic growth with recessions in 2015 and 2022.</p> <p>Recovery in Boston disproportionately benefits more affluent populations.</p>	<p>Slow U.S. economic growth undercut by 2016 recession, intermittent growth in 2020s.</p> <p>Boston suffers national recessions, dramatic drop in higher education sector, and lasting damage from a 2018 superstorm; serious municipal finance challenges.</p>	<p>Strong economic recovery.</p> <p>Living wage is instituted statewide.</p>	<p>Slow and uneven U.S. economic recovery with a major recession in 2017.</p> <p>High unemployment.</p> <p>Health is understood as an economic good and benefit.</p>
Internet and Social Media	<p>Subsidized smartphones with basic data packages lower digital divide; use of health apps grows, integrated with personal biomonitoring.</p> <p>Internet of Things (IoT) provides enhanced social and environmental monitoring</p>	<p>More communication shifts to social media.</p> <p>Digital divide grows, including intergenerational differences.</p> <p>Misinformation more frequently leads to serious consequences.</p>	<p>Subsidized smartphones with basic data packages lower digital divide; use of health apps grows, integrated with personal biomonitoring</p> <p>Social networks facilitate personal wellbeing.</p>	<p>Highly intuitive and adaptive technologies and subsidized minimum connection data packages eliminate digital divide.</p>

	Scenario #1	Scenario #2	Scenario #3	Scenario #4
THE MACRO AND OPERATING ENVIRONMENTS				
Health Information Technology	In all scenarios, EHRs that integrate genetic and medical information become ubiquitous and interoperable with secure cloud-based access and analytic services that enable public health analytics.			
	<p>EHRs also take into account personal biomonitoring data, social networking data, and risk factors related to the social determinants of health.</p> <p>Digital health coaches used by some, particularly affluent.</p> <p>Cognitive computing tools analyze all relevant knowledge on any aspect of health care, facilitate decision-making.</p>	<p>EHRs are limited to genetic, medical, and very basic demographic information.</p> <p>Growth of "virtual doctors" and digital health coaches; free and ad-supported versions often provide inadequate diagnoses and recommended products from their advertisers.</p>	<p>Ubiquitous and interoperable EHRs take into account personal biomonitoring data, social networking data, and risk factors related to the social ecology of health.</p> <p>A wide range of apps link individuals, their biomonitoring tools, EHRs, and personalized digital health coaches.</p>	<p>Digital health coaches and private and public systems collecting health and SDH data are secure, interoperable, and ubiquitous.</p> <p>Data is effectively anonymized, city government makes available all data not protected by privacy laws.</p>
Health Care	In all scenarios, only 2% of Massachusetts residents remain uninsured.			
	<p>Virtually all residents have access to care. Major local systems become Accountable Care Organizations (ACOs); most care is integrated, capitated.</p> <p>All providers incorporate tobacco assessment, counseling, and referral practices into overall wellness and treatment plans.</p>	<p>Insurance coverage does not mean access to good care. Worsening shortages of health care providers, payment reductions, and cost of care pose significant challenges with access to actual, quality, and comprehensive care and services – disproportionately affect the poor.</p>	<p>All residents have access to affordable, high quality, and comprehensive health care. Health care providers are more consolidated and capitated. Prevention is an integral part of care.</p>	<p>ACOs provide great care to all using expanded care teams and self-care tools. Residents in low-income communities receive high quality care.</p> <p>Prevention is funded through bundled payments linked to health outcomes.</p>
Health Care Providers' Role in Population Health	<p>Focus on high-utilizers of health care services to provide them with highly coordinated care (hot spotting).</p> <p>Some ACOs address social determinants of health.</p>	<p>Focus on hot spotting and enhanced care management of highest utilizers.</p>	<p>In addition to hot spotting, many ACOs target and support population health activities that are most needed, fund community groups and BPHC to address the social determinants of health.</p>	<p>Perform and share analyses of community health trends, conduct hot spotting, and fund community groups to address the social determinants of health.</p>

	Scenario #1	Scenario #2	Scenario #3	Scenario #4
THE MACRO AND OPERATING ENVIRONMENTS				
Citizen Science and Engagement	<p>Widespread participation in data collection through everyday consumer products and Internet of Things and its aggregation for citizen group analysis.</p> <p>Some residents, groups use their own analyses and public discussions to hold regulatory bodies, companies accountable.</p>	<p>Better-off individuals, families, and communities are able to organize data, extract valuable intelligence from it, and use it to improve their communities.</p>	<p>Crowd-sourced and equitable participation.</p> <p>Individual and groups of active citizens conduct their own analyses and hold regulatory bodies and companies accountable.</p>	<p>Residents participate in public health innovation process. Many provide oversight to community-based testing and implementations of innovations.</p> <p>Most contribute to citizen science, do monitoring, and participate in holding regulatory bodies and companies accountable.</p>
Climate Change Effects and Mitigation	<p>Increased sea-level rise, summer heat waves, and increases in storm intensity and/or frequency.</p> <p>2018 superstorm dramatically exposes disparities in recovery.</p> <p>Declining air quality periodically increases asthma and other conditions, particularly in low-income neighborhoods.</p>	<p>Prevalence, impact, and cost of floods, hurricanes, strong winter storms, and heat waves grow significantly. Growth of “climate refugees” in the city and shelters.</p> <p>Periodic contamination of food and drinking water; reduced air quality, stagnant water, and overcrowding of housing units. 2018 superstorm destroys Long Island Bridge, leads to long-term economic damage.</p>	<p>Growing frequency of large and vicious storms and periodic summer heat waves.</p> <p>BPHC and community resilience efforts improve sustainability and adaptability of the city. This prevents or lowers cost of damage, makes recovery quicker particularly for low-income neighborhoods.</p>	<p>Prevalence of floods, hurricanes, strong winter storms, and heat waves grows.</p> <p>Cost and impact of disasters are effectively reduced, prevented or managed through improved planning and widespread participation in preparedness, mitigation.</p>
Health Threats	<p>Growing frequency of asthma attacks and infectious disease outbreaks.</p> <p>Growing prevalence of cancers, mental and behavioral health problems, and chronic diseases.</p>	<p>Increased mold, asthma prevalence; heat wave damage.</p> <p>Growing prevalence of cancers, mental and behavioral health problems, asthma and other chronic diseases.</p>	<p>Bacterial and infectious disease outbreaks driven by climate change.</p>	<p>Bacterial and infectious disease outbreaks driven by climate change.</p>
Health Equity and Disparities	<p>Significant declines in health disparities for certain racial and ethnic minorities.</p>	<p>Disparities worsen, longer life expectancy for some leads to extraordinarily disabled adults.</p>	<p>Significant reductions in inequities, some inequities in violence are entirely eliminated.</p>	<p>Significant reductions in health inequities across health conditions and neighborhoods.</p>

	Scenario #1	Scenario #2	Scenario #3	Scenario #4
BOSTON PUBLIC HEALTH COMMISSION (BPHC)				
Funding	<p>Periodic cuts in federal and state funding.</p> <p>Funding streams incentivize collaborations on specific health concerns, emergency preparedness, and environmental health.</p>	<p>Reductions in federal, state and often city funding.</p> <p>Funding priorities lead BPHC to focus on environmental health, infectious disease control and prevention, and emergency preparedness.</p>	<p>State and federal funds account for populations served.</p> <p>Funding streams incentivize multi-sectoral collaborations, community prevention, and policy work.</p> <p>Federal categorical funding, where not reduced or eliminated, allows payment for accreditation and building foundational capabilities.</p>	<p>Reduced federal funds for some categorical programs. State and federal funds account for populations served.</p> <p>New funding streams include shared cost savings or gain sharing from ACOs, fees on social impact bonds, and crowdsourced funding.</p>
IT and Informatics	<p>Improved data systems, flow, and infrastructure facilitate oversight and data collection, reduce administrative and reporting costs, integrate with health providers' network of interoperable EHRs and other local, state, and federal surveillance systems.</p>	<p>BPHC struggles to keep up with informatics advances. Most advanced analytics are done by hired analysts or by competitors.</p> <p>Challenged to close the gap between antiquated tools and approaches; and significant blind spots in data collected.</p>	<p>Platform agnostic cloud backbone provides storage and analytics, enables BPHC to conduct advanced analytics and real-time simulations of the city.</p> <p>New knowledge technologies improve assessments, evaluation of ROI of BPHC services, and ability to target resources and tailor services.</p>	<p>Platform agnostic cloud backbone provides storage, data is accessible to BPHC and (in anonymized and user-friendly form) to the public for analysis and use.</p> <p>Facilitates ROI and quality assessments and improvements for BPHC and services provided through volunteer, community-based, and private entities.</p>
Workforce (1,101 employees in 2013)	<p>880 employees, 20% reduction. Best and brightest in public health are hired away by delivery systems.</p>	<p>550 employees, 50% reduction. Overworked, and often undertrained.</p>	<p>880 employees, 20% reduction. Increased staff diversity at all organizational levels.</p>	<p>550 employees, 50% reduction. Staff diversity mirrors city demographics.</p>

	Scenario #1	Scenario #2	Scenario #3	Scenario #4
BOSTON PUBLIC HEALTH COMMISSION (BPHC)				
Surveillance and Epidemiology	<p>BPHC works with more granular data, adjusts data collection methods to accommodate new data sources; and concentrates on analysis, interpretation, and response to surveillance.</p> <p>Facilitates hot spotting efforts by health care providers.</p> <p>ACOs and BPHC rely on universities and private entities to provide "big data" analyses.</p>	<p>BPHC forecasts and provides early-warning for likely asthma attacks and other issues by neighborhood.</p> <p>Challenged to keep up with evolving systems; citizen, social media and internet-based reporting periodically overwhelm BPHC capacity to respond appropriately.</p>	<p>BPHC methodologies and analyses effectively integrate traditional and new data streams.</p> <p>Supports health care providers and community groups in identifying, targeting, and eliminating health disparities.</p>	<p>BPHC provides technical assistance, training, and quality monitoring of surveillance and analyses conducted by ACOs, universities, community-based organizations, and citizen scientists.</p> <p>Incentivizes public and private sector solutions and consumer tools that facilitate surveillance and citizen science.</p>
Health education and promotion	<p>Significant portions of these services are adopted by ACOs.</p> <p>BPHC focuses on in-person outreach for growing number of elders, and health literacy programming and training among health care providers.</p> <p>Uses games, digital coaches, and simulations to improve health education.</p> <p>Provides quality control on the widespread application of digital health coaches by health care providers.</p>	<p>Messaging and marketing become more tailored, but BPHC's info is tuned out among proliferating communication tools and forms.</p>	<p>BPHC promotes the integration of health promotion into schools, and new community activities (e.g., time banking).</p> <p>Assures cultural competence and affordability of digital health coaches and apps that effectively guide users toward healthy behaviors.</p> <p>Develops health dashboards for each neighborhood and "Privileged", a highly successful game that shows the effect of greater opportunities and of disparities on health.</p>	<p>BPHC provides technical assistance, training, and quality monitoring of health education and promotion conducted by ACOs, universities, community-based organizations, and citizen scientists.</p> <p>Incentivizes services and consumer tools that facilitate behavior change, dissemination, and addressing of social ecology of health.</p>

	Scenario #1	Scenario #2	Scenario #3	Scenario #4
BOSTON PUBLIC HEALTH COMMISSION (BPHC)				
Chronic Disease Prevention and Control	<p>BPHC shifts toward capacity building and policy work, reduces-disease specific efforts.</p> <p>Trains hospitals and others on hiring and training community health workers (CHWs).</p> <p>Facilitates hot spotting efforts by health care providers.</p>	Funding largely eliminated.	<p>Continues to provide leadership and builds partnerships for citywide, integrated prevention approaches.</p> <p>Maintains healthy eating, active living efforts.</p> <p>Trains hospitals and others on hiring and training CHWs, especially for primary care teams.</p>	BPHC provides technical assistance, training, and quality monitoring for chronic disease control and prevention efforts conducted by ACOs, schools, universities, community-based organizations, and citizen scientists.
Infectious Disease Prevention and Control	<p>Improved surveillance enables faster awareness and response – including isolation and quarantining – to major and minor infectious disease outbreaks.</p> <p>Focuses on climate-driven outbreaks of water- and vector-borne infectious diseases such as Legionnaires' disease, West Nile, and dengue fever.</p>	<p>Improved surveillance enables faster awareness and response – including isolation and quarantining – to major and minor infectious disease outbreaks.</p> <p>Increased infectious outbreaks because of storms and flooding.</p>	Improved surveillance (including social media use) enables faster awareness and response to major and minor infectious disease outbreaks.	<p>BPHC accelerates identification of outbreaks using aggregated data, including social media.</p> <p>BPHC is joined in this analysis by ACOs, universities, community-based organizations, and citizen scientists.</p> <p>Maintains core responsibilities such as quarantine and isolation authorities.</p>
Emergency Medical Services	<p>Demand for services declines with improved care coordination by ACOs.</p> <p>Improved on-site assessments, increased treatments at home, and payment for house calls to check on patients for fall prevention and self-management.</p>	<p>Demand for services grows with climate change impacts, residents hesitate to call the ambulance to avoid incurring costs they cannot pay.</p> <p>Shortages in basic EMS supplies and functioning equipment.</p> <p>Non-garaged ambulances challenged in major storms.</p>	<p>911 calls decline with improving care and prevention.</p> <p>EMS often treats 911 callers at home, preventing unnecessary hospitalization.</p> <p>EMS contribution to outcomes are evaluated, not just response time.</p>	<p>Demand for services declines with improved care and prevention.</p> <p>EMS partners with other BPHC bureaus to incentivize the development of and equitable access to quality services and consumer tools that improve self-management and prevent medical emergencies.</p>

	Scenario #1	Scenario #2	Scenario #3	Scenario #4
BOSTON PUBLIC HEALTH COMMISSION (BPHC)				
Violence Prevention	In all scenarios, BPHC drops direct services and shifts even more to capacity-building.			
	<p>Primarily relies on trauma-informed treatment strategies, and individual community initiatives through health care and BPHC initiatives to promote positive youth development, improve quality of life for victims, increase awareness about domestic violence, provide access to BPHC Family Justice Center services, and stop teen dating abuse.</p> <p>Some declines in violence but economic and environmental challenges perpetuate disparities.</p>	<p>Need for trauma-informed care and violence prevention grows, fueled by growing income disparity, availability of guns, and climate change impacts.</p> <p>Growth of violence exacerbates disparities among communities.</p> <p>Regression to law-enforcement model.</p>	<p>BPHC facilitates systemic and sustained quality improvement efforts in health care, educational institutions, workplaces, and other venues to provide ubiquitous capabilities in effective violence prevention and mitigation.</p> <p>Schools enhance social and emotional learning for kids.</p> <p>All health care providers include violence risk and exposure in childhood screening. Findings prompt more investment in violence prevention efforts.</p>	<p>BPHC provides technical assistance, training, and quality monitoring for violence prevention activities conducted by community organizers, ACOs, universities, and community-based organizations.</p> <p>Incentivizes development of child and youth services (e.g., mentoring, tutoring, and after school programming), and community economic development.</p>
Emergency Preparedness	<p>BPHC uses simulations and games to facilitate drills, increase readiness and response capacity, and anticipate and mitigate impacts on the hardest-hit populations.</p> <p>EHRs facilitate tracking of patients and family reunification.</p>	<p>After the superstorm in 2018, BPHC is provided with the funding and support to promote equitable planning and improve coordination with state disaster response agencies, national and local nonprofits, and the Department of Homeland Security.</p>	<p>Co-develops and coordinates across agencies to implement specific metrics as they relate to health and medical impacts of emergencies, particularly for the most vulnerable.</p> <p>Uses real-time data, games, and simulations to improve preparation, resilience, response, and recovery.</p>	<p>BPHC provides technical assistance, training, and quality monitoring for emergency preparedness efforts conducted by ACOs, universities, and community-based organizations.</p> <p>Fosters emergent post-event groups like Occupy Sandy.</p> <p>Assures integration of equity and racial justice lens into community planning, emergency preparation, mitigation, and recovery.</p>

	Scenario #1	Scenario #2	Scenario #3	Scenario #4
BOSTON PUBLIC HEALTH COMMISSION (BPHC)				
Environmental Health	In all scenarios, BPHC continues protection from environmental hazards, laboratory safety, and lead poisoning.			
	<p>Responds to growing environmental health violations driven by climate events.</p> <p>Expands environmental health awareness in policies and environmental education programming.</p> <p>Promotes and regulates urban gardening (e.g., waste management, and animal farming).</p>	<p>Environmental health violations grow with climate events, economic downturns. BPHC increases reliance on law enforcement to address personal behavior as it relates to environmental health violations.</p> <p>Increased flooding, and need for spill and contamination cleanup.</p>	<p>Promotes and monitors alternative economics activities (e.g., urban gardening, time banking) to reduce disparities, offers technical assistance.</p> <p>Uses real-time data and simulations to improve city's planning.</p>	<p>BPHC provides technical assistance, training, and quality monitoring for environmental health efforts conducted by other agencies, universities, and community-based organizations.</p> <p>Promotes and monitors alternative economics activities such as urban gardening and time banking, offers technical assistance.</p>
Early Childhood, Adolescent, and Family Health	<p>Federal Maternal and Child Health program funding declines as health care provides these services.</p> <p>Systematic screening increases demand for services, but demand exceeds funding and provider shortages remain.</p> <p>Helps all Boston public schools integrate health education and sexually transmitted infection prevention programming.</p>	<p>Most federal Maternal and Child Health program funding declines as health care formally adopts these services and budgets are constrained.</p> <p>Early childhood health worsens as mental health concerns are frequently missed during pediatric visits.</p> <p>Many non-federally funded resources and services are cut.</p>	<p>BPHC loses most federal maternal and child health funds as health care provides most of these services.</p> <p>Successfully organizes and assures universal access to child, adolescent, and family health services and after-school programs.</p>	<p>Loses most federal maternal and child health funds as health care provides most of these services.</p> <p>Facilitates highly diverse collaborations to map and identify where it would be most impactful to develop new services or adjust existing ones, including mentoring, tutoring, and after-school programs.</p>

	Scenario #1	Scenario #2	Scenario #3	Scenario #4
BOSTON PUBLIC HEALTH COMMISSION (BPHC)				
Health Equity and Racial Justice (HERJ)	<p>BPHC coordinates across its bureaus and efforts to consistently focus on HERJ.</p> <p>Works closely with selected leaders of other government agencies and health care provider organizations to develop and implement benchmarks, and conducts evaluations for these organizations.</p>	<p>BPHCs efforts are reduced as funding declines, even as health equity and racial justice worsen.</p>	<p>BPHC becomes a role model for a socially just and health-promoting workplace. HERJ focus permeates city agencies, governing boards.</p> <p>BPHC brings benchmarks to other agencies and organizations, measurement and evals are owned by the organizations themselves.</p> <p>Works with health education and promotion staff on the “Privileged” game and its use.</p>	<p>BPHC provides technical assistance, training, and quality monitoring for BPHC bureaus, other government agencies, health care, schools, universities, community-based organizations, and citizen scientists in integrating HERJ focus, conducting evaluations, and identifying strategies to improve.</p> <p>HERJ stimulates a focus on fairness and equity in the discussions on the innovation organizing platform</p>
Addictions Prevention, Treatment, and Recovery Support	In all scenarios, BPHC becomes licensed to provide fully integrated behavioral health and trauma-informed services.			
	<p>Partners with ACOs as a cost-effective “one-stop shop” for prevention, treatment, recovery support.</p> <p>Coordinates services across BPHC bureaus, builds capacity for integrated treatment, improves universal screening protocols to appropriately identify clients in need of support.</p>	<p>Demand for services grows with economic challenges and personal stress.</p> <p>Loss of Long Island facility reduces capacity.</p> <p>BPHC role and funding reduced.</p>	<p>Demand for services grows with improving access to care. BPHC is low-cost and preferred provider, major funding from ACOs for coverage.</p>	<p>Demand declines with improvements in access to services, community prevention, and proliferation of meaningful and recognized work and volunteer opportunities.</p>
Homeless services	<p>Demand for services increases, but funding remains insufficient.</p> <p>Insurance helps fund housing. Follow-on services subject to changing funding priorities.</p>	<p>Demand for services increases, but funding remains stable.</p> <p>Loss of Long Island shelter, garden, and other services in major storm. Foundations offer old school facilities as low-income/homeless housing.</p>	<p>Demand for services remains stable.</p> <p>Provides quick turnaround triage; links and targets resources and services effectively; provides humane, rehabilitative conditions.</p>	<p>Homeless shelters and services remain but are reduced because of home sharing, increased formal employment and co-production, self-sufficiency, mental health services.</p>