

State Strategies to Address Opioid Use Disorder Among Pregnant and Postpartum Women and Infants Prenatally Exposed to Substances, Including Infants with Neonatal Abstinence Syndrome

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Since 1999, the rate of opioid use disorder (OUD) has more than quadrupled, from 1.5 per 1,000 delivery hospitalizations to 6.5 (1), with similar increases in incidence of neonatal abstinence syndrome (NAS) observed for infants (from 2.8 per 1,000 live births to 14.4) among Medicaid-insured deliveries (2). CDC's response to the opioid crisis involves strategies to prevent opioid overdoses and related harms by building state capacity and supporting providers, health systems, and payers.* Recognizing systems gaps in provision of perinatal care and services, CDC partnered with the Association of State and Territorial Health Officials (ASTHO) to launch the Opioid Use Disorder, Maternal Outcomes, and Neonatal Abstinence Syndrome Initiative Learning Community (OMNI LC). OMNI LC supports systems change and capacity building in 12 states.† Qualitative data from participating states were analyzed to identify strategies, barriers, and facilitators for capacity building in state-defined focus areas. Most states focused on strategies to expand access to and coordination of quality services (10 of 12) or increase provider awareness and training (nine of 12). Fewer states focused on data, monitoring, and evaluation (four of 12); financing and coverage (three of 12); or ethical, legal, and social considerations (two of 12). By building capacity to strengthen health systems, state-identified

strategies across all focus areas might improve the health trajectory of mothers, infants, and families affected by the U.S. opioid crisis.

Guidance for pregnant and postpartum women with OUD includes universal screening for substance use during pregnancy; provision of medication-assisted treatment and behavioral counseling during pregnancy and the postpartum period; anticipation and management of NAS for infants prenatally exposed to substances; and multidisciplinary, long-term

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*CDC opioid portal site. <https://www.cdc.gov/opioids/strategy.html>.

† Twelve states were identified for participation in the first year of OMNI LC: Alaska, Florida, Illinois, Kentucky, Nevada, Ohio, Pennsylvania, Rhode Island, Tennessee, Vermont, Washington, and West Virginia. States were invited to participate in OMNI LC based on a high prevalence or incidence of opioid-related behaviors and outcomes (e.g., NAS incidence, OUD prevalence, overdose death rates), available treatment for OUD (e.g., medication-assisted treatment for pregnant and postpartum women), a declared state of emergency, and state-initiated or -developed interventions to address the opioid crisis.



follow-up care for mothers and infants to improve outcomes.[§] Provision of services requires coordinated effort among providers, health departments, and other state and local agencies, including residential treatment programs, housing authorities, and child welfare agencies.[¶] OMNI LC uses a learning collaborative framework (3) that is designed to support states in developing and implementing systems change on complex public health issues.

As part of the learning collaborative framework, 12 state teams, comprising leaders from multidisciplinary agencies,** participated in a 2-day meeting in Arlington, Virginia, in November 2018, with support from ASTHO, CDC, and other federal and academic partners.^{††} Five focus areas were defined: 1) access to and coordination of quality services; 2) provider

awareness and training; 3) data, monitoring, and evaluation; 4) financing and coverage; and 5) ethical, legal, and social considerations. State teams developed plans of action within one or more focus areas and outlined activities to accomplish goals. CDC abstracted data from state action plans and other information sources (i.e., topic-specific discussion notes and state presentations). CDC coded data and identified strategies, existing barriers, and facilitators.^{§§} Codes were validated by a separate group of CDC researchers using the same codebook; differences were resolved through consensus.

Focus Areas

Access to and coordination of quality services. Among the 12 state teams, 10 developed action plans to address access to and coordination of quality services for pregnant and postpartum women with OUD and infants prenatally exposed to substances, including infants with NAS (Table 1). Existing barriers included geographic and logistic challenges (e.g., limited resources in rural areas and lack of transportation or child care) and lack of coordinated clinical and social services

[§] <https://www.acog.org/Clinical-Guidance-and-Publications/Committee-Opinions/Committee-on-Obstetric-Practice/Opioid-Use-and-Opioid-Use-Disorder-in-Pregnancy?IsMobileSet>.

[¶] <https://store.samhsa.gov/system/files/sma16-4978.pdf>.

** The following leaders participated on state teams: state health official; Medicaid medical director; behavioral, mental health, or alcohol and drug abuse director; Title V director; and a provider or facility champion. Each state team was composed of a minimum of five members representing the leadership described above. States might have included additional state staff members to support leadership participating in the meeting.

†† Participants of the in-person meeting included representatives of the following organizations: American College of Obstetricians and Gynecologists, Association of Maternal and Child Health Programs, Centers for Medicare & Medicaid Services, Health Resources and Services Administration, National Association of State Alcohol and Drug Abuse Directors, Substance Abuse and Mental Health Services Administration, Administration for Children and Families, and University of Illinois at Chicago.

§§ A strategy is defined as a method or technique used to enhance the adoption, implementation, and sustainability of a program, practice, or policy. Strategies should identify/define discrete components operationally, including: who enacts the strategy (actor); actions, steps, or processes, using active verb statements (action); and the target of the strategy (action target). <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3882890/>. Barriers and facilitators are defined as factors obstructing or enabling improvements, presenting problems or providing incentives, by moderating or mediating public health practice, programs, or policies.

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TABLE 1. Defined areas of focus targeting pregnant and postpartum women with opioid use disorder and infants prenatally exposed to substances, by state — Opioid Use Disorder, Maternal Outcomes, and Neonatal Abstinence Syndrome Initiative Learning Community, 2018

Focus area	Definition	State												
		AK	FL	IL	KY	NV	OH	PA	RI	TN	VT	WA	WV	
Access to and coordination of quality services	Assessment of eligibility and availability of services to aid in treatment, referral, or recovery efforts (e.g., mental health services, child care, and transportation services), coordination of quality care, and integration of ancillary services	Yes*	Yes	— [†]	Yes	Yes	Yes	Yes	Yes	—	Yes	Yes	Yes	Yes
Provider awareness and training	Guidance, training, and education for providers on treatment protocols and guidelines to standardize care, screen and refer for treatment, and increase familiarity with additional clinical or social service resources and relevant state-specific laws and policies (e.g., plans of safe care)	Yes	—	Yes	Yes	Yes	Yes	Yes	Yes	Yes	—	Yes	—	Yes
Data, monitoring, and evaluation	Monitoring the burden of substance use or misuse through analysis of surveillance data, evaluation of programs, and policy or quality improvement initiatives	Yes	—	—	—	—	—	—	Yes	—	—	Yes	—	Yes
Financing and coverage	Medical coverage, reimbursement, and billing strategies for treatment of opioid use disorder during and after pregnancy, for prevention efforts, and to sustain long-term care provision	—	Yes	—	—	—	—	—	—	—	Yes	—	Yes	—
Ethical, legal, and social considerations	Programs, policies, or policy amendments to address social stigma and legal considerations (e.g., mandatory reporting) that affect uptake, access to, and provision of clinical, substance use, and mental health services	—	—	Yes	—	—	—	—	—	Yes	—	—	—	—

Abbreviations: AK = Alaska; FL = Florida; IL = Illinois; KY = Kentucky; NV = Nevada; OH = Ohio; PA = Pennsylvania; RI = Rhode Island; TN = Tennessee; VT = Vermont; WA = Washington; WV = West Virginia.

* "Yes" indicates a state is working on strategies within the area of focus.

[†] Dash indicates a state is not working on strategies within the area of focus.

(Table 2). Strategies included coordination of OUD treatment, wraparound services (e.g., nutrition or mental health services), and trauma-informed, family-centered care; improvement in collaboration between state agencies and other state organizations; and implementation of statewide perinatal quality collaboratives (Table 3). Telemedicine could facilitate access to care in rural areas or areas with limited services (Table 2).

Provider awareness and training. Nine of 12 state team action plans focused on improving health care provider awareness and training related to care for vulnerable populations^{¶¶} (Table 1). Identified barriers included lack of awareness and experience among providers in identifying women with OUD and prescribing medication-assisted treatment to pregnant and postpartum women (Table 2). Strategies identified included implementing clinical protocols and standardized services; educating health care providers about evidenced-based screening and treatment standards; and developing plans of safe care (i.e., best practices for infants affected by substance use or withdrawal symptoms to ensure their safety and well-being

once released from the hospital, and referral to services for caregivers, including mothers, with substance use disorder) requirements^{***} (Table 3). Resources such as screening, brief intervention, and referral to treatment training and provider 24-hour hotlines might facilitate efforts (Table 2).

Data, monitoring, and evaluation. Four of 12 state team action plans included establishing or modifying quality assurance and monitoring systems for vulnerable populations (Table 1). Reported barriers included inconsistent data collection and monitoring practices and limitations in data processing capacity (Table 2). Strategies included plans to develop quality improvement protocols, data systems, and standard data elements that identify pregnant and postpartum women with OUD and infants with NAS to improve care and service coordination (Table 3). Leveraging existing statewide data systems might advance implementation of data-related activities (Table 2).

Financing and coverage. Three of 12 state teams developed plans to address financing and insurance coverage (Table 1).

^{¶¶} Vulnerable populations are defined in this report as pregnant or postpartum women with OUD and infants prenatally exposed to substances, including infants with NAS.

^{***} Plans of safe care are defined in the Comprehensive Addiction and Recovery Act of 2016, amended version (July 22, 2016). <https://www.congress.gov/bill/114th-congress/senate-bill/524/text>.

TABLE 2. Existing barriers to and facilitators of addressing opioid use disorder among pregnant and postpartum women and infants prenatally exposed to substances — Opioid Use Disorder, Maternal Outcomes, and Neonatal Abstinence Syndrome Initiative Learning Community, state action plans,* 12 states,† 2018

Focus area	Existing barriers and facilitators
Access to and coordination of quality services	
Existing barrier	<ul style="list-style-type: none"> Limited access to comprehensive clinical services, longer term MAT, and mental and behavioral health therapy because of limited number of specialized providers, delay in connection to care, variable transportation resources, and patient cost of services and treatment Limited access to services in rural areas because of reduced provider and social service availability, constrained health care infrastructure, and patient distance from care Lack of comprehensive, coordinated, quality, continuous, and integrated care systems and social services for women with OUD and infants prenatally exposed to substances during care transition (e.g., from prenatal, obstetric, and delivery/neonatal intensive care unit to postpartum and pediatric care; from positive screen for OUD to treatment)
Existing facilitator	<ul style="list-style-type: none"> Telemedicine to facilitate access to care in areas with low provider capacity PQC infrastructure to facilitate provider coordination of services Existing facility-based interventions or in-patient programs with resources on parenting and social skills for women with OUD and infants prenatally exposed to substances Existing care and service referral processes for infants prenatally exposed to substances, including infants with NAS to ensure connection to appropriate care and services Existing workgroups or task forces to focus on health and social services for infants prenatally exposed to substances, including infants with NAS
Provider awareness and training	
Existing barrier	<ul style="list-style-type: none"> Lack of statewide provider awareness and experience with identifying and treating OUD, being a MAT prescriber, linking patients to other trained MAT providers, or broader issues affecting use or misuse of substances Inconsistent access to training and education for providers to better care for women with a positive screen for mental health conditions or substance use or misuse Unclear reporting requirements and inconsistent application of evidence-based standards of care, including variable use of SBIRT for mental health or substance use or misuse in clinics and facilities
Existing facilitator	<ul style="list-style-type: none"> Statewide 24-hour telephone support lines to support provider knowledge of MAT prescribing guidelines PQC infrastructure to provide training opportunities (e.g., care bundles or waiver trainings) Use of the SBIRT practice for provider training on mental health conditions and substance use Leverage of current grant-funded programs to facilitate new training curricula for providers treating substance use
Data, monitoring, and evaluation	
Existing barrier	<ul style="list-style-type: none"> Inconsistent data collection and monitoring practices within a state, affecting measurement of services, assessment of burden, and reporting (e.g., OUD prevalence among pregnant and postpartum women, and plans of safe care for infants and caregivers) Limited in-state capacity to analyze data on prescription drug monitoring and OUD leads to delayed data analysis
Existing facilitator	<ul style="list-style-type: none"> Existing statewide data systems that identify women who test positive for substance use during pregnancy and infants prenatally exposed to substances
Financing and coverage	
Existing barrier	<ul style="list-style-type: none"> Variable coverage of MAT treatment and counseling, ranging from full to partial or limited coverage for services (e.g., coverage gaps beyond 6 weeks postpartum) Limited provider understanding of insurance coverage for substance use treatment and counseling services, including MAT, which affects utilization of resources Reimbursement issues, including lack of billing codes, coding discrepancies, and challenges with telemedicine or telehealth program reimbursement, resulting in limited provision of services Lack of sustainable funding for programs, including PQCs, home visiting programs, screening and behavioral interventions, or drug treatment programs, that support quality care and services
Existing facilitator	<ul style="list-style-type: none"> Current billing and reimbursement structures that incorporate OUD recovery treatment, including inpatient substance use treatment and services
Ethical, legal, and social considerations	
Existing barrier	<ul style="list-style-type: none"> Stigma associated with substance use, including discrimination and criminalization Fear of separation experienced by pregnant and postpartum women, from infants prenatally exposed to substance, including infants with NAS Ethical concerns of health care providers about screening, reporting, and treating OUD during pregnancy Gaps in provision of and access to social services, such as housing, transportation, and access to child care, for pregnant and postpartum women who use or misuse substances Broader issues, such as polysubstance use, intergenerational poverty, and systemic factors and environmental conditions that might contribute to the opioid crisis that affect health outcomes
Existing facilitator	<ul style="list-style-type: none"> Statewide substance use campaigns currently include antistigma messaging, and promote care coordination including plans of safe care for infants and caregivers

Abbreviations: MAT = medication-assisted treatment; NAS = neonatal abstinence syndrome; OUD = opioid use disorder; PQC = perinatal quality collaborative; SBIRT = screening, brief intervention, and referral to treatment.

* State action plans include an action document, presentation materials, and in-person discussions at the Opioid Use Disorder, Maternal Outcomes, and Neonatal Abstinence Syndrome Initiative Learning Community kick-off meeting in 2018.

† Alaska, Florida, Illinois, Kentucky, Nevada, Ohio, Pennsylvania, Rhode Island, Tennessee, Vermont, Washington, and West Virginia.

TABLE 3. Strategies to address opioid use disorder among pregnant and postpartum women and infants prenatally exposed to substances — Opioid Use Disorder, Maternal Outcomes, and Neonatal Abstinence Syndrome Initiative Learning Community, state action plans,* 12 states,† 2018

Focus area	Strategies
Access to and coordination of quality services	<ul style="list-style-type: none"> • Add a focus on pregnant and postpartum women and infants to statewide opioid initiatives and obtain internal state stakeholder confirmation • Communicate, collaborate, and coordinate within the state to avoid duplication of effort among agencies and organizations on OUD and NAS • Develop a MAT provider network map for pregnant and postpartum women with OUD using various state sources to share with stakeholders and the public • Implement evidence-based strategies to engage women in OUD treatment by building community-based service capacity to improve trauma-informed and family-centered care • Develop protocols and implementation processes for plans of safe care that include provision of services for postpartum women as caregivers for infants prenatally exposed to substances • Implement a PQC to coordinate OUD treatment networks, provide standards of care, disseminate communication and training on addressing stigma during care, and catalog social/wraparound services for pregnant and postpartum women and infants prenatally exposed to substances (e.g., nutrition and mental health services, housing services, parenting support, or early intervention) • Incorporate specific services and early education initiatives for infants prenatally exposed to substances into existing state frameworks and policies focused on infants and children • Improve care coordination and transition care from hospital discharge to pediatric services for postpartum women with OUD and infants prenatally exposed to substances
Provider awareness and training	<ul style="list-style-type: none"> • Educate providers and the health care community on the importance of MAT and counseling services • Educate providers and the health care community on requirements for plans of safe care requirements • Implement provider training on clinical standards and treatment using the prescription waiver to increase the number of active, listed, and licensed MAT providers • Train facility-based, prenatal, and community health care providers and program staff members on the SBIRT practice for pregnant women and caregivers of infants prenatally exposed to substances • Implement a PQC to develop clinical protocols, prescribing protocols, and standardized services for the treatment and management of pregnant and postpartum women with OUD, and the treatment and management of infants prenatally exposed to substances, including infants with NAS • Develop perinatal care practice standards and protocols for universal screening of prenatal and postpartum OUD, and facility-based screening for infants prenatally exposed to substances • Develop protocols for rapid quality improvement on care coordination of pregnant and postpartum women with OUD and infants prenatally exposed to substances • Develop a framework and training for implementing plans of safe care in all jurisdictions and communities
Data, monitoring, and evaluation	<ul style="list-style-type: none"> • Develop protocols to measure and evaluate rapid quality improvement on care coordination of pregnant and postpartum women with OUD and infants prenatally exposed to substances (e.g., PQC) • Develop a standardized data system to aid in identifying pregnant and postpartum women who use or misuse substances and infants prenatally exposed to substances, and collect information to meet Child Abuse Prevention and Treatment Act of 2016 reporting requirements • Identify standard data elements, data collection practices, and case definitions for OUD and NAS surveillance in birth hospitals • Establish a data-sharing process to identify eligibility for, referral to, and enrollment in special programs or social services for infants with NAS using data from multiple information systems to monitor early identification and connections to systems of care
Financing and coverage	<ul style="list-style-type: none"> • Identify and expand coverage to increase access to inpatient or residential OUD treatment and comprehensive services for postpartum women with infants • Collaborate with stakeholders to implement a care bundle for postpartum women with OUD and infants prenatally exposed to substances, including infants with NAS • Develop and implement a plan to provide and reimburse integrated, wraparound services for infants prenatally exposed to substances, up to age 1 year • Work with insurers, including Medicaid, to change prior authorization prescribing requirements for MAT, ensure full insurance coverage up to 1 year postpartum, and remove special requirements for prescribing approved medications • Identify sources for funding (e.g., Medicaid and federal grants) to support training efforts statewide and implementation of standardized clinical care
Ethical, legal, and social considerations	<ul style="list-style-type: none"> • Develop nonstigmatizing messages for providers of substance use prevention and treatment and social and child welfare services on support of pregnant and postpartum women with OUD and infants prenatally exposed to substances, including those with NAS • Train providers on implicit bias and antidiscrimination of pregnant women with mental health conditions or who use and misuse substances • Coordinate with statewide antistigma campaigns to address stigma toward pregnant and postpartum women who use and misuse substances, and infants prenatally exposed to substances • Standardize family-focused policies and practices across state agencies and health care organizations for postpartum women with OUD and infants prenatally exposed to substances

Abbreviations: MAT = medication-assisted treatment; NAS = neonatal abstinence syndrome; OUD = opioid use disorder; PQC = perinatal quality collaborative; SBIRT = screening, brief intervention, and referral to treatment.

* State action plans include an action document, presentation materials, and in-person discussions at the Opioid Use Disorder, Maternal Outcomes, and Neonatal Abstinence Syndrome Initiative Learning Community kick-off meeting in 2018.

† Alaska, Florida, Illinois, Kentucky, Nevada, Ohio, Pennsylvania, Rhode Island, Tennessee, Vermont, Washington, and West Virginia.

Reported barriers were variable coverage of OUD treatment for pregnant and postpartum women and care of infants with NAS, issues with service reimbursement, and limited funding for services (Table 2). Strategies included collaborating with insurers and other stakeholders to expand coverage of services, implementing care bundles (e.g., groups of health services), limiting prior authorization requirements, and providing full health insurance coverage up to 1 year postpartum (Table 3). Modifying current billing and reimbursement structures might facilitate coverage of appropriate care for OUD (Table 2).

Ethical, legal, and social considerations. Two of 12 state teams focused on ethical, legal, or social considerations (Table 1). State teams reported that pregnant and postpartum women with OUD and infants with a diagnosis of NAS might experience stigma, including discrimination and criminalization, and gaps in provision of social services (Table 2). States noted that providers had ethical concerns about screening, reporting, or treating OUD during pregnancy because some states require reporting to child welfare or protection agencies.^{†††} State teams highlighted broader issues, including polysubstance use and systemic factors contributing to the opioid crisis. Strategies included creating nonstigmatizing messages for health care and service providers, training providers on unconscious bias and antidiscrimination practices for pregnant women with mental health conditions or OUD, and incorporating family-focused policies and practices into agencies and organizations (Table 3). Existing statewide efforts on substance use can be leveraged to improve care coordination and address stigma (Table 2).

Discussion

OMNI LC aims to build state capacity to support systems change in states. Most states focused on increasing access to and coordination of quality services and provider awareness and training, with fewer states focused on data, monitoring, and evaluation; financing and coverage; or ethical, legal, and social issues. Implementing strategies to provide quality services and trained providers might be the initial areas of focus for states building capacity to improve perinatal outcomes for families affected by the opioid crisis. Future work in OMNI LC might focus on the importance of surveillance and evaluation, coverage, and stigma experienced by women and infants (4,5).

As has been found in other learning communities, stakeholder partnerships were identified by OMNI LC states as important across all focus areas and a necessary component of capacity-building (6). Stakeholder partnerships can act as levers to address barriers and are a critical aspect of implementing

systems change (6,7). For example, states planned to engage hospital leadership, professional organizations, and provider champions in establishing statewide perinatal health networks.

Perinatal quality collaboratives are highlighted as a strategy and facilitator in the focus areas of access to and coordination of quality services and of provider awareness and training. These collaboratives are state-based networks for implementing quality improvement activities using rapid data analysis to improve the health of mothers and infants.^{§§§} Many state perinatal quality collaboratives address OUD and implement the patient-safety obstetric care bundle for pregnant and postpartum women with OUD, developed by the Alliance for Innovation on Maternal Health program.^{¶¶¶} The bundle includes developing partnerships with health care facilities and organizations, training providers on clinical care practices and standards, identifying state and local reporting guidelines, connecting women to appropriate care, and implementing requirements for plans of safe care.^{****}

Beyond immediate care for pregnant and postpartum women with OUD, broader social and contextual issues discussed by state teams included lack of resources for mental health treatment, lack of sustainable funding for social programs, polysubstance use, and systemic factors such as intergenerational poverty. States noted difficulty with addressing OUD independent of other substance use (e.g., tobacco, alcohol, or marijuana). Approximately 90% of pregnant women who use opioids for nonmedical reasons concurrently use other legal and illicit substances (8), and with the changing nature of drug use, drug overdose deaths involving opioids, cocaine, or other psychostimulants are increasing (9). Social determinants of health, described as contributors to the opioid crisis, include intergenerational or persistent poverty, unstable housing, substandard education, and bias by race or ethnicity that might introduce stigma and unequal access to treatment and care (10). States in OMNI LC might focus on polysubstance use and additional social, ethical, and legal considerations, including the social determinants of health, by supporting multidisciplinary collaboration among various agencies (e.g., departments of housing, education, and public health).

The findings in this report are subject to at least three limitations. First, qualitative information collected reflects the activities and experiences of members of the state teams participating in OMNI LC. Thus, it is not representative of a state's entire opioid crisis response activities, which might be directed by state priorities and available funding and capacity.

^{§§§} <https://www.cdc.gov/reproductivehealth/maternalinfanthealth/pqc.htm>.

^{¶¶¶} <https://www.acog.org/About-ACOG/ACOG-Departments/Patient-Safety-and-Quality-Improvement/What-is-AIM?IsMobileSet>.

^{****} <https://safehealthcareforeverywoman.org/patient-safety-bundles/obstetric-care-for-women-with-opioid-use-disorder/>.

^{†††} <https://www.gutmacher.org/state-policy/explore/substance-use-during-pregnancy>.

Summary**What is already known about this topic?**

Opioid use disorder (OUD) during pregnancy contributes to adverse maternal and infant outcomes, including neonatal abstinence syndrome. In response to the opioid crisis, changes in state-level systems are critical for improving health outcomes.

What is added by this report?

Multidisciplinary state teams most commonly identified strategies focused on increasing access to and coordination of quality services or improving provider awareness and training to improve outcomes for pregnant and postpartum women with OUD and infants prenatally exposed to substances, including opioids.

What are the implications for public health practice?

As identified by multidisciplinary state teams, implementing strategies to improve health care quality and training providers are important to addressing the opioid crisis. Future work with states' teams might focus on increasing surveillance and evaluation, sustaining coverage, and reducing stigma experienced by women and infants.

Second, abstracted information sources required interpretation because verbatim transcripts were unavailable; however, the qualitative analysis protocol required consensus-based decision-making to limit over-interpretation. Finally, the findings of this analysis from 12 states are not generalizable to all states; however, strategies, barriers, and facilitators might be informative for states seeking to address the opioid crisis for vulnerable populations.

OMNI LC highlights strategies in five focus areas to address the needs of pregnant and postpartum women with OUD and infants prenatally exposed to substances and demonstrates the use of participatory multidisciplinary teams to identify possible strategies for intervention. By building capacity through statewide collaboration and leveraging of stakeholder partnerships (6), states might establish long-term, sustainable systems change and optimize maternal and child health outcomes.

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Outbreak of Electronic-Cigarette–Associated Acute Lipoid Pneumonia — North Carolina, July–August 2019

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On September 6, 2019, this report was posted as an MMWR Early Release on the MMWR website (<https://www.cdc.gov/mmwr>). Electronic cigarettes (e-cigarettes) produce an aerosol by heating a liquid that usually contains nicotine, flavorings, and other chemicals that users inhale, a behavior commonly referred to as “vaping.” E-cigarettes can also be used to deliver marijuana and other drugs. In recent months, more than 200 possible cases of acute lung injury potentially associated with vaping were reported from 25 states (1). During July and August 2019, five patients were identified at two hospitals in North Carolina with acute lung injury potentially associated with e-cigarette use. Patients were adults aged 18–35 years and all experienced several days of worsening dyspnea, nausea, vomiting, abdominal discomfort and fever. All patients demonstrated tachypnea with increased work of breathing on examination, hypoxemia (pulse oximetry <90% on room air), and bilateral lung infiltrates on chest x-ray. All five patients shared a history of recent use of marijuana oils or concentrates in e-cigarettes. All of the products used were electronic vaping pens/e-cigarettes that had refillable chambers or interchangeable cartridges with tetrahydrocannabinol (THC) vaping concentrates or oils, which were all purchased on the street. Three of the patients also used nicotine-containing e-cigarettes, and two of the patients smoked marijuana or conventional cigarettes, although none used other illicit drugs. All five patients were hospitalized for hypoxemic respiratory failure; three required intensive care for acute respiratory distress syndrome, one of whom required intubation and mechanical ventilation. All of the patients survived.

On admission, all patients had an elevated white blood cell count with a neutrophilic predominance and absence of eosinophilia. Initially, all patients were treated empirically with antibiotics (the two-drug combination of ceftriaxone and azithromycin, or a fluoroquinolone) for presumed community-acquired or aspiration pneumonia, but all developed worsening respiratory failure within 48 hours of admission. Blood and sputum cultures were negative for bacterial pathogens; tests for influenza, *Mycoplasma*, and *Legionella* also were negative.

Computed tomography of the chest revealed diffuse basilar-predominant infiltrates with a range of “ground glass” opacities and nodular or “tree-in-bud” infiltrates in all patients (Figure 1). Three patients underwent bronchoscopy

with bronchoalveolar lavage on hospital days 3–5, yielding a combination of neutrophils, lymphocytes, and vacuole-laden macrophages, but without evidence for alveolar hemorrhage or eosinophilia (Figure 2). No bronchoscopic lung biopsies were performed. Lavage cytology was stained with oil red O, which confirmed extensive lipid within alveolar macrophages (Figure 2). Based on clinical history, radiography, and laboratory and bronchoscopic diagnostics, a diagnosis of acute exogenous lipoid pneumonia was made for all five patients.

All five patients improved clinically within 24–72 hours after initiation of intravenous methylprednisone (120 mg–500 mg daily). All five patients survived and were discharged home on a taper of oral prednisone.

One potential explanation for acute lipoid pneumonia among these patients is that aerosolized oils inhaled from e-cigarettes deposited within their distal airways and alveoli, inciting a local inflammatory response that impaired vital gas exchange. Lipoid pneumonia has long been described from aspiration of oil into the lungs and has been associated with e-cigarette use in some case reports (2–6). Symptoms of lipoid pneumonia are often nonspecific with variable chest imaging, which can lead to delayed or missed diagnosis (6).

These five cases highlight the importance of awareness of a potential association between use of marijuana oils or concentrates in e-cigarettes and lipoid pneumonia. Diagnosis of lipoid pneumonia among these patients was based on history of using liquids in e-cigarettes that contain sources of lipid, consistent radiologic findings, demonstration of lipid-laden macrophages in respiratory samples, and exclusion of alternative diagnoses. Lipid-laden macrophages are best demonstrated by performing special lipid stains such as oil red O or Sudan staining of cytology from bronchoalveolar lavage (6). Further investigation of the specific pathogenesis of acute lung injury and inciting factors are warranted to determine whether other cases in the ongoing multistate outbreak (1) bear the same features as the cases described in this report. Patients with lipoid pneumonia might improve on corticosteroids; however, the optimal treatment regimen and duration, as well as the long-term effects of this lung injury, are uncertain (6).

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FIGURE 1. Computerized tomography images showing diffuse lung infiltrates in three patients with e-cigarette-associated severe lung disease — North Carolina, July–August 2019

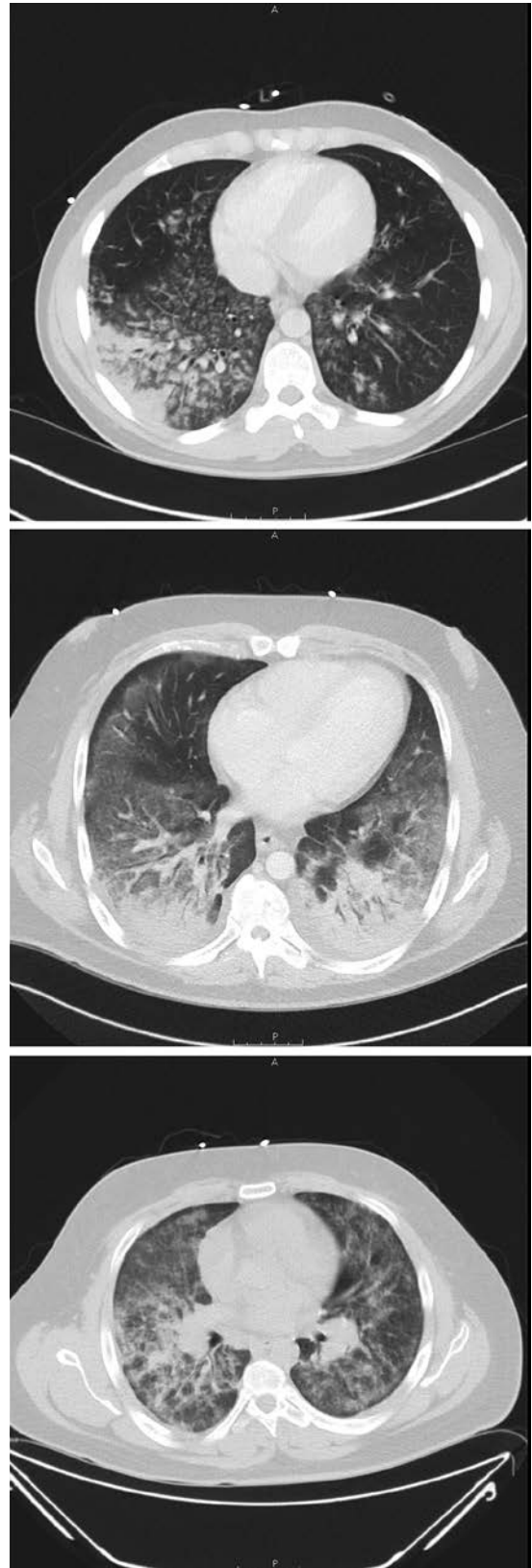
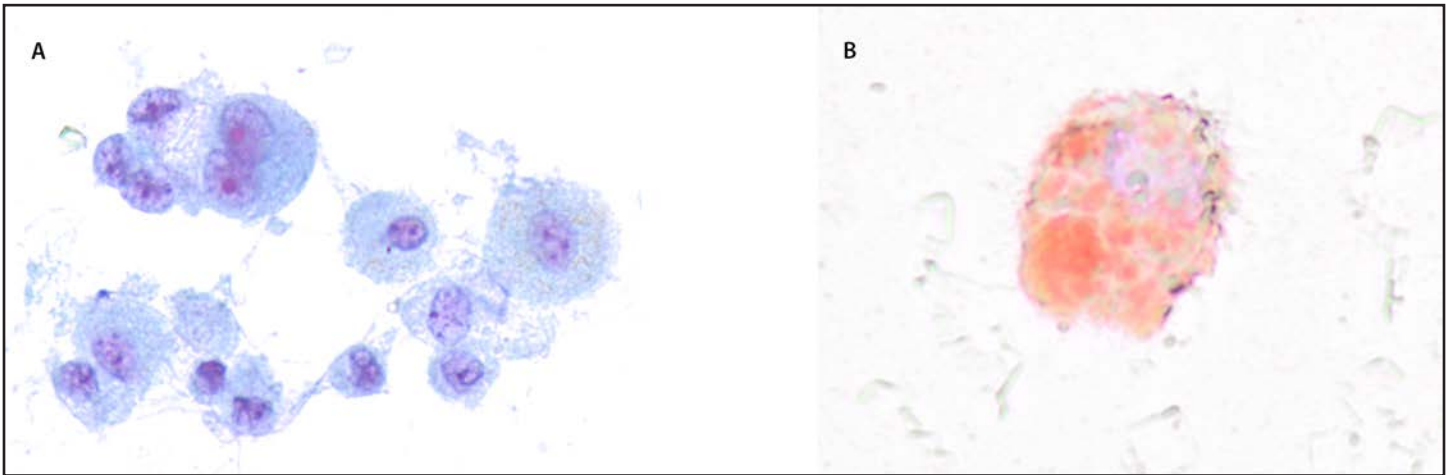


FIGURE 2. Microscopy of a bronchoalveolar lavage sample (Papanicolaou stain [A]* and oil red O stain [B]†) from a patient with acute lung injury associated with vaping — North Carolina, July–August 2019



* Papanicolaou stain demonstrating alveolar macrophages laden with vacuoles.

† Oil red O stain showing lipid deposits staining red (400x magnification).

Severe Pulmonary Disease Associated with Electronic-Cigarette–Product Use — Interim Guidance

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On September 6, 2019, this report was posted as an MMWR Early Release on the MMWR website (<https://www.cdc.gov/mmwr>).

As of August 27, 2019, 215 possible cases of severe pulmonary disease associated with the use of electronic cigarette (e-cigarette) products (e.g., devices, liquids, refill pods, and cartridges) had been reported to CDC by 25 state health departments. E-cigarettes are devices that produce an aerosol by heating a liquid containing various chemicals, including nicotine, flavorings, and other additives (e.g., propellants, solvents, and oils). Users inhale the aerosol, including any additives, into their lungs. Aerosols produced by e-cigarettes can contain harmful or potentially harmful substances, including heavy metals such as lead, volatile organic compounds, ultrafine particles, cancer-causing chemicals, or other agents such as chemicals used for cleaning the device (1). E-cigarettes also can be used to deliver tetrahydrocannabinol (THC), the principal psychoactive component of cannabis, or other drugs; for example, “dabbing” involves superheating substances that contain high concentrations of THC and other plant compounds (e.g., cannabidiol) with the intent of inhaling the aerosol. E-cigarette users could potentially add other substances to the devices. This report summarizes available information and provides interim case definitions and guidance for reporting possible cases of severe pulmonary disease. The guidance in this report reflects data available as of September 6, 2019; guidance will be updated as additional information becomes available.

Preliminary reports from state health department investigations, a published case series of patients in Illinois and Wisconsin (2), and three other published case series (3–5), describe clinical features of pulmonary illness associated with e-cigarette product use. According to these reports, the onset of respiratory findings, which might include a nonproductive cough, pleuritic chest pain, or shortness of breath, appears to occur over several days to several weeks before hospitalization. Systemic findings might include tachycardia, fever, chills, or fatigue; reported gastrointestinal findings, which have preceded respiratory findings in some cases, have included nausea, vomiting, abdominal pain, and diarrhea. Most identified patients have been hospitalized with hypoxemia, which,

in some cases, has progressed to acute or subacute respiratory failure. Patients have required respiratory support therapies ranging from supplemental oxygen to endotracheal intubation and mechanical ventilation. Many patients initially received a diagnosis of infection and were treated empirically with antibiotics without improvement. In the largest cohort, 53 patients from Illinois and Wisconsin (2), the six-patient case series in Utah (4), and in the five North Carolina patients described in a report in this issue of *MMWR* (3), many patients who were treated with corticosteroids improved. All patients in these reports described to date have had abnormal radiographic findings, including infiltrates on chest radiograph and ground glass opacities on chest computed tomography scan.

All patients have a reported history of e-cigarette product use, and no consistent evidence of an infectious etiology has been discovered. Therefore, the suspected cause is a chemical exposure. The type, extent, and severity of any chemical-related illness might depend on multiple factors including the chemical to which the user was exposed; chemical changes associated with heating, dose, frequency, and duration of exposure; product delivery methods; and behaviors and medical conditions of the user. The specific behaviors and exposures of identified patients have varied. Most have reported a history of using e-cigarette products containing cannabinoids such as THC, some have reported the use of e-cigarette products containing only nicotine, and others have reported using both. No consistent e-cigarette product, substance, or additive has been identified in all cases, nor has any one product or substance been conclusively linked to pulmonary disease in patients.

Health care providers who cared for the five North Carolina patients diagnosed acute exogenous lipoid pneumonia in all patients based on history of e-cigarette use and clinical, radiographic, laboratory, and bronchoscopy findings. Specifically, the authors identified lipids within alveolar macrophages from the three bronchoalveolar lavage (BAL) specimens stained with oil red O. All five patients reported using marijuana oils or concentrates in e-cigarettes, and three also reported using nicotine (3). In a report describing the clinical course and outcomes of six patients from Utah, health care providers described the potential diagnostic utility of identification of

Summary**What is already known about this topic?**

Twenty-five states have reported more than 200 possible cases of severe pulmonary disease associated with the use of electronic cigarettes (e-cigarettes).

What is added by this report?

Based on available information, the disease is likely caused by an unknown chemical exposure; no single product or substance is conclusively linked to the disease.

What are the implications for public health practice?

Until a definitive cause is known, persons should consider not using e-cigarettes. Those who use e-cigarettes should seek medical attention for any health concerns. Clinicians should report possible cases to their local or state health department.

lipid-laden macrophages from BAL specimens (4). Among the 53 cases from Illinois and Wisconsin, however, the pathologic findings were heterogeneous. Whereas almost half (24/53) of these patients underwent BAL, seven reports described the use of oil red O stain that identified lipid-laden macrophages (2). Additional pathologic analyses are in progress on specimens from some of these patients (2). The clinical significance of lipid-laden macrophages is currently unclear. It is not known whether the lipid is exogenous (from inhaled material) or endogenous (from altered lipid metabolism). In addition, it is not known whether lipid-laden macrophages are a marker of exposure to e-cigarette aerosol or they are central to the disease process.

CDC is currently coordinating a multistate investigation. Investigations in affected states are focused on describing exposures and the epidemiologic, clinical, laboratory, and behavioral characteristics of cases. In conjunction with a task force from the Council for State and Territorial Epidemiologists and affected states, interim outbreak surveillance case definitions* (Table), data collection tools, and a database to collect relevant patient data have been developed and released. The interim outbreak case definitions will be updated as necessary as additional information becomes available.

CDC has provided technical assistance to states, has issued a Clinical Action alert through its Clinician Outreach and Communication Activity network on August 16, 2019 (6), and has initiated data collection from states. CDC staff members have deployed to Illinois and Wisconsin, the first states that identified patients, as part of an epidemiologic assistance investigation to assist with their state investigations and continue to work closely with affected states to characterize the

exposures and the extent and progression of this illness. CDC is working closely with the Food and Drug Administration (FDA) to facilitate collection of information regarding recent e-cigarette product use among patients and to provide technical assistance related to product samples associated with patients for chemical analysis of remaining substances or chemicals within the e-cigarettes. FDA is focused on processing targeted product samples associated with clinical illness and will analyze samples if there is enough material to test. Those with questions regarding the collection of e-cigarette products for possible testing by FDA should use the following e-mail address: FDAVapingSampleInquiries@fda.hhs.gov.

On August 30, 2019, CDC published recommendations for clinicians, public health officials, and the public based on preliminary information obtained from states and treating clinicians as a Health Advisory (7). CDC has created a website (https://www.cdc.gov/tobacco/basic_information/e-cigarettes/severe-lung-disease.html) (8) to disseminate up-to-date information and has created a dedicated e-mail address for clinicians and health officials to use to communicate about this public health emergency response (VapingAssocIllness@cdc.gov).

Clinicians are encouraged to consider e-cigarette-associated pulmonary disease as one possible etiology in the broad differential diagnosis of patients with pulmonary disease and a history of e-cigarette product use. Clinicians should evaluate and treat for other possible causes of illness (e.g., infectious, rheumatologic, neoplastic, or other) as clinically indicated. They should report possible cases† to their local or state health department for further investigation.

If e-cigarette product use is suspected as a possible etiology for a patient's pulmonary disease, a detailed history of the substances used, the sources, and the devices used should be obtained, as outlined in the Health Advisory (7), and efforts should be made to determine if any remaining product, devices, or liquids are available for testing. Additional recommendations for clinicians, public health officials, and the public are available and will be updated as needed (6–8). Clinicians should contact their local or state health departments for further guidance as needed. State public health officials should promptly notify CDC about possible cases and refer to CDC for the most recent versions of the surveillance case definitions, reporting guidelines, and case investigation forms. Public health officials seeking these documents should e-mail CDC at eoevent101@cdc.gov. CDC will revise these tools as new information becomes available and disseminate them to state health departments. General questions regarding this outbreak can be answered by contacting CDC-INFO (<https://www.cdc.gov/cdc-info/index.html>).

* Outbreak surveillance case definitions are intended for public health data collection purposes and should not be used as a clinical diagnostic tool or replace individual clinical judgment.

† Clinical illness compatible with the case definition that has not yet been classified.

TABLE. CDC surveillance case definitions* for severe pulmonary disease associated with e-cigarette use — August 30, 2019

Case classification	Criteria
Confirmed	Using an e-cigarette (“vaping”) or dabbing [†] during the 90 days before symptom onset
	AND
	Pulmonary infiltrate, such as opacities on plain film chest radiograph or ground-glass opacities on chest computed tomography
	AND
	Absence of pulmonary infection on initial work-up: Minimum criteria include negative respiratory viral panel, influenza polymerase chain reaction or rapid test if local epidemiology supports testing. All other clinically indicated respiratory infectious disease testing (e.g., urine antigen for <i>Streptococcus pneumoniae</i> and <i>Legionella</i> , sputum culture if productive cough, bronchoalveolar lavage culture if done, blood culture, human immunodeficiency virus–related opportunistic respiratory infections if appropriate) must be negative
	AND
	No evidence in medical record of alternative plausible diagnoses (e.g., cardiac, rheumatologic, or neoplastic process).
Probable	Using an e-cigarette (“vaping”) or dabbing [†] in 90 days before symptom onset
	AND
	Pulmonary infiltrate, such as opacities on plain film chest radiograph or ground-glass opacities on chest computed tomography
	AND
	Infection identified via culture or polymerase chain reaction, but clinical team [§] believes this is not the sole cause of the underlying respiratory disease process OR minimum criteria to rule out pulmonary infection not met (testing not performed) and clinical team [§] believes this is not the sole cause of the underlying respiratory disease process
	AND
	No evidence in medical record of alternative plausible diagnoses (e.g., cardiac, rheumatologic, or neoplastic process).

* These surveillance case definitions are meant for surveillance and not clinical diagnosis; they are subject to change and will be updated as additional information becomes available if needed.

[†] Using an electronic device (e.g., electronic nicotine delivery system (ENDS), electronic cigarette (e-cigarette), vaporizer, vape(s), vape pen, dab pen, or other device) or dabbing to inhale substances (e.g., nicotine, marijuana, tetrahydrocannabinol, tetrahydrocannabinol concentrates, cannabinoids, synthetic cannabinoids, flavorings, or other substances).

[§] Clinical team caring for the patient.

While this investigation is ongoing and the definitive cause of reported illnesses remains uncertain, persons should consider not using e-cigarette products. Those who do use e-cigarette products should monitor themselves for symptoms (e.g., cough, shortness of breath, chest pain, nausea, vomiting, or other symptoms) and seek medical attention for any health concerns. Regardless of the ongoing investigation, persons who use e-cigarette products should not buy these products off the street and should not modify e-cigarette products or add any substances that are not intended by the manufacturer.

E-cigarette products should never be used by youths, young adults, pregnant women, or by adults who do not currently use tobacco products. Adult smokers who are attempting to quit should use evidence-based smoking cessation treatments, including counseling and FDA-approved medications; those who need help quitting tobacco products, including e-cigarettes, should contact their medical provider. Persons who are concerned about

harmful effects from e-cigarette products may call their local poison control center at: 1-800-222-1222. CDC will continue to advise and alert the public as more information becomes available.

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Notes from the Field

Interventions to Reduce Measles Virus Exposures in Outpatient Health Care Facilities — New York City, 2018

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Strengthening health care facility infection control is crucial to preventing infectious disease transmission. Guidelines to prevent or minimize airborne pathogen spread in outpatient health care facilities exist (1); however, few reports describe practical implementation when engineering controls, such as recommended airborne infection isolation rooms (negative pressure rooms), are unavailable* (2). On September 30, 2018, a person with measles, a highly contagious respiratory illness characterized by fever and rash, that is spread by airborne transmission, was detected in New York City (NYC),[†] and as of December 10, 42 laboratory or epidemiologically linked cases had been confirmed. By September 3, 2019, with 654 confirmed cases, this measles outbreak had become the largest in the United States since 1992, well before endemic domestic measles transmission was declared eliminated in 2000^{§,¶} (3,4). Interventions used in 15 outpatient health care facilities to attempt to prevent health care facility exposure from patients with suspected measles were evaluated.

During December 10–12, 2018, the NYC Department of Health and Mental Hygiene (DOHMH) surveyed the 17 NYC outpatient health care facilities that reported one or more suspected measles cases during September 30–December 10, 2018, to understand infection control procedures and share best practices. The facilities included seven group practices, four single-provider practices, four federally qualified health centers, and two urgent care centers. The primary staff member responsible for infection control at each facility was invited to participate in the survey.

Among the 17 contacted facilities, 15 participated. All 15 reported posting signs about measles symptoms and conducting patient screening for fever or rash. Thirteen facilities screened by telephone while scheduling appointments, 12 screened at check-in, and 10 screened both during scheduling and at check-in. Although no facility reported having a negative

pressure room, 14 examined patients with suspected measles in a private exam room and prohibited subsequent use of that room for 2 hours.

Alternative isolation interventions were used by 13 facilities to attempt to minimize exposures from potentially infectious patients. These interventions included examining patients outdoors, including in their cars (10 facilities), having patients use separate entrances or examination spaces that were removed from the general patient population (six), evaluating patients after normal business hours (four), and conducting home visits (four).

When measles virus exposures occur in health care facilities, identifying and notifying nonimmune exposed persons and offering postexposure prophylaxis, when indicated, can be time- and human resource-intensive (5). Although most hospitals have infection control protocols that include use of negative pressure rooms, most outpatient facilities do not (6). No surveyed facility in this evaluation had a negative pressure room, the lack of which could make controlling airborne measles virus transmission in outpatient settings difficult (6). However, if they lacked a negative pressure room, most surveyed health care facilities used strategies to attempt to reduce exposures to measles and other airborne-transmitted pathogens, save time and human resources, and minimize health care-associated transmission of measles. Although this report does not assess the effectiveness of these interventions, it shares strategies to attempt to reduce measles exposures in health care facilities. The essential common element in the implemented strategies is early awareness that a patient might have measles, optimally before that patient enters the health care facility. This underscores the importance of maintaining a high index of suspicion during an outbreak, performing measles screening, and rapidly identifying patients with suspected measles.

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* <https://www.cdc.gov/infectioncontrol/guidelines/isolation/index.html>.

[†] <https://www1.nyc.gov/assets/doh/downloads/pdf/han/alert/2018/alert38-measles-outbreak.pdf>.

[§] <https://www1.nyc.gov/assets/doh/downloads/pdf/han/alert/2019/measles-transmission-ended.pdf>.

[¶] <https://www.cdc.gov/measles/cases-outbreaks.html>.

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Notes from the Field

Fatal *Naegleria fowleri* Meningoencephalitis After Swimming in Hot Spring Water — California, 2018

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In October 2018, a previously healthy boy was admitted to an intensive care unit at a southern California hospital after experiencing 2 days of headache, vomiting, and fever and 1 day of altered mental status. He was initially treated empirically for bacterial and viral meningitis and subsequently displayed decreased level of consciousness and experienced respiratory failure, requiring intubation and mechanical ventilation. Computed tomography scan of the brain showed diffuse cerebral edema. A wet mount of cerebrospinal fluid obtained by lumbar puncture revealed amebic organisms consistent with *Naegleria* species, and a treatment regimen for *Naegleria* was added, including miltefosine (1), which is now commercially available.* The infectious disease clinician notified CDC, which then notified state and local public health. Polymerase chain reaction testing of a cerebrospinal fluid specimen at the Mayo Clinic on hospital day 2 identified *N. fowleri*, a free-living ameba found in warm fresh water that causes primary amebic meningoencephalitis (PAM). The patient's condition continued to worsen, and he died on hospital day 3.

Family members stated that 12 days before symptom onset the boy had visited a hot spring area in Inyo County, in the Eastern Sierra region of California, where he swam in a natural freshwater pool. This hot spring area is known locally as Hot Ditch, where a stream of warm spring water flows down from the source with several small shallow pools along the course. These untreated (unchlorinated) freshwater pools had been frequented by local residents and visitors for decades without any previous report of PAM.

N. fowleri is found in warm freshwater lakes, ponds, and hot springs worldwide, but PAM is rare. In 2014, a Florida boy aged 11 years developed fatal PAM after exposure to a hot spring and river pond in Costa Rica where *N. fowleri* was identified (2). In the United States, 145 PAM cases were reported during 1962–2018 (range = 0–8 cases annually); most cases occurred in young males exposed to warm recreational waters during the summer months[†] (3). Infection occurs when water containing *N. fowleri* enters the nose, usually while a person is swimming or diving. The ameba migrates from the nose

to the brain along the olfactory nerve through the cribriform plate, destroys brain tissue, and causes cerebral edema. The case fatality rate for PAM exceeds 97% (3), and the median time from symptom onset to death is 5 days (4). Infection is not transmitted by swallowing contaminated water.

This was the ninth PAM case in California in a patient exposed to warm fresh water and the third in a patient exposed to hot spring water; the first case occurred in 1971 in an adolescent aged 16 years who swam in a desert hot spring in southern California (5). In response to this most recent case, Inyo County Health and Human Services issued a press release to inform and warn the public about the potential for *N. fowleri* infection from swimming in the Hot Ditch natural pools and posted warning signs at each of these pools to alert visitors of the risk.

Although contracting PAM is rare after swimming in hot spring water, the potential risk for this disease should be considered, and persons should either refrain from hot spring water-related activities or take actions to prevent spring water from going up the nose (<https://www.cdc.gov/parasites/naegleria/swimming.html>). Parents should consider this potential risk for their children before exposure to hot spring water.

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*Miltefosine was previously available through CDC. It is now commercially available and can be ordered at <https://www.impavido.com/>.

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Notes from the Field

Rabies Exposures from Fox Bites and Challenges to Completing Postexposure Prophylaxis After Hurricane Irma — Palm Beach County, Florida, August–September 2017

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On August 29, 2017, epidemiology staff members at the Florida Department of Health in Palm Beach County (DOH-Palm Beach) were notified through syndromic surveillance via the Florida Electronic Surveillance System for the Early Notification of Community-based Epidemics (ESSENCE-FL) of an emergency department visit at hospital A for a fox bite received by a county resident (patient A) on August 27. ESSENCE-FL is a system that includes syndromic surveillance that allows users to query emergency department (ED) visit records electronically to conduct surveillance for hospital visits related to reportable conditions. ESSENCE-FL provides data that are deidentified but include patient demographic information along with a patient identification number allowing system users to identify cases of reportable conditions that might not otherwise have been reported through ED visit records. According to medical records, a bite to the foot occurred while the patient, who was experiencing homelessness, was sleeping outdoors. At that time (day 0), patient A received rabies postexposure prophylaxis (rPEP), including wound washing, human rabies immune globulin, and dose 1 of 4 doses of rabies vaccine (Figure), with subsequent doses to be administered on days 3, 7, and 14 (1). On August 29, Palm Beach County Animal Care and Control (PB-ACC) informed DOH-Palm Beach of a second person (patient B) bitten by a fox on August 28. While interviewing patient B outside of his workplace, PB-ACC euthanized an aggressive gray fox suspected of causing the bites and sent it to the DOH Bureau of Public Health Laboratories in Jacksonville for testing. On August 30, laboratorians reported that brain tissue from the fox tested positive for rabies by direct fluorescent antibody testing (2).

On August 30, patient A visited a DOH-Palm Beach clinic for the second rabies vaccine dose, accompanied by a third person bitten by a fox (patient C) who was previously unknown to DOH-Palm Beach and PB-ACC. Neither of these two patients had a referral to the clinic, and both left before receiving vaccine. No contact information was collected, although both patients were reported by clinic staff members to be experiencing homelessness. Although patient B was initially interviewed by PB-ACC, DOH-Palm Beach had difficulty contacting the patient to explain the need for rPEP. After multiple attempts, patient B was contacted by DOH-Palm Beach through the

patient's employer on September 1 and subsequently initiated rPEP at hospital B.

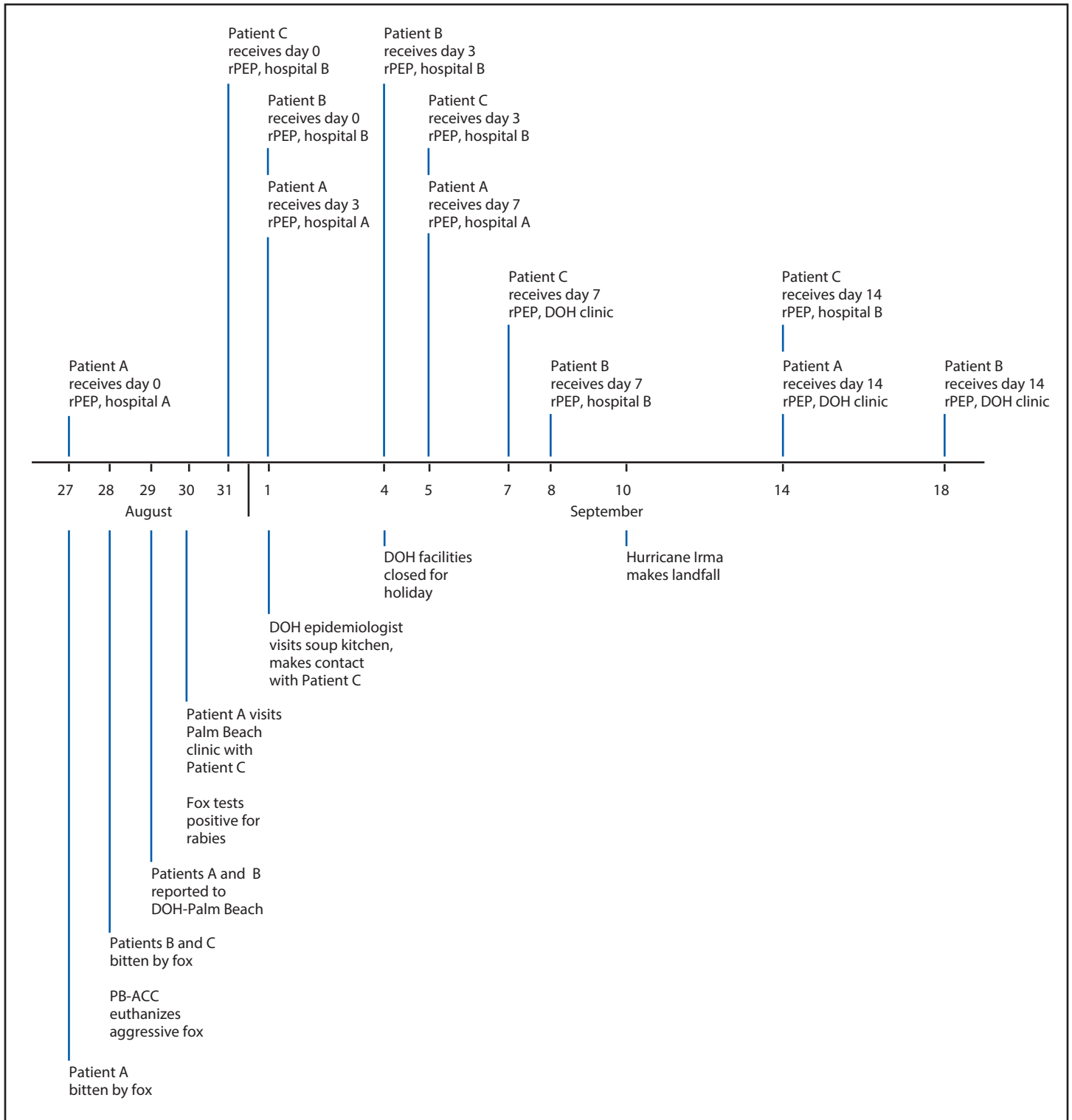
On September 1, DOH-Palm Beach visited a soup kitchen in an urban area near where the rabid fox had been found to search for patients A and C. Patient C was contacted there and reported that rPEP had been initiated at hospital B on August 31. Contact information was exchanged, and the patient received a vaccination schedule. Patient A received vaccine dose 2 on September 1 after contacting DOH-Palm Beach using information obtained from Patient C.

Because of office closures and transportation difficulties caused by Hurricane Irma, all three patients experienced modifications to their rabies vaccination schedules. Once initiated, rPEP should be kept as close to schedule as possible, although delays in vaccine administration of up to a few days are not considered likely to have a significant adverse effect (3). DOH facilities were closed on September 4 for a state holiday, and patients with doses due that day were advised to go to the hospital to remain on schedule. Patient B received rabies vaccine doses 2 and 3 at hospital B on September 4 and September 8, respectively. Patient C received vaccine dose 2 at hospital B (September 5), and dose 3 at a DOH clinic (September 7). Patient A received vaccine dose 3 at hospital A (September 5).

On September 10, Hurricane Irma made landfall in southern Florida. DOH-Palm Beach suspended services at clinics and offices on September 8 and reopened with limited services on September 13. On September 14, patients A and C received rabies vaccine dose 4 at a DOH clinic and hospital B, respectively. Patient B received vaccine dose 4 at a DOH clinic on September 18.

Possible rabies exposure is a reportable condition in Florida; however, these cases were not reported to DOH-Palm Beach by health care providers even though fox bites are considered high-risk exposures (4). Surveillance through ESSENCE-FL not only provided the initial notification for this investigation to DOH-Palm Beach, but a method to track patients' hospital visits for rPEP when they received care outside of health department clinics. This was important in the days following Hurricane Irma, when DOH-Palm Beach offices were closed and patients had rPEP scheduled. Epidemiologists were able to log into ESSENCE-FL remotely to monitor patient visits using medical record numbers or patient demographics. ESSENCE-FL monitoring helped DOH-Palm Beach identify missed rPEP visits and facilitated contact with patients to ensure receipt of recommended doses. All three patients completed their rPEP series by September 18, 2017, with schedule modifications. Subsequently, no human rabies cases associated with these exposures were reported in Palm Beach County.

FIGURE. Timeline of events surrounding fox bites and receipt of rabies postexposure prophylaxis* for three patients — Palm Beach County, Florida, August–September 2017



Abbreviations: DOH = Florida Department of Health; PB-ACC = Palm Beach Animal Care and Control; rPEP = rabies postexposure prophylaxis.
 * rPEP consists of wound washing, 1 dose of human rabies immune globulin (on day 0), and 4 doses of rabies vaccine (on days 0, 3, 7, and 14).

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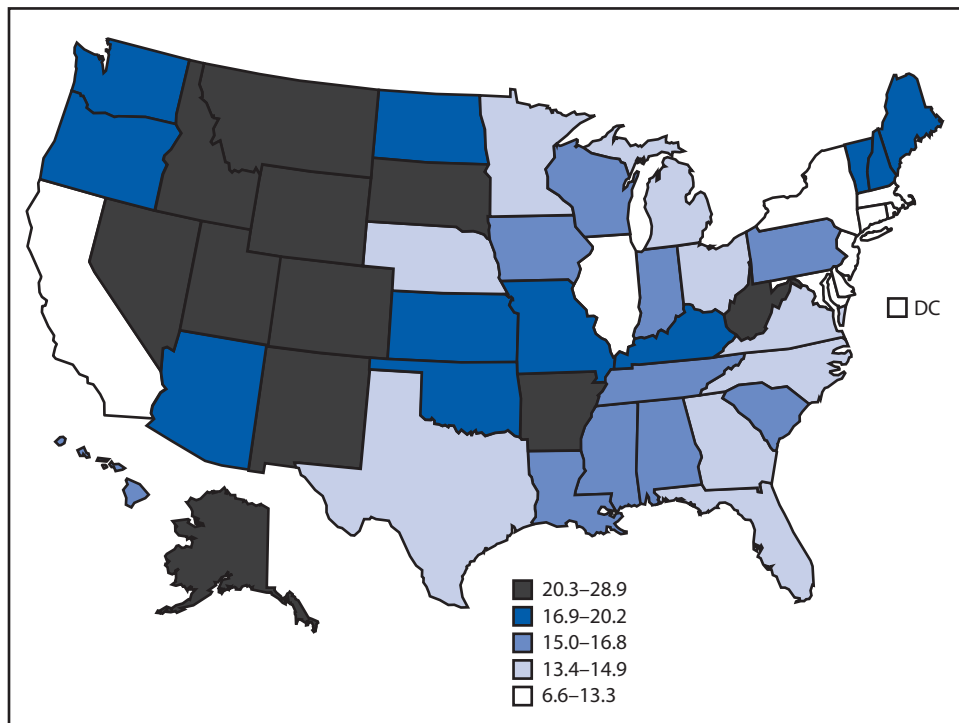
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QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Age-Adjusted Rates* of Suicide,[†] by State — National Vital Statistics System, United States,[§] 2017

Abbreviation: DC = District of Columbia.

* Deaths per 100,000 population, age-adjusted to the 2000 U.S. standard population.

[†] Suicides are identified using the *International Classification of Diseases, Tenth Revision* underlying cause of death codes U03, X60–X84, and Y87.0.

[§] The overall U.S. age-adjusted rate for suicide was 14.0 per 100,000 population in 2017.

In 2017, the U.S. age-adjusted suicide rate was 14.0 per 100,000 population, but rates varied by state. The five states with the highest rates were Montana (28.9 deaths per 100,000 population), Alaska (27.0), Wyoming (26.9), New Mexico (23.3), and Idaho (23.2). The five with the lowest rates were the District of Columbia (6.6), New York (8.1), New Jersey (8.3), Massachusetts (9.5), and Maryland (9.8).

Source: National Center for Health Statistics, National Vital Statistics System. Mortality Data, 2017. <https://www.cdc.gov/nchs/deaths.htm>.

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For more information on this topic, CDC recommends the following link: <https://www.cdc.gov/violenceprevention/suicide/index.html>.

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