



EFFORTS TOWARD EQUITY

Even as we document the health effects of biases and discrimination in medicine, many individuals, groups, and organizations have been doing important, innovative work in their local health care environments to try to alleviate and eventually solve some of these problems. This series of brief case studies offers glimpses of various initiatives, each of which aims to address a particular manifestation of discrimination in medicine or health care. We hope they will spark ideas for efforts that other physicians and health care organizations can pursue.

Transforming Narratives of Gun Violence

Peter T. Masiakos, M.D., Clementina M. Chéry, Rachele Gardner, M.S.W., and Eric Gordon, Ph.D.

PROBLEM Boston's reputation as a relatively safe U.S. city¹ overlooks the depth and complexity of trauma, racism, and marginalization faced by the predominantly Black and Brown residents of the Dorchester, Roxbury, and Mattapan neighborhoods, who live with deeply affecting sequelae of gun violence.

INTERVENTION Transforming Narratives of Gun Violence (TNGV) is a community-centered storytelling initiative launched in December 2021 and devoted to advancing healing and centering the

experiences of the people most affected by gun violence in Boston.

INSTITUTION TNGV is a consortium that began with a partnership among the Gun Violence Prevention Center at Massachusetts General Hospital (MGH), the Engagement Lab at Emerson College, and the Louis D. Brown Peace Institute (LDBPI), a Dorchester-based center of healing for families affected by murder, trauma, grief, and loss. Additional partners have since joined. The work is supported by institutional funding (from MGH and Emerson College)

and the Stavros Niarchos Foundation (SNF).

DESCRIPTION By uniting classroom theory with hands-on learning, TNGV supports six to eight studio courses each year in which faculty, students, and community partners work together to conceive of, create, and distribute "narrative interventions" in the form of media projects and art with specific organizational, social, or policy-change goals. The people closest to the problems being highlighted produce the content, rather than simply being



Quiet Rooms.

Ruth Rollins, president and founder of We Are Better Together, Warren Daniel Hairston Project (WAB2G), holds a photo of her son Danny, who was murdered in Boston in 2007. Driven by her personal experiences and her expertise as a domestic violence advocate, Ruth founded WAB2G in 2017 to empower women and girls affected on both sides of gun violence in the peacemaking process. View the film *Quiet Rooms* at <https://youtu.be/2GWZB54rQ1c>. Photo courtesy of the Engagement Lab at Emerson College.

its subjects. Community partners choose to receive either a financial stipend or four college credits for participating in one of the courses.

By leveraging the resources of higher education and an academic medical center, and by following the lead of community organizations that are more directly connected to neighborhood needs, TNGV creates deeply personal art and media projects about and with people experiencing violence. The goal is to influence trauma-informed medical curri-

cula, health and urban policy, and program design.²

RESULTS TO DATE So far, 106 students, 44 community learning partners, and 7 faculty members have collaboratively created four documentary films, three long-form news stories, a role-playing game, a virtual-reality experience, and several theater pieces. These works have been integrated into organizational trainings and policy discussions. For example, the Center for Teen Empowerment, an organization devoted to social

change led by young people, has incorporated the role-playing game it helped develop into its onboarding process for teens who are new to the program. Massachusetts medical schools have hosted screenings and panel discussions of a TNGV film in courses about improving the delivery of trauma-informed care. And Boston City Councilor Brian Worrell organized a film screening and panel discussion during a legislative session that informed the allocation of resources to community organizations working to prevent violence.

Reflecting on the painful encounters between surgeons and mothers of victims of firearm violence chronicled in the Perspective article “The Quiet Room,”³ we created a 19-minute documentary film, *Quiet Rooms*, that centers the voices of survivors and documents the perspective of people who have received devastating news in small hospital waiting rooms (see photo). Survivors tell their stories (which often highlight a lack of resources to help them navigate the aftermath of trauma) and then, drawing on their firsthand experiences, suggest actionable ways for hospitals to improve the care offered to families. The film has been seen by thousands of people at medical conferences, film festivals, medical schools, and hospitals throughout the United States, as well as in a courthouse, a prison, and legislative chambers in Massachusetts. Its representation of the isolating space where these devastating conversations occur has inspired an effort to redesign the MGH family waiting room with input from survivors.

Downstream uses of TNGV products demonstrate how thoughtfully told stories can influence organizational policy and practice. But amplifying these stories can be difficult in the contemporary media environment, where violence is often treated as fodder for attention-grabbing headlines. Therefore, TNGV focuses not only on generating better content but also on developing better processes for sharing honest and authentic stories crafted in environments built on trust. Creating and deploying community-centered interventions

first requires changing the narratives that are used to systematically exclude the most directly affected communities, replacing the typical victim–perpetrator binary with nuanced stories from the people who experience the long-term physical, psychological, financial, and spiritual impact of violence.

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- Centers for Disease Control and Prevention. Firearm mortality by state. March 1, 2022 (https://www.cdc.gov/nchs/pressroom/sosmap/firearm_mortality/firearm.htm).
- Gordon E, Gardner R, Chéry C, Sacks C, Masiakos PT. Collaborative critical making in higher education: a case study of a community-centred storytelling effort to transform harmful narratives of gun violence in Boston. *CoDesign*. March 20, 2024 (<https://www.tandfonline.com/doi/full/10.1080/15710882.2024.2329559>).
- Masiakos PT, Griggs C. The quiet room. *N Engl J Med* 2017;377:2411-2.

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A Multitiered Mentorship Model — Fostering Inclusive Pathways to Health Careers

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PROBLEM Since a factor that limits diversity in the health care workforce is low recruitment and retention of students from historically excluded groups, there is an urgent need to broaden access to learning and mentoring opportunities that create pathways to biomedical careers.

INTERVENTION STEM+M Connect aims to foster a diverse health care workforce using a multitiered near-peer mentoring program for navigating key academic transition points by building career awareness, a sense of belonging, and social networks.

INSTITUTION Tufts University School of Medicine.

DESCRIPTION To create learning and mentoring opportunities to help bridge key academic transi-

tion points (high school to college, college to medical school),¹ Tufts University School of Medicine's Office for Multicultural Affairs and Center for Science Education (CSE) launched a multitiered mentoring program called STEM+M (science, technology, engineering, and math, plus medicine) Connect. The goal is to build career awareness, a sense of belonging, and social networks capable of supporting students' transitions to college and medical school. The program was designed to address the need for paid internships, inclusive of students who require financial compensation; access to research and clinical experiences; and cultivation of strong social networks with role models to reduce the challenge of academic and career transitions. Connect leverages a multitiered mentoring model, whereby un-

dergraduate mentors from diverse backgrounds receive mentoring as part of a research internship while serving, in turn, as near-peer mentors for high school mentees of similar backgrounds. Though most programming runs during the summer, an active alumni network fosters the type of lasting relationships associated with advancement and persistence in STEM+M careers.

Research internships are a linchpin for most career paths in the health sciences.² Unfortunately, paid internships are in short supply, and accessing them generally requires a professional network. In concert with the Center for STEM Diversity at Tufts, Connect recruits undergraduate mentors, who receive a paid 8-week internship with a research or clinical host of their choice. CSE supports selection of the host site

and sets expectations with advisors. Throughout the internship, undergraduate mentors have weekly check-ins with CSE faculty to support their growth and navigation of laboratory and professional experiences. Undergraduate mentors are also formally trained in near-peer mentoring before meeting three to five high school mentees³; this training includes inspirational storytelling, reflecting on cultural humility, and simulation of challenging situations by means of case studies. The mentoring experience culminates with a presentation of their research to all mentees — a powerful role-modeling activity.

Early opportunities for career exploration and mentorship are strongly linked to retention of diverse students in STEM+M careers.² High school mentees are recruited through partnerships with high-need Boston-area school districts, and participants commit to a 4-week paid summer program with follow-up experiences throughout the next year. Connect has five key components: bonding experiences, explicit exposure to the “hidden curriculum,” celebrating diversity in STEM+M, science learning, and structured weekly meetings with mentors. A highlight is living on campus for 2 weeks as participants in the Tufts Mini Med School program and interacting with faculty and medical students in a range of hands-on learning

cases, lectures, patient presentations, and a capstone project. The experience culminates with a reception for mentors, mentees, and their families.

RESULTS TO DATE With support from a National Institutes of Health Science Education Partnership Award, we are using social cognitive career theory,⁴ perspectives of belonging in science,⁵ and social network analysis to investigate how elements of Connect programming affect students’ career perspectives, sense of belonging, and professional networks.

Preliminary results show a substantial increase in high school participants’ interest in science, sense of belonging to the STEM+M community, and confidence in their ability to succeed in a STEM+M career (self-efficacy). Social network analysis reveals growth in the high school participants’ social capital, as they come to feel more able to seek advice on applying to or fitting in at college. Qualitative analysis of focus-group interviews by an external evaluator has revealed the development of strong social networks.

Since the launch of Connect in 2021, a total of 9 undergraduate mentors and 37 high school students have participated. All 9 undergraduate alumni have completed or are completing degrees in a STEM+M major. All 5 who have graduated from college remain in STEM+M: 1 is in dental school and 4 are in biomedical research positions, with 2 of the 4 currently applying to medical

school. Of the high school mentee alumni, 24 are currently completing high school; of the 13 who have graduated, 11 have enrolled in college, and most are majoring in a STEM or health-related field.

We believe Connect offers an innovative model for institutions seeking to create effective pathway programs. Its multitiered program provides empowering, inclusive, next-step career opportunities for both mentors and mentees and fosters strong STEM+M support networks.

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1. Zhang C, Kuncel NR, Sackett PR. The process of attrition in pre-medical studies: a large-scale analysis across 102 schools. *PLoS One* 2020;15(12):e0243546.
2. Atkins K, Dougan BM, Dromgold-Sermen MS, Potter H, Sathy V, Panter AT. “Looking at myself in the future”: how mentoring shapes scientific identity for STEM students from underrepresented groups. *Int J STEM Educ* 2020;7:42.
3. Tenenbaum LS, Anderson MK, Jett M, Yourick DL. An innovative near-peer mentoring model for undergraduate and secondary students: STEM focus. *Innovative High Educ* 2014;39:375-85.
4. Lent RW, Brown SD. Social cognitive model of career self-management: toward a unifying view of adaptive career behavior across the life span. *J Couns Psychol* 2013; 60:557-68.
5. Peterson NA, Speer PW, McMillan DW. Validation of a brief sense of community scale: confirmation of the principal theory of sense of community. *J Community Psychol* 2008;36:61-73.

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 An audio interview with Revati Masilamani is available at NEJM.org



experiences, including microbiology and

anatomy labs, simulation-center

Table Stakes for Equity — Consumer Demographic Data at a State-Based Marketplace

S. Monica Soni, M.D., and Jessica Altman, M.P.P.

PROBLEM Although the value of member-reported demographic data is widely accepted,¹ few health care organizations have scaled up collection of these data. Even fewer routinely stratify operational measures by demographic data to identify disparate outcomes and act to address findings.

INTERVENTION Covered California, the state's health insurance marketplace, has designed an application for insurance coverage to encourage consumers to submit their demographic data, which inform efforts to equitably increase health care coverage and reduce health disparities.

INSTITUTION Covered California.

DESCRIPTION Covered California's pursuit of health equity required a commitment to collect and use consumer demographic data to enable deployment of data-informed, equity-driven policies. From its inception in 2011, the application for marketplace coverage has incorporated comprehensive demographic questions exceeding the minimum requirements, including applicants' written and spoken language, ethnicity, race, gender identity, sexual orientation, and disability status. Though responding is optional, the questions about language, ethnicity, and race appear within the standard flow of the application, requiring no additional navigation.

As recommended by consumers, the tone is informal, and the applicant is referred to by first name — for example, “In what language should we speak to Jane?” or “Is Jane of Hispanic, Latino or Spanish Origin?” The responses trigger branching logic, including six subgroups for respondents who affirm they are of “Hispanic, Latino or Spanish Origin” and a list of 15 races, with an “other” option for both questions. We allow and store up to 10 responses for race or ethnicity per applicant.

To address potential consumer concerns, the prompt notes that “We use this information to make sure that everyone has the same access to health care. If you choose to answer these questions, your information will be kept confidential.”

The approach has been successful. Unlike systems (such as Healthcare.gov) that receive incomplete member-reported demographic data and must impute many members' race and ethnicity on the basis of their names and locations, Covered California has prioritized collecting demographic data in its application and website design and thus can rely exclusively on member-reported data.^{1,2} In 2023, of our more than 1.6 million enrollees, 80% had a selection for race or ethnicity,³ with only 7.6% selecting “other race” as their response.

RESULTS TO DATE The actionable insights derived from our disaggregated data have been pivotal, informing budgetary decisions and resource allocation. We determined that eligible Black and Hispanic or Latino Californians were less likely than their White counterparts to enroll in Covered California plans, particularly in southern California. This finding led to a strategic enhancement of our outreach efforts, including hiring staff from these communities, increasing the presence of enrollment partners (such as certified enrollment counselors) with language concordance, and investing in local media channels. Furthermore, we initiated community-engagement strategies, partnering with trusted local organizations and churches. Together with the state's expansion of Medicaid, these adjustments contributed to a steady decrease in the uninsured rate among Hispanic or Latino Californians, which fell from 21.4% in 2013 to 9.1% in 2022.⁴

Gathering complete demographic data on consumers is table stakes: an essential requirement for achieving our mission. Covered California has shown that demographic data can be collected and used well. We challenge the health care industry to accept the imperative for collecting member-reported demographic data and embrace the

smarter organizational operations that result.

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1. Boehmer U, Kressin NR, Berlowitz DR, Christiansen CL, Kazis LE, Jones JA. Self-reported vs administrative race/ethnicity data and study results. *Am J Public Health* 2002; 92:1471-2.
2. Branham DK, Finegold K, Chen L, et al. Trends in missing race and ethnicity information after imputation in HealthCare.gov marketplace enrollment data, 2015-2021. *JAMA Netw Open* 2022;5(6):e2216715.

3. Covered California. Covered California active member profile: June 2023. September 1, 2023 (https://hbex.coveredca.com/data-research/library/active-member-profiles/CC_Membership_Profile_2023_06_R20230922_Rev1.xlsx).
4. UCLA Center for Health Policy Research. Data from California Health Interview Survey (CHIS) 2013, 2016, 2022 for Californians ages 0 to 64 (<https://ask.chis.ucla.edu/>).

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An Urban Farm–Anchored Produce Prescription Program — Food as Medicine and Economic Justice

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PROBLEM One third of Black and Latinx residents in Chicago are food insecure.¹ Food insecurity was exacerbated by closure of supermarkets during the Covid-19 pandemic, which led to especially low availability of fresh produce on the city’s racially minoritized West Side.²

INTERVENTION VeggieRx is a produce prescription program anchored by the Farm on Ogden, a

20,000-square-foot urban agriculture facility.

INSTITUTIONS A partnership among Lawndale Christian Health Center, the Chicago Botanic Garden, and the University of Illinois’s Chicago Partnership for Health Promotion.

DESCRIPTION VeggieRx prescriptions are provided by health center clinicians to patients with diet-

related diseases such as obesity and diabetes, many of whom are also experiencing food insecurity. To redeem prescriptions, patients are given an appointment at the Farm on Ogden, a 20,000-square-foot urban agriculture facility that is located on the West Side of Chicago, one block from Lawndale Christian Health Center’s main campus, and is accessible by several public bus and train routes. The farm is operated by the Chicago Botanic Garden’s urban agriculture program, Windy City Harvest, and houses a 7300-square-foot indoor greenhouse, a 50,000-gallon aquaponics system, a year-round indoor farmer’s market, commercial and teaching kitchens for nutrition education and local culinary entrepreneurs, an aggregation space for urban farmers, job training for justice-involved residents, and certificate programs in farming, food safety, cooking, and nutrition (see photo).

Participants can redeem their prescriptions each week for one box of fresh produce and recipes, nutrition education classes, indi-



VeggieRx Participants Attending a Nutrition Class at the Farm on Ogden.

Courtesy of Bernardo Barrios.

vidualized dietary counseling, and cooking lessons. Once enrolled, participants can receive produce boxes and attend classes weekly. Boxes vary with seasonal availability and include instructions on how to store and prepare the enclosed items. Virtual and in-person classes are held in both English and Spanish, with videos of classes posted online. Classes are taught by staff from the Chicago Partnership for Health Promotion, a large provider of nutrition education for low-income families.

RESULTS TO DATE In fiscal year 2023, a total of 2592 patients participated in the program, with more than 5000 additional people receiving benefit from household access to fresh produce. In total, 18,895 produce boxes were distributed, equivalent to 151,160 lb of fresh produce. Ninety-five percent of VeggieRx participants reported consuming at least half of their produce boxes, and 31% reported a decrease in food insecurity.

Evaluations of the program thus far have revealed promising results.

When we compared VeggieRx participants (enrolled 2016–2021) with a sample of matched controls from the same health system, we found significant relative reductions in weight and body-mass index in the intervention group.³

Today, the Farm on Ogden stands in the same neighborhood where Martin Luther King, Jr., and his family moved in 1966 to join residents in protesting systemic racism in Chicago.⁴ Nearly 60 years later, reflecting an ethos of food as medicine, the Farm on Ogden is a community resource for economic justice and vitality in a neighborhood that has sustained decades of structural disinvestment and racism. Health systems that identify food insecurity as a key lever of population health inequity can allocate a portion of their community benefit spending to forge multisector food partnerships that address the multiple drivers of food insecurity. Lasting solutions will need to combine strategies that address individual-level social needs with place-based investment in high-poverty communities to align resources,

build community wealth, and advance racial, economic, and health equity.

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1. City of Chicago. Chicago Food Equity Agenda (https://www.chicago.gov/content/dam/city/sites/food-equity/pdfs/City_Food_Equity_Agenda.pdf).
2. Rush University Medical Center. Rush and community partners fight food insecurity in West Garfield Park after store closes. November 5, 2021 (<https://www.rush.edu/news/rush-and-community-partners-fight-food-insecurity-west-garfield-park-after-store-closes>).
3. Tung EL, Detmer WM. The VeggieRx program: evaluation of clinical health outcomes. Presented at the VeggieRx Quarterly Evaluation Meeting, Chicago, October 18, 2023.
4. Bernstein D. Martin Luther King Jr.'s 1966 Chicago campaign. Chicago Magazine. July 25, 2016 (<https://www.chicagomag.com/chicago-magazine/august-2016/martin-luther-king-chicago-freedom-movement>).

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Academic Medical Center–Public Health Partnerships for Outbreak Response — Collaborating with Underresourced Communities

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PROBLEM Local public health infrastructure often lacks resources to rapidly deploy clinical services such as vaccination and diagnostic testing during public health crises. Such crises often hit hardest in underresourced

communities with inadequate access to health care.

INTERVENTION Mobile teams from two academic medical centers (AMCs) partnered with the Chicago Department of Public Health

(CDPH) to provide rapid on-site responses during public health crises and longitudinal community-based clinical care between crises.

INSTITUTIONS CDPH, Rush University System for Health (RUSH),

and University of Illinois Health System, Chicago (UI Health).

DESCRIPTION AMCs have not traditionally provided public health clinical services, such as testing and vaccination, and not-for-profit hospitals don't typically include public health-oriented clinical care in their community health improvement plans. Departments of public health, for their part, often lack the ability to deploy clinical teams during outbreaks, which results in delayed responses.¹ Moreover, outbreaks disproportionately affect structurally disadvantaged communities, because of poor health care access and crowded living conditions. So when residents in the largest homeless shelter in Chicago, who are predominantly Black and Latinx, began testing positive for Covid-19 in April 2020, clinicians from RUSH and UI Health coordinated with CDPH to test shelter staff members and residents and make infection-control recommendations. Of the 366 people tested, 45% tested positive.² Since that time, RUSH and UI Health have established mobile testing and vaccination teams in contractual partnership with CDPH.

Initially, the teams responded to Covid-19 outbreaks in congregate settings such as homeless shelters and nursing homes. As Covid vaccinations became available, the teams provided vaccination in congregate settings as well as other sites, such as senior housing and community-based organizations. RUSH also partnered with CDPH during the pandemic on initiatives aimed at improving health equity, including Covid testing, isolation, vaccination, and contact tracing focused on Chicago's West Side, which has his-

torically been marginalized owing to redlining and other acts of structural racism. CDPH and RUSH also created a public health data hub that breaks down metrics by race and ethnicity.

In focusing on structurally disadvantaged communities and structural racism, this work contributes to citywide antiracism efforts. Black and Latinx people are overrepresented among people experiencing homelessness and among those affected by recent outbreaks of diseases including Covid-19, varicella, and measles.^{3,4} In Chicago, vaccine access is lower in Black neighborhoods than in White neighborhoods as a result of health care and pharmacy deserts.⁵ Providing vaccination and testing in familiar community locations helps to increase access to care and build trust with community members. Between outbreaks, the mobile teams provide routine vaccination services at community sites in underresourced communities, in partnership with community organizations.

The infrastructure built during the pandemic positioned the partnership to respond rapidly to the 2022 mpox outbreak, allowing it to collaborate closely with community organizations in vaccinating high-risk people. And with tens of thousands of asylum seekers arriving in Chicago, the mobile teams have also provided urgent responses for varicella, group A strep, and measles outbreaks. Under the guidance of CDPH, the RUSH and UI Health teams helped to quickly control the measles outbreak by providing vaccinations, testing, and medical screening.³ In addition, the RUSH data hub created to support CDPH during the Covid pandemic was quickly transformed

into a data repository for measles vaccination and case reporting.

Our experience shows that AMCs can partner with public health and community leaders to codesign and deliver innovative care that is community-based, focused on structurally disadvantaged geographic areas, and informed by disease surveillance and epidemiologic analysis. AMCs can complement the strengths of departments of public health by bringing educational expertise, content knowledge, and operational expertise in delivering clinical care. Mobile teams educate the public about not only vaccination, but also other public health issues such as overdose prevention, hypertension, sexual health, and diabetes. They use their clinical expertise to connect patients to health care and social care services.

Many medical students and residents are eager to participate in public health-oriented clinical care. Working on the mobile teams provides an opportunity to develop their passion for public health. These teams also expand the health care worker pipeline by creating opportunities for community health workers to provide services and education in their own communities.

RESULTS TO DATE Since the beginning of the Covid pandemic, RUSH and UI Health mobile teams have administered 54,234 Covid tests and 19,528 Covid vaccinations at community-based sites. They have delivered 6031 mpox, varicella, hepatitis A, influenza, and measles-mumps-rubella vaccinations at community-based sites. They have administered four doses of varicella-zoster immune globulin and five doses of immune globu-

lin intramuscular to nonimmune high-risk people exposed to varicella and measles, respectively. They have held more than 2200 testing, vaccination, and education events in collaboration with more than 220 organizations.

We learned from the Covid pandemic that health care systems and public health departments must work together to successfully protect the health of the public. Partnerships between public health departments and AMCs create the infrastructure to respond nimbly to public health crises, provide ongoing community-based clinical services to un-

derresourced communities, and educate the next generation of health care and public health workers about putting health equity concepts into action.

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1. Bourdeaux M, Sasdi A, Oza S, Kerry VB. Integrating the US public health and medical care systems to improve health crisis response. *Health Aff (Millwood)* 2023;42:310-7.
2. Chang YS, Mayer S, Davis ES, et al.

Transmission dynamics of large coronavirus disease outbreak in homeless shelter, Chicago, Illinois, USA, 2020. *Emerg Infect Dis* 2022;28:76-84.

3. Gressick K, Nham A, Filardo TD, et al. Measles outbreak associated with a migrant shelter — Chicago, Illinois, February–May 2024. *MMWR Morb Mortal Wkly Rep* 2024; 73:424-9.

4. Ghinai I, Davis ES, Mayer S, et al. Risk factors for severe acute respiratory syndrome coronavirus 2 infection in homeless shelters in Chicago, Illinois — March–May, 2020. *Open Forum Infect Dis* 2020;7(11): ofaa477.

5. Qato DM, Daviglius ML, Wilder J, Lee T, Qato D, Lambert B. ‘Pharmacy deserts’ are prevalent in Chicago’s predominantly minority communities, raising medication access concerns. *Health Aff (Millwood)* 2014; 33:1958-65.

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Preventing and Controlling Global Antimicrobial Resistance — Implementing a Whole-System Approach

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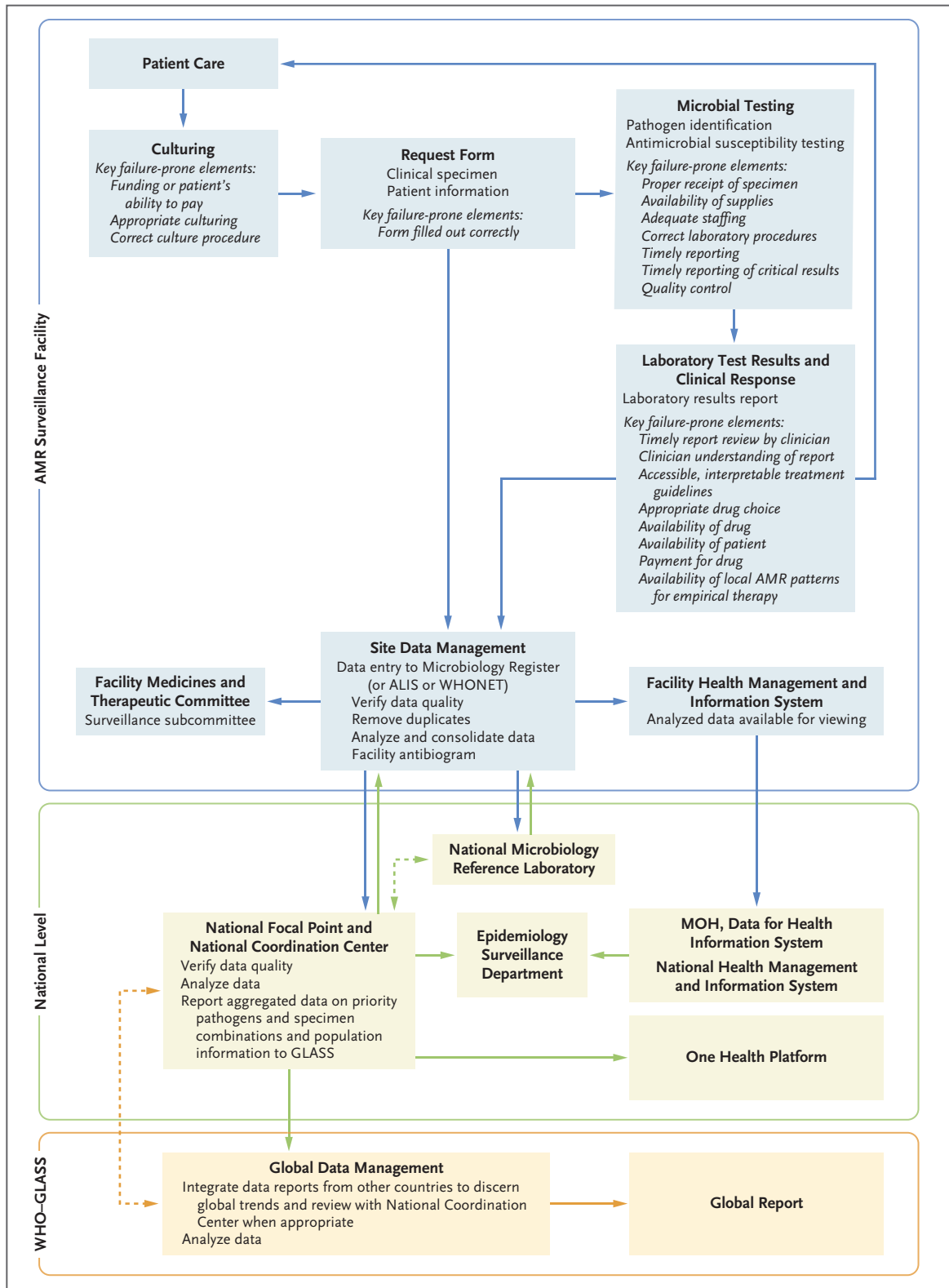
Antimicrobial resistance (AMR) remains a major global public health problem despite concerted surveillance, prevention, and control efforts. The World Health Organization (WHO) has identified AMR as one of the top 10 global health threats, with an estimated 1.3 million deaths attributable to bacterial AMR in 2019.¹ The problem was gravest in western sub-Saharan Africa, where AMR-related mortality was 27.3 deaths per 100,000 people.¹ The emergence of AMR anywhere can quickly become a global problem.

Decades of alarm have led to numerous calls to action, reports, guidelines, national action plans, and policy proposals. National and global agencies, foundations, pro-

fessional societies, governments, networks of experts, and industry collaborations have supported these efforts. Research has shown the importance of environmental and animal reservoirs of AMR and has yielded potentially transformational technologies, including nucleic acid amplification tests, whole-genome sequencing, and automated rapid diagnostics. Programs focused on antimicrobial and diagnostic stewardship have complemented ongoing health care–associated infection prevention and control efforts.

These achievements are impressive, but the current situation is far less encouraging, particularly in low- and middle-income countries (LMICs). National action plans generally haven’t been im-

plemented at scale, nor have they stemmed the emergence and spread of increasingly resistant microorganisms. With few exceptions (e.g., reduced prescribing of antimicrobials in a network of private South African hospitals), stewardship guidelines have had limited impact. Basic infection prevention and control are still inadequate in many facilities. Promising diagnostic technologies remain too costly or impractical to use in much of the world. Evolution of AMR continues to outpace the introduction of new antimicrobials. Surveillance is improving but lags behind global dissemination of resistant pathogens. Insufficient microbiology-laboratory capacity limits timely surveillance, especially in LMICs.



Ugandan Ministry of Health Antimicrobial Resistance Surveillance System Data and Information Flow Chart.

The diagram was originally prepared for SPIDAAR (the Surveillance Partnership to Improve Data for Action on Antimicrobial Resistance) by the Ugandan Ministry of Health (MOH) and the Antimicrobial Resistance (AMR)–National Coordination Center for the Department of National Health Laboratories and Diagnostic Services for the Ugandan MOH. The diagram shows systems at the global (World Health Organization–Global Antimicrobial Resistance and Use Surveillance System [WHO–GLASS]), national (MOH), and facility (site) levels. The facility-level section has been annotated to show key failure-prone elements of the system for obtaining cultures, laboratory testing, providing laboratory test results to clinicians, and treating patients. Implementation and maintenance of each of these elements can be tracked over time to assess the effectiveness of quality-improvement initiatives. MOH and hospital progress were evaluated with a self-assessment tracker (see the Supplementary Appendix, available at NEJM.org). The original diagram was provided by Mugerwa Ibrahim from the Ugandan MOH. ALIS denotes African Laboratory Information System.

We recently participated in a public–private collaboration (the Surveillance Partnership to Improve Data for Action on Antimicrobial Resistance [SPIDAAR], funded by Pfizer and the Wellcome Trust) aimed at assisting ministries of health (MOHs) and hospitals in Ghana, Kenya, Malawi, and Uganda in implementing, scaling up, and sustaining improved AMR surveillance capacity. This demonstration project evolved from focused detection of AMR in pathogens targeted by the WHO’s Global Antimicrobial Resistance and Use Surveillance System (GLASS) program² to include broader efforts to leverage real-time AMR data to improve patient care. SPIDAAR provided insights into the type of integrated system that would be required to address gaps between aspirational national action plans and progress on the ground. The Ugandan MOH’s surveillance-system diagram captures a vision of the high-level systems required for improvement and MOH–hospital coordination (see figure).

Although success was observed in some domains, progress was hindered by systems-related challenges, such as lack of sustainable financing, supply-chain deficiencies, laboratory-staff turnover, clinician distrust in laboratory services, and failure to use culture

results to guide treatment. These observations were in keeping with our previous experience in other countries, where we found that existing fragmented approaches to addressing AMR are unlikely to facilitate timely recognition of resistance trends and sustainable improvements in care.

We believe several steps could be taken to accelerate progress. First, countries — and the funders and agencies that support them — will need to develop and implement an integrated, whole-system approach to AMR. Results will be limited if the complexity of real-world systems isn’t understood and if inefficient, unreliable, or failure-prone components aren’t identified and addressed. Methods such as “Failure Mode and Effects Analysis” and “Hazard Analysis and Critical Control Point” can help identify points at which systems may fail and quality control and improvement should be prioritized. When addressing these issues, it’s important to consider how changes in one part of the system could have unexpected, deleterious effects elsewhere. Practical improvement-science methods (such as the Model for Improvement, Lean, and Six Sigma) could be used.

A whole-system approach requires collaboration and coordination. Across multiple AMR

programs, we identified opportunities for organizations to coordinate their efforts rather than independently focusing on individual components of the system. Moreover, AMR programs and academic research often weren’t linked to other in-country systems-strengthening and One Health efforts, which limited the use of shared learning and problem solving to increase efficiency and accelerate sustainable population health improvement.

Planning, implementation, and scale-up of these efforts should be led by the people who best understand the context and challenges — country and health care leaders, MOH representatives, community stakeholders, clinicians, laboratory and pharmacy experts, and patients. National action plans should address all levels of the system — individual people, communities, clinicians and health workers, “microsystems” (small units of care, such as clinics), health care delivery systems, and policy and payment³ — and should include provisions focused on inequity as well as access to clean water, sanitation, and other determinants of population health. Global partners should better coordinate their support of country-led action plans.

Second, it will be important to recognize that national AMR-

surveillance systems differ from systems focused on local detection of AMR and prompt treatment with appropriate antimicrobials, although both depend on accurate laboratory testing. National surveillance requires a system for obtaining culture results from community sources and health care facilities, reference laboratories to verify the accuracy of testing conducted by local facilities and to further characterize circulating microbial strains, and data systems for promptly communicating results and resistance trends.

Local AMR control and enhanced patient care require code-sign and testing of potential solutions, communication and feedback, and trust among laboratory leaders, pharmacists, clinicians, and patients. Building trust requires confidence in the accuracy and timeliness of laboratory results, which has often been missing, especially in hospitals in LMICs. External challenges, including unreliable supply chains for microbiologic supplies and antibiotics needed for treating resistant infections, undermine local improvement efforts, which underscores the importance of whole-system planning.

Third, countries could better integrate plans for implementation, scale-up, and sustainability into action plans.⁴ It will be important to test implementation plans and prototypes in various settings, adapt implementation tactics to local contexts, and address predictable funding, resource, and workforce limitations before attempting to scale up promising programs. In our experience, action plans often rely too heavily on education and training, which are important but

are unlikely to be effective unless they are reinforced over time; promote self-efficacy; address overwork, burnout, and turnover among staff members; are supported by adequate resources; provide staff members with sufficient skills and tools to improve their work; and assess knowledge and competency with evaluation frameworks such as Miller's Pyramid.

Fourth, national, regional, and local leaders could create peer-learning systems for AMR teams. Shared learning among teams could promote data transparency and transfer of knowledge regarding innovative approaches to overcoming common barriers. In SPIDAAR, we found that such discussions energized teams and illuminated systems-level problems and solutions. Shared-learning methods, such as the Institute for Healthcare Improvement's Breakthrough Series collaborative model, are well established.

Finally, companies, funders, nongovernmental agencies, and countries could accelerate the adoption of "leapfrog" innovations (transformative technologies that can be adapted and implemented in low-resource settings despite barriers) to address challenges inherent to traditional microbiologic methods.⁵ The culturing and susceptibility-testing methods often used in hospital laboratories in LMICs are relatively slow and labor-intensive and lack the specificity of strain characterization required for epidemiologic investigation. Policymakers could explore strategies for making new point-of-care and automated methods more widely available in health care facilities and in the field. Experience with new tuberculosis diagnostics (including those with AMR-detection capa-

bilities), malaria diagnosis in the community, and HIV and Covid-19 point-of-care tests suggests that cost-effective deployment is possible. Developers should consider users in low-resource settings at the outset, rather than adapting products originally designed for high-income countries. Widespread adoption requires collaboration to overcome regulatory, intellectual-property, and cost-related challenges and local infrastructure constraints. So-called frugal innovations, developed in areas with highly constrained resources, could help bypass some of these barriers.

Articulating the principles of whole-system improvement is easier than putting them into action. Nonetheless, whole-system approaches can inform planning, implementation, and sustainable scale-up amid other pressing health priorities. While focusing on AMR in SPIDAAR, Malawi had to manage Covid-19, destructive storms, a cholera outbreak, and introduction of wild poliovirus type 1. Whole-system improvement methods are useful for mitigating such intercurrent public health challenges, but cross-program learning may not always occur. For example, SPIDAAR teams in two countries were largely unaware of national infant and maternal health programs supported by their MOHs.

The basic principles for addressing AMR have been known for decades, and scientific and technological innovations are promising, but implementation has been too slow. The problem of AMR has intensified. Action plans could be more effective if the realities of implementation, scale-up, and sustainability were considered and addressed before the ink is dry.

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1. Murray CJL, Ikuta KS, Sharara F, et al. Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis. *Lancet* 2022;399:629-55.

2. World Health Organization. Prioritization of pathogens to guide discovery, research and development of new antibiotics for drug-resistant bacterial infections, including tuberculosis. September 4, 2017 (<https://www.who.int/publications/i/item/WHO-EMP-IAU-2017.12>).

3. Chin MH, Goldmann D. Meaningful disparities reduction through research and translation programs. *JAMA* 2011;305:404-5.

4. Barker PM, Reid A, Schall MW. A framework for scaling up health interventions: lessons from large-scale improvement initiatives in Africa. *Implement Sci* 2016;11:12.

5. Okeke IN, Feasey N, Parkhill J, et al. Leapfrogging laboratories: the promise and pitfalls of high-tech solutions for antimicrobial resistance surveillance in low-income settings. *BMJ Glob Health* 2020;5(12):e003622.

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