Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.
Prioritizing Child Health: Promoting Adherence to Well-Child Visits in an Urban, Safety-Net Health System During the COVID-19 Pandemic

Arvin Garg, MD, MPH; Tracey Wilkie, MA; Alison LeBlanc, MS, PMP; Rulan Lyu, MS; Thomas Scornavacca, DO; Josephine Fowler, MD, MSc; Lawrence Rhein, MD, MPH; Eric Alper, MD

Background: After discovering racial/ethnic disparities in adherence to well-child visits, UMass Memorial Health worked to identify and mitigate barriers to adherence for patients and families across 53 primary care practices in central Massachusetts.

Methods: When the systemwide goal to reduce racial/ethnic disparities in well-child visit adherence was established, a multidisciplinary team of leaders from UMass Memorial Health worked together to engage patients and stakeholders to identify obstacles to adherence. Transportation, language, and scheduling were identified as barriers. The team employed a number of countermeasures to address these barriers: A new workflow was created for requesting free curb-to-curb transportation for Medicaid patients, practices were provided with tip sheets for accessing interpreter services, and a protocol for scheduling appointment reminders was developed. In addition, the team leveraged robust data analytics to communicate real-time data to practices to keep them informed of their progress toward the system’s health equity goal. Primary data results are reported from October 1, 2020, to September 30, 2021.

Results: For patients who identified as Hispanic/Latinx, adherence rose from 64.3% at baseline to 74.1% (p < 0.001); and for patients who identified as Black/African American, adherence rose from 58.7% at baseline to 71.9% (p < 0.001). The gap in adherence to well-child visits for Black/African American and Hispanic/Latinx children compared to White children narrowed (12.4 percentage points to 5.1; p < 0.001; 6.8 percentage points to 2.9; p < 0.001).

Conclusion: Through a unique partnership between health system leaders, frontline staff, and the system’s informatics team and by engaging caregivers to identify and address barriers to well-child visits, UMass Memorial Health was able to improve adherence to well-child visits among patients who identify as Black/African American or Hispanic/Latinx.

Despite medical and scientific advancements, racial/ethnic health inequities continue to increase in the United States. These inequities begin in childhood, persist throughout adulthood, and are often intergenerational.1–3 For example, Black children have higher rates of asthma than White children (12.6% vs 7.7%).6,7 Black and Latinx adults have higher rates of hypertension and depression than White adults, while Asian and Latinx adults have higher rates of diabetes mellitus.7–9 The COVID-19 pandemic has further exacerbated inequities with the racial gap in life expectancy between Black and White US residents, which has widened to six years.10

In addition, macro-level social, economic, and political factors create lifelong health inequities characterized by poverty, adversity, and distress, which shape and influence health behavior, stress, and social dynamics, contributing to disparate health outcomes and disease burden.11 These factors directly create inequitable living environments, environmental exposures, and social circumstances; namely, the social determinants of health (SDOH). SDOH—the social circumstances in which people are born, work, live, and age and the wider set of forces and systems shaping the conditions of daily life—are key drivers of health and affect disparities in health outcomes across the life course.11–13 To achieve health equity, health systems will need to address the downstream consequences of these policies on patients as well as embrace their role as anchor institutions to advocate for more equitable social and health policies.

In 2020 Eric Dickson, MD, MHCM, FACEP; UMass Memorial Health’s president and chief executive officer, charged the UMass Memorial Health system leadership with identifying opportunities to promote equity in health care access and outcomes. Leveraging health record data, a multidisciplinary team of leaders discovered large racial and ethnic disparities in adherence to well-child visits. As the goal for well-child visits is to promote optimal health, development, and well-being, the team recognized this disparity as a critical threat to child health. To address this health care inequity, UMass Memorial Health created a multidisciplinary working group with the aim of understanding the barriers to well-child visit adherence among families of color and mitigating those barriers. The overall goal of the
project was to improve the adherence to well-child visits by 5 percentage points (from ∼64% to 69%) for patients who identify as Hispanic/Latinx and for patients who identify as Black/African American (from ∼59% to 64%) over a one-year time period.

METHODS

Study Site

UMass Memorial Health is a safety-net health care system that provides care to patients in central Massachusetts and its surrounding communities. It includes four hospitals: UMass Memorial Medical Center, UMass Memorial Health-HealthAlliance-Clinton Hospital, UMass Memorial Health-Marlborough Hospital, and UMass Memorial Health-Harrington Hospital. It is the largest health system in central Massachusetts, and the second largest in the Commonwealth of Massachusetts.

Health Equity Promotion in a Safety-Net Health Care System

UMass Memorial Health regularly reviews quality metrics to ensure that it is providing outstanding care to all. The hospital’s analytics team developed a Health Equity Ambulatory Quality Dashboard (Figure 1) to report on performance rates of the Ambulatory Quality Measures (Healthcare Effectiveness Data and Information Set [HEDIS®]) from its payer contracts by race, ethnicity, and language. HTN, hypertension; BP, blood pressure.

Figure 1: The hospital’s analytics team developed a Health Equity Ambulatory Quality Dashboard to report on performance rates of the Ambulatory Quality Measures (Healthcare Effectiveness Data and Information Set [HEDIS®]) from its payer contracts by race, ethnicity, and language. HTN, hypertension; BP, blood pressure.
Securing Leadership Buy-In and Support

A multidisciplinary team worked to identify barriers to well-child visit adherence among families of color. The team included clinical and administrative leaders from Pediatrics, Family Medicine, Population Health, Informatics, and Registration. From the outset, the team engaged with a variety of internal and external stakeholders to understand the potential barriers and facilitators to well-child visit adherence. Informal interviews were conducted with patient-facing staff, providers, and administrative leaders to understand families’ challenges to well-child visit adherence across the UMass Memorial Health system. In addition, the team leveraged the expertise of a robust analytics team and data scientist who examined practice-level data by race and ethnicity to identify areas for improvement. Overall, 53 practices (pediatrics, family medicine) within the UMass Memorial Health system were identified as providing pediatric care, and specifically well-child visits.

To ensure the success of the project, the team met on a regular basis to review progress toward its goals and engaged executive leadership from the hospital system to support the implementation of strategies to improve adherence to well-child visits and promote health equity overall.

Addressing Barriers

First, a systemwide health equity goal related to improving adherence to well-child visits among families of color was set and communicated to primary care and quality leaders in each participating practice. In communications, leaders were encouraged to think creatively about ways to improve adherence to well-child visits. One strategy for improvement identified and shared with leaders was to conduct well-child visits during acute care appointments to help patients avoid making multiple trips to the hospital or practice setting. Our performance on the metric was also shared monthly with our senior leadership team and board of trustees.

Second, the analytics team created individual dashboards for each pediatric practice. Dashboards allow practice leaders to review performance by race, ethnicity, and preferred language in real time and target tailored interventions driven by the local practice.

Third, information was gathered from Black/African American and Hispanic/Latinx caregiver and parent interviews to identify barriers by conducting a root cause analysis to explore barriers to health care access among caregivers and parents more deeply. The health system collaborated with Massachusetts Health Quality Partners (MHQP) and conducted 30 qualitative interviews with a linguistically and culturally diverse group of parents/caregivers/adolescents (15 with English speakers and 15 with Spanish speakers) to identify common barriers to well-child visits. From the qualitative interviews, transportation, language, and scheduling emerged as key barriers to adherence.

Fourth, the team created tools and resources to help practices address the most common barriers to adherence that were identified by caregivers and parents. To address transportation barriers, the team developed a workflow to help providers leverage the Provider Request for Transportation form (PT-1), which allows providers to request free curb-to-curb transportation for Medicaid patients. The team found that PT-1 forms were underutilized due to their complex nature. Thus, by streamlining these forms and workflows, providers were better able to request rides for their patients. To address language barriers, the team created tip sheets for providers to access interpreter services (in-person, iPad, and telephone interpreter options were made available). To address scheduling challenges, the team worked with an outside vendor to establish a protocol for regular appointment reminders. The vendor was able to outreach to patients overdue for appointments, remind patients of upcoming appointments several days ahead of time, and send a final appointment time on the day of the appointment. These strategies to address transportation, language, and scheduling barriers were employed throughout all 53 primary care practices, which served 34,142 patients aged 0 to 21 years.

Statistical Analysis

Descriptive statistics were used to track monthly changes over time with well-child visit adherence. As mentioned above, we used the BGV to measure the deviation of each racial/ethnic group’s measure rate from the overall measure rate and weight each group by its population size. The two-sample z-test of proportions was used to determine if the change in the adherence rate for well-child visits for each racial/ethnic group over the one-year time period was statistically significant. Using the four-sample z-test of proportions, we determined whether changes in the well-child visit adherence gaps between White and Black/African American children and between White and Hispanic/Latinx children were significant. Statistical significance was defined as \( p < 0.05 \).

RESULTS

By the end of the project year (October 1, 2020, to September 30, 2021), adherence to well-child visits improved significantly compared to baseline. Overall, for patients who identify as Hispanic/Latinx, adherence rose from 64.3% at baseline to 74.1%, \( p < 0.001 \), and for patients who identify as Black/African American, adherence rose from 58.7% at baseline to 71.9%, \( p < 0.001 \). For White patients, adherence also rose, from 71.1% to 77.0%, \( p < 0.001 \). (Figure 2). The greatest improvement was achieved among patients aged 3 to 21 years (data not shown). However, we found persistent high disparities for Hispanic/Latinx children aged younger than 15 months for well-child visits (data not shown).
DISCUSSION

This project was able to significantly reduce the racial gap in well-child visits in a large safety-net health system despite the fact that it was conducted during the pandemic. We were able to achieve this, and markedly surpass our targeted benchmarks, by aligning various hospital leaders and staff with a common goal, using data in real time to measure progress, engaging and listening to caregivers who helped us identify critical barriers, and working with frontline staff to identify potential solutions. Engaging patients to identify problems with health care access and then help health system leaders to design patient-centered solutions that are culturally responsive to eliminate health inequities is an important future direction that UMass Memorial Health plans to pursue. We hope that other health systems across the United States will replicate this novel model of practice transformation and implementation of health equity initiatives.

Overall, we believe this is an important and timely project geared toward improving well-child adherence for children of color that has important implications for advancing health and health care equity in the United States. Children are the poorest segment of the US population, with 2 in 5 children living in impoverished conditions. Since 2020, for the first time in history, the majority of children in the United States are Black, Indigenous, or people of color. Low-income children of color, who represent 70% of all low-income children and 26% of children overall in the United States, face the consequences of experiencing poverty and structural and interpersonal racism throughout their lives. Our results suggest that it is possible for health systems to take actions to reduce the racial and ethnic inequities with well-child visits.
Figure 3: Shown in the graph is the change in between-group variances (BGVs) by race/ethnicity during the study period and three months post study period (October 1, 2020, to December 31, 2021).

We recognize that reviewing quality data by race and ethnicity itself is not innovative; however, specifically designing health equity initiatives to address health care disparities is relatively novel and uncommon for health care systems to prioritize. Furthermore, leveraging visual analytics and real-time dashboards to illustrate not only the existing disparities but the need for change down to the individual patient level is a promising concept for health care overall. Although technology has advanced rapidly over the past several years, health equity–focused data analytics, unlike patient safety, are often underutilized in the health care setting. In addition, quality and performance data (including health equity metrics) are sometimes several months old by the time they get to end users. In our case, the health system analytics team was able to create robust data dashboards with real-time practice-level data to help clinicians and staff track their progress. Given the great success of this project and the overwhelming support for data dashboards by clinicians and staff, the hospital has invested in providing practice-level, real-time analytics to all departments, with a particular focus on health equity. These dashboards will empower local practice leaders to identify areas of disparity and work to address them; they will remain in place and will continue to provide practices with real-time data. In addition, resource and tip sheets created to help providers reduce barriers to adherence to well-child visits will continue to be updated.

To build on the momentum created by the project and continue to close racial/ethnic disparities, there is recognition among the team members and leaders that achieving equity will require addressing the downstream effects of racialized policies and the resultant adverse SDOH (poverty and its associated risk factors, such as lack of transportation and competing demands such as food insecurity and housing instability) that disproportionately negatively affect Black/African American and Hispanic/Latinx families. Nearly all participants in our qualitative interviews with parents/caregivers cited adverse SDOH as the primary barrier to adherence. We believe that the persistent high disparity for Hispanic/Latinx children aged younger than 15 months for well-child care visits was driven by these barriers, including parking cost and transportation. UMass Memorial Health is currently examining how to mitigate these critical factors facing our youngest pediatric population. Although the project team was unsurprised by these findings, they confirmed the team’s overall hypothesis that there is still significant work to be done to remove key barriers to care for patients and families.

Challenges
The project was first implemented during the second wave of the COVID-19 pandemic in New England. While it was a time of great tribulation for the health system, pediatric and health systems stakeholders remained cognizant of the long-term effects of lack of adherence to well-child visits. Fearing the return of previously dormant childhood diseases that have been eradicated by childhood immunizations (for example, pertussis), the project team and stakeholders committed to implementing strategies for improving adherence to well-child visits among patients of color.

Given the constraints on the health system at the time, improvement was slow. To increase momentum, the team
ramped up education, outreach, and deployment of robust visual analytics that helped illustrate the need for improvement. By March 2021, as COVID-19 vaccinations became more readily available and the pandemic was subsiding temporarily, there was a large uptick in well-child visits for all children, with Black/African American and Hispanic/Latinx children completing more of these visits compared to White children.

Next Steps
UMass Memorial Health is exploring expansion of this project to other clinical areas where disparities between racial and ethnic groups persist. Specifically, the health system is looking to improve adherence to colon cancer and osteoporosis screenings among patients of color. Given the inequities in adherence to medical visits among patients who identify as Black/African American and patients who identify as Hispanic/Latinx as well as the stark disparities in screening and outcomes among patients of color due to structural racism and adverse SDOH, expansion to routine preventive screening is vital to promoting health equity. Finally, the health system’s quality care and population health informatics teams are planning to devise a health equity dashboard across all specialties at UMass Memorial that will allow each department to identify current racial inequities with care and disease outcomes and engage them in devising quality improvement projects to address these disparities.

Limitations
There are several important limitations for this project. We are reporting experiences from one health system in central Massachusetts, and our findings may not be generalizable. We also are aware that we were fortunate to have a robust population health and informatics team that allowed us to develop health equity dashboards in real time. Finally, although we found that the narrowing in the racial gap persisted three months post-completion of the project, the viability and long-term benefits from this project remain uncertain.

CONCLUSION
The UMass Memorial Health system was able to significantly improve adherence to well-child visits among patients who identify as Black/African American (58.7% to 71.9%) and patients who identify as Hispanic/Latinx (64.3% to 74.1%) from October 2020 to September 2021, thereby reducing racial/ethnic disparities in adherence while simultaneously promoting health equity. This project was successful due to a unique partnership between health system leaders, frontline staff, population health, and the system’s informatics team, and by engaging parents and caregivers to identify and address barriers to well-child visits. Although racial inequities were narrowed, it is important to acknowledge that they were not eliminated. In addition, given that progress toward reducing disparities in adherence was not consistent throughout the project period, the long-term sustainability and benefits of the intervention are unknown. Ultimately, health systems will need to address the downstream effects of racialized policies and the resultant adverse social determinants of health that their historically marginalized patient populations continue to experience to reach this goal. Achieving health equity will require health systems to build upon our work and learn from one another to continue to innovate and deliver equitable care for all.

ACKNOWLEDGMENTS
The authors would like to acknowledge the generous contributions from caregivers, office staff, health care team members, data analysts from the UMass Memorial Health Office of Clinical Integration, and the Well-Child Visit Health Equity Measure Improvement Workgroup. We also want to acknowledge Massachusetts Health Quality Partners (MHQP) for their expertise and efforts conducting qualitative interviews with parents, caregivers, and adolescents, which guided our work. Finally, we are indebted to the leadership at UMass Memorial Health and UMass Memorial Medical Center who made this work possible.

CONFLICTS OF INTEREST
All authors report no conflicts of interest.

REFERENCES
1. Halfon N, Hochstein M. Life course health development: an integrated framework for developing health, policy, and research. Milbank Q. 2002;80:433–479.
2. Poulton R, et al. Association between children’s experience of socioeconomic disadvantage and adult health: a life-course study. Lancet. 2002 Nov 23;360:1640–1645.
3. Shonkoff JP, et al. The lifelong effects of early childhood adversity and toxic stress. Pediatrics. 2012;129:e232–e246.
4. Ben-Shlomo Y, Kuh D. A life course approach to chronic disease epidemiology: conceptual models, empirical challenges and interdisciplinary perspectives. Int J Epidemiol. 2002;31:285–293.
5. Shonkoff JP, Boyce WT, McEwen BS. Neuroscience, molecular biology, and the childhood roots of health disparities: building a new framework for health promotion and disease prevention. JAMA. 2009 Jun 3;301:2252–2259.
6. Centers for Disease Control and Prevention. Health, United States; 2018, 2019. Accessed Jan 27, 2022. https://www.cdc.gov/nchs/data/hus/hus18.pdf.

Arvin Garg, MD, MPH, is Professor, Department of Pediatrics, University of Massachusetts (UMass) Chan Medical School, Worcester, Massachusetts, and Associate Chief Quality Officer for Health Equity, UMass Memorial Health, Worcester. Tracey Wilkie, MA, is Senior Director, Population Health, UMass Memorial Medical Center, Worcester, and Manager, Population Health Reporting and Analyses, Office of Clinical Integration, UMass Memorial Health. Alison LeBlanc, MS, PMP, is Executive Director, Child Health Equity Center, UMass Memorial Medical Center. Rulan Lyu, MS, is Senior Data Scientist, UMass Memorial Health. Thomas Scornavacca, DO, is Chief Medical Officer, Population Health, Office of Clinical Integration, UMass Memorial Health, and Instructor, Department of Family Medicine and Community Health, UMass Chan Medical School. Josephine Fowler, MD, MSc, is Vice Chair of Clinical Services, UMass Memorial Medical Center, and Associate Professor, Department of Family Medicine and Community Health, UMass Chan Medical School. Lawrence Rhein, MD, MPH, is Associate Professor and Chair, Department of Pediatrics, UMass Chan Medical School. Eric Alper, MD, is Chief Quality Officer and Chief Informatics Officer, UMass Memorial Health. Please address correspondence to Arvin Garg, arvin.garg@umassmemorial.org.
7. Center for American Progress. Health Disparities by Race and Ethnicity. Carratala S, Maxwell C. May 7, 2020. Accessed Jan 27, 2022. https://www.americanprogress.org/issues/race/reports/2020/05/07/484742/health-disparities-race-ethnicity/.
8. US Department of Health and Human Services, Office of Minority Health. Diabetes and Asian Americans. (Updated: Mar 1, 2021.) Accessed Jan 27, 2022. https://minorityhealth.hhs.gov/omh/browse.aspx?lvl=4&lvlid=48.
9. Williams DR, et al. Race, socioeconomic status, and health: complexities, ongoing challenges, and research opportunities. Ann N Y Acad Sci. 2010;1186:69–101.
10. Centers for Disease Control and Prevention, National Center for Health Statistics. Vital Statistics Rapid Release: Provis-

1. Braveman P, Egerter S, Williams DR. The social determinants of health: coming of age. Annu Rev Public Health. 2011;32:381–398.
14. Center on Budget and Policy Priorities. 4 in 10 Children Live in a Household Struggling to Afford Basics. Sherman A. Oct 21, 2020. Accessed Jan 27, 2022. https://www.cbpp.org/blog/4-in-10-children-live-in-a-household-struggling-to-afford-basics.
15. US Census Bureau. Race and Hispanic Origin by Selected Age Groups: Projections for the United States, 2017–2060. Main Series, Table 6. (Updated: Sep 2018.) Accessed Jan 27, 2022. https://www2.census.gov/programs-surveys/popest/tables/2017-2017-summary-tables/np2017-t6.xlsx.
16. Kids Count Data Center. Children Below 200 Percent Poverty by Race in the United States. (Updated: Dec 2020.) Accessed January 27, 2022. https://datacenter.kidscount.org/data/tables/6726-children-below-200-percent-poverty-by-race?loc=1&loct=.
17. Kids Count Data Center. Child Population by Race in the United States. (Updated: Sep 2021.) Accessed January 27, 2022. https://datacenter.kidscount.org/data/tables/103-child-population-by-race?loc=1&loct=.