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Addressing Maternal Mortality And Morbidity In California Through Public-Private Partnerships

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ABSTRACT In 2006, noting a rise in maternal deaths and complications, the California Department of Public Health launched efforts to investigate maternal deaths. In that year, the California Maternal Quality Care Collaborative was formed as a public-private partnership to lead maternal quality improvement activities. Key steps undertaken over the next decade included linking public health surveillance to actions, mobilizing a broad range of public and private partners, developing a rapid-cycle Maternal Data Center to support and sustain quality improvement initiatives, and implementing a series of data-driven large-scale quality improvement projects. While US maternal mortality has worsened in the 2010s, by 2013 California's rate had been cut in half to a three-year average of 7.0 maternal deaths per 100,000 live births. The state's rate had become comparable to the average rate in Western Europe (7.2 per 100,000). In this article we describe the key steps undertaken by the California Department of Public Health and the California Maternal Quality Care Collaborative that supported change at large scale. Special challenges for implementation are also discussed.

Over the past two decades the US has seen troubling trends in multiple measures of maternal health: Maternal mortality rates have increased by 50–70 percent.^{1–4} The rate of severe maternal morbidity, defined by the Centers for Disease Control as major complications identified using a set of hospital diagnosis and procedure codes, has more than doubled.⁵ Also, the Healthy People 2020 low-risk first-birth cesarean rate has risen by more than 50 percent,⁶ without any improvement noted in infant outcomes.⁷ Overall, US maternity care suffers from both overtreatment of many low-risk women and lack of advanced care for some high-risk patients.^{8,9} The care of pregnant women has national importance beyond infant outcomes, as maternity care is the most

frequent overall reason for hospitalization, cesarean section is the most common surgery, and Medicaid is financially responsible for half of all US births.

California is a large and diverse state with vast agricultural areas, remote mountainous regions, and many of the nation's most populous cities. California's nearly 500,000 annual births account for one of every eight US births.¹⁰ With 1990 as a baseline, California had similar rises through the mid-2000s in maternal mortality, severe morbidity, and cesarean rates as the rest of the nation.

What sets California apart is the early recognition of these maternal health problems and the combined efforts of the California Department of Public Health and the California Maternal Quality Care Collaborative, comprising clinicians,

hospitals, and many other stakeholders, to address these issues. The reversal of these trends in California, illustrated in exhibit 1, is in contrast to the situation in the country overall. While the US maternal mortality rate has worsened in the 2010s, California has cut its rate nearly in half, from 13.1 per 100,000 live births, on average, in the baseline period of 2005–09 to a three-year average of 7.0 during 2011–13—a level comparable to the average rate of 7.2 in Western European countries in 2015.¹ The Collaborative’s more recent quality improvement projects have focused on the population-level reduction of major maternal complications (severe maternal morbidity) and primary cesarean deliveries. This article provides a detailed description of the activities of the Collaborative to address these maternal health challenges.

We identified four key steps in the Collaborative’s journey toward large-scale and sustained improvement in maternity outcomes: linking public health surveillance to action steps; mobilizing a broad set of public and private partners to work collaboratively; establishing a low-burden, rapid-cycle data system to support improvement efforts; and implementing multipartner, large-scale interventions that integrate clinical providers with public health services. Our experience with this four-step model should have general relevance for other states as the nation strives to improve maternity outcomes.

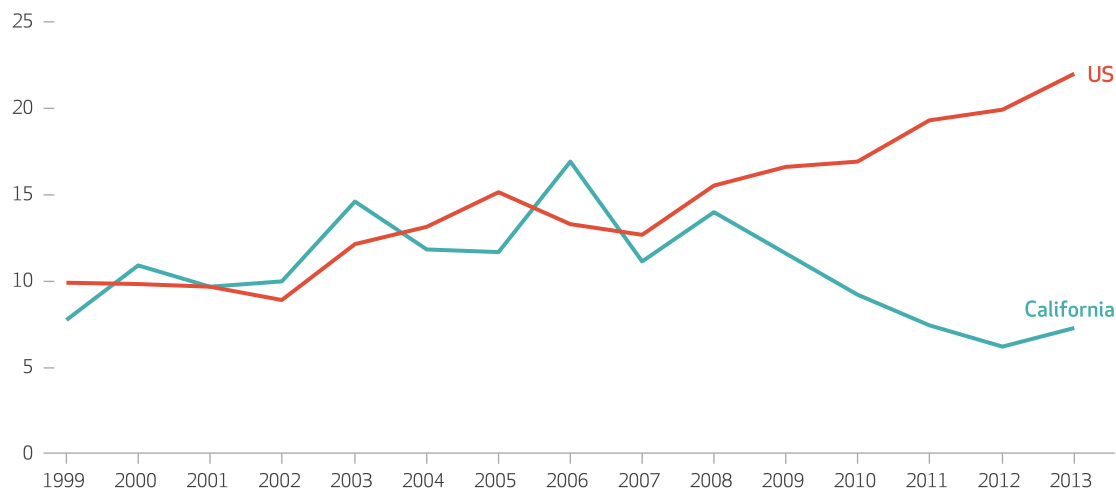
Step 1: Link Public Health Surveillance To Action Steps

In 2006 the California Department of Public Health observed a rising trend in maternal deaths through its death certificate surveillance (see exhibit 1). It allocated resources from the Title V Maternal and Child Health Services Block Grant Program to initiate the California Pregnancy-Associated Mortality Review project for in-depth case reviews. *Maternal mortality* is defined by the World Health Organization and the National Center for Health Statistics to include deaths while pregnant or within forty-two days of the end of a pregnancy from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes.¹¹ The Centers for Disease Control and Prevention (CDC) has recommended alternative terminology: *pregnancy-related mortality* (similarly defined, except that it includes pregnancy-related deaths up to one year following delivery).¹² This is used by maternal mortality review committees in their case reviews to more accurately identify cases for quality improvement purposes.

Each year since 2006 the Collaborative and the California Department of Public Health have together convened a multidisciplinary committee composed of maternity, perinatal, and public health clinical experts that is charged with the review of maternal deaths. Importantly, the charge of this mortality review committee is not only to ascertain the causes of death and the demographic characteristics of women who died

EXHIBIT 1

Maternal mortality rates per 100,000 live births in California and the United States, 1999–2013



SOURCES Authors’ reproduction of data from the following sources in the public domain. For California: California Department of Public Health, Center for Family Health, Maternal, Child and Adolescent Health Division, March 2015; and the California Birth and Death Statistical Master Files. For the US: data for 1999–2007 from the National Center for Health Statistics (NCHS); and data for 2008–13 from CDC WONDER, Centers for Disease Control and Prevention. **NOTE** Maternal mortality is defined in the text.

but also to analyze contributing factors and opportunities for future improvement.¹³ These causes of death and potential intervention strategies are entered into a database. The committee then links its epidemiologic investigation to actions: the communication of findings and recommendations to a broad range of public and clinical stakeholders, the development of quality improvement toolkits, and the design and creation of large-scale quality improvement efforts aimed at addressing problems identified in the review.

The first two years of case reviews revealed that obstetric hemorrhage and preeclampsia were the two most preventable causes of maternal mortality and the two most important drivers of maternal morbidity.¹⁴ These two conditions were the subject of the Collaborative’s first two toolkit task forces. The findings of the California Pregnancy-Associated Mortality Review directly informed the work of these task forces, which were charged with developing recommendations and strategies for clinician- and hospital-based quality improvement efforts and then collecting them into quality improvement toolkits. Designed to be in-depth implementation guides for each topic, the toolkits include examples of evidence-based practices, sample policies, mini-reviews of key topics, implementation recommendations, and an educational slide set. Each task force was seeded with members of the maternal mortality review committee to present the quality improvement lessons gleaned from the case reviews.

This pattern of multidisciplinary experts working together continued through more recent toolkit task forces for cardiovascular disease (the most common cause of maternal mortality), venous thromboembolism (one of the most preventable causes), and supporting vaginal birth

and reduction of primary cesareans. Members of the California Pregnancy-Associated Mortality Review and the toolkit task forces are selected for their expertise but also to represent different parts of the large, diverse state. This creates a geographically dispersed group of educated and dedicated leaders committed to promoting and supporting toolkit implementation.

Following the launch of a specific quality improvement initiative, the Collaborative convenes peer learning groups of hospitals committed to maternal quality improvement efforts. Members of this community of learning benefit from sharing experiences and strategies and receiving individual coaching regarding implementation. The Regional Perinatal Programs of California, also Title V funded, provide regional coordinators who make personal visits to each hospital to help disseminate toolkits and provide encouragement and technical assistance where requested. Toolkits include slide sets for local clinicians to use at their institutions, thus widening the circle of expertise and support for implementation.

The series of quality improvement efforts to address maternal mortality in California (exhibit 2) began in 2008 with the establishment of the multidisciplinary OB Hemorrhage Task Force. The task force’s charge was to design a quality improvement program and raise awareness of maternal mortality by speaking to physicians and nurses at hospital medical staff and professional society meetings throughout the state. Early in the following year a draft of the Obstetric Hemorrhage Toolkit was released, and the first of a series of intense improvement collaboratives began, consisting of thirty hospitals. A similar approach was used in 2010 for preeclampsia and other pregnancy-related hypertensive disorders, with a task force developing a comprehensive

EXHIBIT 2

California quality improvement (QI) actions focused on the reduction of maternal mortality, 2006–19

Years	Action
2006	California Pregnancy-Associated Mortality Review established by the CDPH, in partnership with CMQCC and PHI
2008	CMQCC/CDPH OB Hemorrhage Task Force and statewide maternal mortality education campaign established
2009–10	CMQCC Hemorrhage QI collaboratives I and II
2010–11	CMQCC/CDPH Preeclampsia Task Force and QI collaborative
2011	Release of CDPH maternal mortality report and education campaign
2011–14	HEN/CMQCC/CHA-HQI QI collaborative focused on hemorrhage and preeclampsia
2015–16	CMQCC/Merck for Mothers QI collaborative for hemorrhage and hypertension severe morbidity
2016–19	CMQCC QI collaboratives (3 cohorts) for supporting vaginal birth and reducing primary cesarean delivery

SOURCE Authors’ analysis of data from the California Maternal Quality Care Collaborative. **NOTES** CDPH is California Department of Public Health. CMQCC is California Maternal Quality Care Collaborative. PHI is Public Health Institute. HEN is Hospital Engagement Network (part of the Partnership for Patients project of the Centers for Medicare and Medicaid Services). CHA-HQI is California Hospital Association-Hospital Quality Institute.

implementation toolkit, followed by a quality improvement collaborative involving twenty-five hospitals and a statewide lecture series. In 2011 the California Department of Public Health released the first in-depth medical record review of pregnancy-related deaths occurring between 2002 and 2007. The release received widespread attention in the medical and public health communities. Additional quality collaboratives (some included as many as 136 hospitals) were conducted over the next three years, supported first by the Hospital Engagement Network (under the Partnership for Patients Project of the Centers for Medicare and Medicaid Services) and then by the Merck for Mothers initiative.

As we noted earlier (see exhibit 1), maternal mortality rates improved in California during the time period when the Collaborative's efforts began (exhibit 2). Public health clearly aims to observe progress at the population level, but when that occurs, it is often a challenge to precisely determine causation. The coincidence of the advent of quality improvement activities and the reductions in the maternal death rate in California is suggestive. However, it is important to note that other changes could have contributed to the observed trends.

Step 2: Mobilize A Broad Set Of Public And Private Partners

As maternal mortality became the focus of sustained effort in California, it was critical to understand that improvement of maternity outcomes at scale was beyond the capabilities of any one agency, organization, or discipline. To this end, the California Department of Public Health directed resources for the creation of the Collaborative at the same time as the California Pregnancy-Associated Mortality Review committee began its work.

The Collaborative was developed as a hub for convening a broad set of stakeholders (state agencies, payers, purchasers, professional societies, hospital systems, key clinician leaders, and patient and public groups), all of whom were needed to generate ideas and leverage the resources needed to address the challenge of rising maternal mortality and morbidity rates. Regular communications, shared data, and quality improvement experiences created strong engagement among stakeholders. For example, the California districts of multiple national professional societies—American College of Obstetricians and Gynecologists (ACOG), Association of Women's Health, Obstetric and Neonatal Nurses (AWHONN), California Nurse-Midwives Association, and California Academy of Family Physicians—all highlighted the Collaborative's

mortality review findings and quality improvement toolkits in their membership newsletters and at their annual meetings. ACOG and AWHONN provided a statewide speaker network to reach out to hospitals' physician and nursing staffs. The Hospital Quality Institute and the California Hospital Association, one of the institute's members, played a critical role in engaging hospital administrators via their newsletters, regional conferences, and cosponsorship of quality improvement collaboratives. Over time, the Collaborative expanded to include Medicaid programs, health plans, purchasers, and employers, to effectively engage the wide range of hospitals serving California mothers. The Collaborative increased and diversified its funding and developed a comprehensive data center (the Maternal Data Center, described below) that collects data from a variety of sources less than forty-five days old; immediately creates linkages, as detailed below; and displays a range of measures back to every hospital to drive quality improvement. The center's information is a powerful tool for driving partner engagement by supporting transparency both within a given institution and externally through public reporting.¹⁵ The concept of collective impact^{16,17} (for example, through the use of initiatives organized with a centralized infrastructure; having a common agenda, shared metrics, and continuous communication; and involving multiple organizations) is critical when working on topics that cross many boundaries (such as those between public health and clinical medicine, in- and outpatient locations, and social determinants and clinical care factors).

Other states are now creating their own perinatal quality collaboratives, some of which are addressing maternal health issues, while others are focused on infant outcomes. In California, the Collaborative's sister organization, the California Perinatal Quality Care Collaborative, has been focused on neonatal care since 1996. The Council on Patient Safety in Women's Health Care¹⁸ and its implementation arm, the Alliance for Innovation on Maternal Health Program,¹⁹ are providing critical support to collaboratives for maternal quality improvement efforts in multiple other states. The Alliance has been supported by the Maternal and Child Health Bureau of the Health Resources and Services Administration and has engaged national professional, hospital, public health, payer, and patient advocacy organizations interested in maternal health, similar to the approach used in California.

Step 3: Establish A Low-Burden, Rapid-Cycle Data System

Mortality review data provided by the California Pregnancy-Associated Mortality Review described in step 1 are important for establishing priorities. However, they are insufficient to provide timely assessment of progress (or lack thereof), which is a critical component of quality improvement. Key attributes for a data system that supports rapid-cycle data processing include low burden/low cost (particularly for data collection/entry), flexibility (since quality improvement topics change), rapid turnaround (to support frequent feedback), the ability to benchmark (for example, to compare hospitals with similar levels of care or within similar geographies), and an engaging user interface to promote widespread use. A universal data system already exists for maternity care that captures baseline data for every birth in every state: vital records, including birth certificates. Forward-looking states such as Florida, Massachusetts, and Ohio have recognized that deidentified clinical data from birth certificates can be invaluable for rapid-cycle maternity quality improvement projects. This requires that states' public health departments recognize that this use of their vital record data is an important part of their mission. Furthermore, the use of such data for hospital quality improvement and reporting focuses attention on efforts to improve the quality of the birth certificate data, creating a win-win situation of improved care quality and improved data used to evaluate quality. This has proved to be an important step in the progress made in California. However, birth certificate data provide only part of the story, as they typically underreport maternal complications.

To create a comprehensive maternal-infant data set, the Collaborative has established the Maternal Data Center—a “real-time” data center that is driven by the recycling of already collected data (called “green data”). Specifically, every month the center links birth certificate data and mother and infant hospital discharge diagnosis files for all births at each member hospital. This approach markedly reduces the need for costly chart reviews for all but selected data elements for clinical process measures. Data transmission is automated at the hospital level for over 98 percent of data elements—a few measures require additional clinical data elements that are submitted by web entry or supplemental data files. The data-submission cost to hospitals is a one-time expense to program the data feed (which uses the standard data format required by other government agencies).

The California Department of Public Health has pioneered the monthly sharing of partially

deidentified birth certificate data (without names, Social Security numbers, or addresses beyond ZIP codes) forty-five days after the end of every month. The data are transferred to a secure server maintained by Stanford University, where they are automatically linked to discharge data sets (which include patient-level discharge dispositions and *International Classification of Diseases* diagnosis and procedure codes, first ninth and then tenth revisions) provided by the hospitals. The three data sets (birth certificates, maternal discharge files, and newborn discharge files, each containing approximately 500,000 records annually) are successfully linked in over 98 percent of cases, using a combination of deterministic and probabilistic algorithms.

The system creates over fifty maternal/infant performance measures and additional data quality tools. A web-based user interface allows hospitals to access their data using data visualization strategies to promote multiple peer comparisons, benchmark in multiple ways, and track progress over time. A valuable approach within the data center is a focus on measure analysis, which allows facilities to drill down and understand why their rates are elevated—a critical first step in focusing quality improvement efforts.

The web portal also serves as the data entry site for all quality improvement collaboratives to use in recording process and structure metrics. To identify potential disparities (such as by race/ethnicity or payer status), analyses by subpopulations are also automatically provided. The data center's ability to markedly reduce the burden of data collection is important for all hospitals but especially for low-resource hospitals, to enable their participation in quality improvement collaboratives. Currently, 212 of the 240 California hospitals (representing over 95 percent of births) have voluntarily enrolled in the center. The center recently expanded beyond California to support perinatal quality collaboratives in Washington State and Oregon, with slight variations of data sources reflecting each state's own context.

Step 4: Implement Focused Public Health And Clinical Intervention Projects

In the desire to rapidly address serious maternal health challenges, there is an inclination to immediately initiate intervention projects. However, we believe that the Collaborative's sustained success is likely due to having first built a solid foundation using steps 1–3. First, the direction provided by the mortality reviews to focus clinical efforts initially on the two causes—

obstetric hemorrhage and preeclampsia—with greatest preventability and accounting for a high percentage of the state’s severe maternal morbidity¹⁴ has provided an effective and focused call to action. Second, the engagement of partners from all across the health care spectrum (from funders to professional societies) has opened doors and provided the powerful leverage needed to engage a large number of hospitals and clinicians. And third, provision of rapid-cycle data from a low-burden data system has been crucial for the success of quality improvement initiatives and for sustaining achievements. Here we briefly describes specific California projects that have been built upon this foundation.

QUALITY IMPROVEMENT TOOLKITS Starting in 2008, as described above, multidisciplinary task forces developed comprehensive quality improvement toolkits to address the top issues identified by the California Pregnancy-Associated Mortality Review committee. The initial maternal toolkits targeting obstetric hemorrhage²⁰ and preeclampsia²¹ have proved to be immensely popular, with over 10,000 downloads each from the Collaborative website. As further evidence of their widescale spread, by 2016, according to an independent survey, 92 percent of California hospitals had adopted the Obstetric Hemorrhage Toolkit, and 75 percent had adopted the Preeclampsia Toolkit.²²

LEARNING COLLABORATIVES Since 2009 over 180 of the 240 hospitals in California have directly participated in one or more quality improvement learning collaboratives. The Collaborative’s Maternal Data Center provided real-time data collection and quality improvement support.

One of the largest collaboratives, focused on the bigger challenge of reducing severe maternal morbidity (as defined by the CDC),⁵ began in 2015. The ninety-nine participating California hospitals (with over 250,000 annual births col-

lectively) saw a reduction in severe maternal morbidity among women with hemorrhage of more than 20 percent, compared to the 1.2 percent reduction in a contemporary comparison group of forty-eight hospitals (with over 80,000 annual births collectively) that were not yet participating in the collaborative (exhibit 3).²³ Twenty-five of the ninety-nine collaborative hospitals had taken part in a previous hemorrhage collaborative, and they performed even better than the seventy-four hospitals that were participating in their first such collaborative (28.6 percent improvement versus 15.4 percent). This finding reinforces the concept that participating longer in collaboratives or revisiting prior improvement efforts can demonstrate additional benefit.

A key feature of the Obstetric Hemorrhage Toolkit and collaborative is the focus on team development and safety drills, which can improve outcomes for many conditions beyond hemorrhage. With each successive collaborative project, hospitals have increased their quality improvement skills and unit safety. Indeed, the continuous push for maternal safety and quality appears to have helped sustain the overall gains. The most recent hemorrhage collaborative included over 130 hospitals, and the current Supporting Vaginal Birth and Reducing Primary Cesarean Delivery Taskforce has engaged over 160. To better accommodate the large number of facilities involved, the Collaborative adapted the Institute for Healthcare Improvement’s Breakthrough Series model,²⁴ using nurse-physician mentor teams to provide more personal attention to groups of eight to ten hospitals within the larger collaborative.²⁵

Applying The Four-Step Approach

The first toolkit produced by the California Department of Public Health and the Collaborative,

EXHIBIT 3

Reduction of severe maternal morbidity (SMM) among hemorrhage patients in the California Maternal Quality Care Collaborative (CMQCC) for obstetric hemorrhage, by hospital group

Hospital group	Baseline SMM rate per 100 hemorrhage cases	Postintervention SMM rate per 100 hemorrhage cases	Reduction in SMM	p value
Hospitals in CMQCC hemorrhage collaborative (n = 99)	22.7	18.0	20.8%	<0.0001
Without prior hemorrhage collaborative experience (n = 74)	22.7	19.2	15.4	<0.0001
With prior hemorrhage collaborative experience (n = 25)	22.7	16.2	28.6	<0.0001
Hospitals not in CMQCC hemorrhage collaborative and with no prior hemorrhage collaborative experience (n = 48)	28.6	28.2	1.2	0.7713

SOURCE Main EK, et al. Reduction of severe maternal morbidity from hemorrhage using a state perinatal quality collaborative (see note 22 in text). **NOTES** SMM is as defined by the Centers for Disease Control and Prevention. The Collaborative used a modification of the Institute for Healthcare Improvement’s Breakthrough Series format using teams of nurses and physician mentors for groups of eight to ten hospitals. “Postintervention” is the final six months of the eighteen-month collaborative compared to baseline.

in partnership with the March of Dimes, was “Elimination of Non-Medically Indicated (Elective) Deliveries before 39 Weeks Gestational Age,” released in 2010.²⁶ While not directly linked to the maternal mortality efforts that we have described in this article, it was developed and launched through a public-private partnership and served as a pilot project for those efforts. In the March of Dimes, the California organizations had a partner that could help with nationwide dissemination and that had the experience and capacity needed to develop a powerful public information campaign to help shape patients’ perspectives. The success of this national effort has been well documented.¹⁰

The most recent, currently ongoing California statewide quality improvement initiative is focused on supporting vaginal birth and reducing primary cesarean deliveries. The initiative is targeting first births that are low risk: a single baby at full term and in the correct position for vaginal birth. This subgroup of births has driven the rise in the overall cesarean rate in the past decade and has the greatest variation in cesarean sections among hospitals (rates varied from 12 percent to 70 percent across California hospitals, according to data from the California Maternal Data Center). A reduction in the rate of first-birth cesareans will prevent these mothers from being in the much higher-risk “prior cesarean” category in their subsequent pregnancies. Both vaginal birth after cesarean and repeat cesarean are much higher risk than vaginal birth without a prior cesarean or even a primary cesarean delivery. Previously, reducing the cesarean birth rate had been a challenging quality improvement project with negligible sustained success, but California has embraced the four-step model described here. In the first year of focusing on this area, California has seen a nearly 4-percentage-point drop in rates of low-risk first-birth cesarean deliveries, from 28.8 percent to 24.9 percent, and many individual hospitals have seen declines of more than 10 percentage points.²⁷ The support of all of the partners described above—especially health plans, purchasers, payers, and public reporting entities—has been key for this significant progress. The Maternal Data Center and its rapid-cycle metrics have been particularly valuable in enabling facilities to perform measure analysis to determine which aspect of labor to focus their quality improvement efforts on.

Special Challenges For Implementation

Two of the larger challenges with quality improvement at population scale involve dissemination and engagement. The California Hospital

Association (in particular, the Hospital Quality Institute) was a key partner in promoting the quality initiatives, engaging hospital leaders and quality departments and encouraging hospitals to enroll in the Maternal Data Center. These actions provided legitimacy for the Collaborative and helped establish its priority among the many potential projects in which hospitals are asked to engage. While there is often concern about the increasing consolidation of health care in the US, one potential advantage is that hospital systems often have greater resources to focus on quality initiatives and can provide support to smaller facilities that may lack the capacity for internal quality improvement. The Collaborative actively recruited hospital systems to leverage these advantages and have the largest possible population impact. Within the Collaborative, systems were able to share quality improvement strategies and compare data with each other and with independent hospitals. The engaged systems in California included Dignity Health, Sutter Health, Kaiser Permanente Southern California, Kaiser Permanente Northern California, Providence St. Joseph Health, Sharp HealthCare, Scripps Health, and a number of smaller systems. Ninety-seven of California’s 240 hospitals are part of larger systems, and nearly 50 percent of California’s annual births occurred within hospital systems (according to data from the California Maternal Data Center). Independent hospitals were also successful in their quality improvement efforts but needed more central support from the Collaborative.

Rural communities face particularly serious maternal health challenges. According to one recent study, 9 percent of rural counties lost their obstetric services in the period 2004–14, and 45 percent of rural counties lacked such services completely in that decade.²⁸ Nationally, rural counties not adjacent to urban areas that lost obstetric services had increases in preterm and out-of-hospital births in the years following closure.²⁹ California has not experienced this degree of maternal health care shortage. Currently, there are only seven small rural counties not adjacent to urban areas that have no obstetric services,²⁸ accounting for fewer than 1,000 of the nearly 500,000 births annually in California.²⁷ The California Medicaid program has made access to services throughout the state an important goal. The expansion of eligibility for Medicaid and the availability of insurance coverage through a highly successful state-based Affordable Care Act Marketplace has reduced the uninsured rate in California to 7.0 percent, with an estimated rate of 3.6 percent after excluding those ineligible for coverage.³⁰ The expanded availability of insurance coverage has had two

critical benefits in supporting women's health: supporting the financial viability of rural health facilities, and increasing access to care for women between pregnancies. This is particularly important for reducing pregnancy complications for women with chronic health conditions.

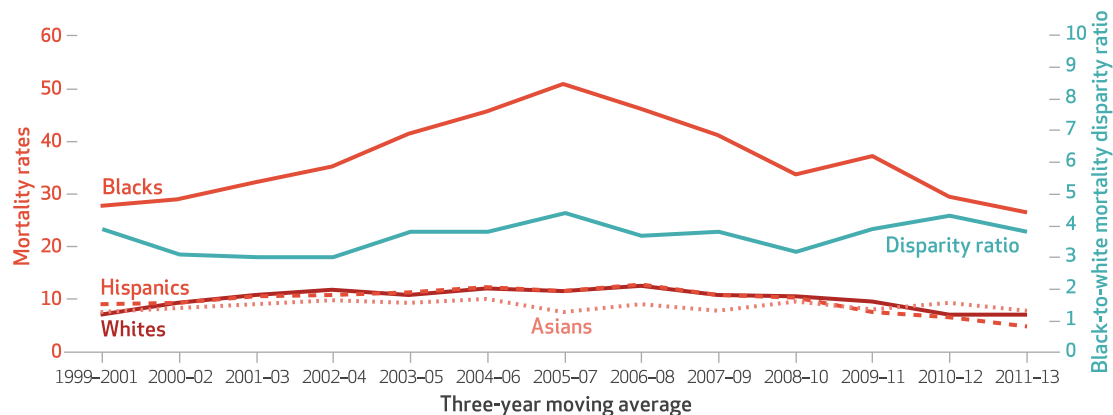
One of the biggest challenges for improving the quality of maternity care in the US is the lack of equity across racial/ethnic groups. Among all quality measures for maternity care, maternal mortality has the largest disparities. Nationally, black women die at a rate three to four times higher than that of white women or Hispanic women.³¹ California data show a reduction in maternal mortality rates for all racial/ethnic groups from 1999–2001 through 2011–13 (exhibit 4). California Hispanic and Asian/Pacific Islander populations had rates very similar to those of whites throughout the time period. Of note, while maternal mortality rates for both black and white mothers fell by 40–50 percent, the gap between blacks' and whites' maternal mortality rates—called the mortality disparity ratio in exhibit 4—remained the same at three to four times higher. This underscores the challenges of maternal mortality: Some of the underlying causes are related to the quality of hospital care and responsive to quality improvement projects directed at hospitals, while other causes may have a stronger relationship to health care delivery issues, social determinants, or chronic racism. For example, hemorrhage is an hospital-centered acute complication that has well-defined and effective treatments. We believe that initiatives such as those described here should

have good success in reducing black-white disparities for deaths and morbidity from hemorrhage but are likely to be less effective in addressing disparities related to other causes that are more dependent on social determinants, comorbidities, and patients' trust in the health care system. Much work remains to be done to improve the way care is provided to black women and communities. A series of such projects that engage communities with the health care system and engage community members with the Collaborative are in their pilot phase in California.

For every quality improvement project, it is always a challenge to maintain focus and sustain the gains made during the active project. The Collaborative has also used the four steps described here to sustain project progress. In particular, ongoing communications via professional organizations that highlight the remaining gaps have kept project topics fresh; for selected projects, health plans have added incentives (financial and other); and the Collaborative's Maternal Data Center has provided automated alerts for hospital leaders should the quality metrics start to slip. One continuing challenge has been the limited number of and expertise among physician and nurse leaders. In partnership with the Hospital Quality Institute and Blue Shield of California, the Collaborative has established a Maternal Quality Improvement Academy with the aim of building quality improvement capacity within every California hospital's maternity unit.

EXHIBIT 4

Maternal mortality rates per 100,000 live births in California, by race/ethnicity, and mortality disparity ratio for non-Hispanic blacks and whites, 1999–2013



SOURCE Authors' reproduction of data from the California Department of Public Health, Center for Family Health, Maternal, Child and Adolescent Health Division, March 2015; and the California Birth and Death Statistical Master Files. **NOTES** Maternal mortality and the maternal mortality rate calculation are defined in the text. The mortality disparity ratio is the mortality rate for non-Hispanic blacks divided by the rate for non-Hispanic whites.

Conclusion

A four-step model to improve the quality of maternity care in California has increased efforts to confront a number of maternal health challenges. The model has supported a variety of large, multidisciplinary quality improvement projects that have reached over 130 hospitals at once, leading to change on a broad scale. The linkage of state mortality and morbidity surveillance projects to quality improvement action has helped engage clinicians. The collaborative partnership of organizations from all parts of the health care system has focused providers' and hospital leaders' attention on maternal health challenges and incentivized progress. The ability to reuse administrative data in near real time has created a low-burden comprehensive data system focused on supporting quality improvement

efforts and activities. Components of this model are now being developed nationwide with support from the CDC and in a collaborative network of state collaboratives.³² Over twenty states have active perinatal quality collaboratives at varying stages of development.³³

Although the decline in maternal mortality rates in California is laudable, it can not be attributed to any one factor. However, the joint leadership of the public and private sectors has helped ensure that all boats are rowing in the same direction. The commitment to maximizing the health of women before pregnancy, protecting their health during pregnancy, and ensuring that all women can achieve equally good outcomes is shared and acted upon by a large community of people and organizations dedicated to reproductive health in California. ■

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