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ENVIRONMENT, CLIMATE, AND HEALTH

Issue Brief

Mosquito Spraying to Reduce Spread of Eastern Equine Encephalitis Virus in Michigan: Legal, Ethical, and Practical Challenges

Introduction

In late summer 2019, Michigan experienced an unusually high number of Eastern Equine Encephalitis (EEE) virus disease cases. The EEE virus (EEEV) is a mosquito-borne virus that can cause severe, long-term neurological damage or death. Ten human EEEV infections were reported across six Michigan counties in 2019, resulting in six deaths.[1] In contrast, Michigan reported only seven human EEEV disease cases total from 2009 through 2018.[2]

Michigan was not alone in experiencing a spike in EEEV disease cases last summer; in fact, it was one of several states across the eastern half of the United States that experienced an outbreak. As of December 17, 2019, the U.S. Centers for Disease Control and Prevention (CDC) reported 38 EEEV disease cases across ten states—nearly five times the average number of annual EEEV disease cases reported nationally during the years 2003-2018.[3] Like Michigan, Massachusetts was hit particularly hard by the virus, reporting 12 human EEEV disease cases in 2019.[4] Additional cases were reported in Alabama, Connecticut, Georgia, Indiana, New Jersey, North Carolina, Rhode Island, and Tennessee.[5]

In response to the outbreak, some states, including Michigan, undertook aerial pesticide spraying to reduce the mosquito population in at-risk areas.[6] According to the CDC, aerial spraying is "the one method that can rapidly reduce the number of mosquitoes spreading a virus in a large area."[7] Although not frequently utilized in Michigan, aerial spraying is more common in states where mosquitoes and mosquito-transmitted diseases are more prevalent, such as Florida and Louisiana.[8] The efficacy of aerial mosquito spraying hinges upon widespread participation because the planes used to apply pesticides fly at a height and speed that make it impossible to exclude only narrow parcels of property.[9]

Michigan's aerial spraying effort surfaced numerous legal, ethical, and practical challenges. This issue brief provides an overview of the legal framework involved in detecting and responding to a mosquito-borne disease outbreak in Michigan and discusses important ethical principles that may guide decision-making.

Eastern Equine Encephalitis Virus: Human Health Consequences and Transmission

Human Health Consequences and Treatment

EEE is a relatively rare but extremely dangerous disease. Most individuals infected by the EEE virus experience only minor, non-specific symptoms such as fever or muscle aches, or do not experience any symptoms at all.[10] For this reason, EEEV infections may go undiagnosed.[11] However, among the estimated 4-5% of infected persons who go on to develop EEE, the health consequences are severe.[12] The fatality rate for the disease is approximately 33 percent, and even individuals who survive EEE are likely to suffer mild to severe long-term neurological impairment.[13]

Currently, no antiviral drug has been deemed effective against the EEE virus.[14] There is also no approved EEE virus vaccine for humans.[15]

Transmission

EEEV is transmitted to humans by infected mosquitoes. Most of the time, EEEV is circulated between *Culiseta melanura* mosquitoes (which do not typically bite humans) and bird reservoirs.[16] The virus is most likely to affect humans if a species of mosquito that feeds on both birds and mammals bites an infected bird; the mosquito may then serve as a "bridging vector," transmitting the virus to mammals such as humans and horses.[17] EEEV-infected humans and horses are "dead-end" hosts because there is too little virus in their bloodstreams to be transmitted to other mosquitoes that bite them.[18]

In the U.S., EEEV transmission occurs most frequently in cedar or hardwood freshwater swamps in the Atlantic, Gulf Coast, and Great Lakes regions.[19] Outdoor workers and individuals engaging in recreational activities in commonly affected areas are at heightened risk of EEE virus infection.[20] Among people infected with EEEV, people over 50 years old or under 15 years old appear more likely to develop a severe disease because of the infection.[21]

Michigan's 2019 EEE Response

Michigan's 2019 EEE outbreak was the largest in Michigan's history, involving ten human disease cases and fifty animal disease cases between July 22 and October 11.[22] As human and animal disease cases continued to emerge in late September, with mild weather (and therefore continued mosquito activity) expected into October, the Michigan Department of Health and Human Services (MDHHS) determined that EEE "represent[ed] an emergent threat to Michigan's public health" and required "decisive action" by public health authorities.[23] In response, MDHHS initiated an aerial mosquito spraying program targeting the mosquito species primarily responsible for transmitting EEEV to humans.[24]

MDHHS handled financial and logistical aspects of the aerial spraying program, including hiring a contractor to apply the treatments, obtaining permits, and managing individual requests to opt out of spraying (discussed further below).[25] The department selected Merus 3.0, an organic insecticide approved by the EPA for use as a public health intervention in residential areas, for use in the aerial treatment.[26] Although MDHHS strongly recommended aerial spraying to local health departments (LHDs) in affected counties, it ultimately deferred to LHDs to decide whether to proceed with spraying at the local level.[27] Participating LHDs were asked to assist with communicating about the proposed spraying to the public.[28]

By October 8, 2019, aerial mosquito spraying was successfully completed in 14 counties, including most high-risk areas in the state.[29] However, spraying could not be accomplished in the majority of Kalamazoo County (Michigan's most heavily affected county[30]) because a small percentage of residents exercised their legal right to opt out of spraying.[31] Due to the geographic spread of the opt-outs, plus the 1,000 by 1,000 foot buffer zone that accompanied each individual's decision to opt their property out of spraying,[32] officials determined that spraying in the county would be ineffective.[33] Unfortunately, this meant that a small minority of Kalamazoo County residents deprived their entire county of a potentially life-saving intervention. This and other legal and ethical issues are described more fully below.

Michigan Legal Framework

EEE Detection and Public Notification

Real-time disease surveillance is essential to timely detecting, investigating, and responding to urgent public health threats, including zoonotic diseases such as EEE. In the EEE context, prompt detection of both human and non-human mammal disease cases is crucial to human health, as both types of cases indicate the presence and EEEV infection of bridging vectors that can transmit the virus to humans.

Michigan law mandates reporting of EEEV disease cases among humans and animals. Human EEEV infections must be reported to the LHD with jurisdiction,[34] while animal infections must be reported to the Michigan Department of Agriculture and Rural Development (MDARD).[35] In addition, the state Department of Natural Resources (DNR) monitors disease among wildlife and must notify MDARD of reportable animal diseases found among wildlife.[36]

In response to an EEEV disease report, LHDs or MDHHS[37] (in the case of a human disease report) and MDARD[38] (in the case of an animal disease report) must take appropriate investigative action. Identifiable medical or epidemiological information collected in connection with a disease investigation is confidential and generally not open to public inspection absent the individual or animal owner's consent.[39] However, an exception to this general rule permits public disclosure when necessary to protect the public's health. For human disease cases, the determination of public health necessity may be made by either a local health officer or the MDHHS director.[40] For animal disease reports, public inspection without an animal owner's consent is permitted if the MDARD director determines that disclosure is necessary to protect animal or human health *or* if the MDHHS director determines that disclosure is necessary to protect the public health.[41]

Public disclosure of certain EEEV disease case details, such as the geographic location where exposure likely occurred, is important because many preventive measures may be undertaken individually. These include avoiding outdoor activities between dusk and dawn when mosquitoes are most active, using insect repellant, wearing protective clothing, clearing outdoor areas of potential mosquito breeding sites, and using screens and

mosquito nets.[42] In addition, public awareness of an emerging disease threat may help to increase public support of more rigorous interventions, such as aerial spraying, if they become necessary.[43]

EEE Response

Responding to a mosquito-borne disease threat in Michigan through aerial spraying involves multiple agencies, levels of government, and laws. At the state level, both MDHHS and MDARD play important roles, as MDHHS has general responsibility for protecting human health, while MDARD has specific authority to regulate pesticide use. LHDs play a crucial role as well because they are primarily responsible for providing local public health services. Multiple laws are implicated in responding to EEE, including Michigan's Public Health Code, Natural Resources and Environmental Protection Act (NREPA) and Pesticide Use Regulation, and Emergency Management Act. This section will describe each law as it pertains to responding to EEE and will discuss the various governmental entities' roles in implementing the law.

Public Health Code

The Michigan Public Health Code provides for the protection and promotion of public health across the state and establishes the structure and legal authority through which public health services are provided.[44] The code allocates primary public health legal authority and responsibility to qualified local health departments (LHDs).[45] Accordingly, LHDs are responsible for investigating, preventing, and controlling diseases and environmental health hazards within their jurisdiction and have broad authority to take action to respond to public health threats.[46]

As the state health department, MDHHS has general authority and responsibility for protecting health and preventing disease throughout the state.[47] MDHHS is responsible for promoting and coordinating local health services across the state[48] and for performing public health functions which are more efficiently accomplished at the state level.[49] MDHHS also possesses broad public health powers that parallel those granted to local public health departments, and it may intervene at the local level if an LHD is not able or willing to perform necessary public health functions.[50]

In the context of responding to EEE, MDHHS developed a multijurisdictional aerial spraying program, presumably because spraying could be more efficiently accomplished on a multicounty basis and because the presence and threat of EEEV-infected mosquitoes is not confined by county lines. In connection with the spraying program, MDHHS hired a contractor, obtained needed permits, managed the opt-out process, and selected a pesticide.[51] However, MDHHS did not unilaterally impose the aerial treatment at the local level (although it lawfully could have done so[52]), but rather recommended treatment to particular counties; it then deferred to LHDs to decide whether to include counties within their jurisdiction in the spraying program.

Given state health officials' evolving understanding of the EEE threat as cases increased and, accordingly, the state's expedited timeline for spraying,[53] local health officers had to quickly decide whether to participate in the state spraying program. In making this decision, they had to weigh local environmental conditions, public concerns about pesticide use, public fears about EEE, and uncertainty about the degree to which EEE posed a continued threat, particularly given the time of year. Upon deciding to include their counties in spraying, LHDs had to swiftly launch public communication and education programs to ensure county residents were appropriately apprised of the intended spraying.

The MDHHS-led aerial spraying program required considerable collaboration and coordination between state and local health departments and careful navigation of instances in which jurisdiction overlapped. While the state's leadership and financial support were vital to enabling a prompt and effective response to a multicounty threat, LHDs had to play a crucial role in assessing the severity of the EEE threat at the local level, evaluating the necessity and appropriateness of the proposed spraying program for their jurisdiction, and devising and quickly implementing a local communications plan. These challenges inherent to quickly responding to an urgent public health threat were likely exacerbated by state and local health officials' lack of familiarity with MDARD's Pesticide Use Regulation and its notification and opt out requirements as applied to aerial mosquito spraying, discussed further below.

Natural Resources and Environmental Protection Act and Pesticide Use Regulation

Pesticide use in Michigan is governed by the state's Natural Resources and Environmental Protection Act (NREPA).[54] Among other things, NREPA establishes licensure requirements for pesticide dealers and commercial pesticide applicators, registration requirements for pesticides distributed in the state, and notification requirements pertaining to pesticide application.[55] NREPA designates MDARD as the agency responsible for implementing the law's pesticide use provisions and grants the agency authority to promulgate rules.[56]

MDARD has promulgated Regulation No. 637 pertaining to Pesticide Use, which establishes pesticide use standards, requirements for pesticide preparation and cleaning facilities, steps to minimize off-target drift during pesticide application, and commercial notification and posting requirements, among other things.[57] Provisions that posed challenges in Michigan's 2019 EEE response are described in greater detail below.

Notification Requirements

Within Regulation No. 637, rule 11 establishes notification requirements for commercial applicators making a community-wide broadcast pesticide application, such as through aerial mosquito spraying.[58] Rule 11 prohibits aerial mosquito spraying unless the applicator has made "documented efforts to provide prior notification to persons who own or reside on property that is within the target area or to their authorized representatives."[59] In mosquito control contexts, documented notification efforts must involve one or more of the following strategies:

(i) Personal contact.
(ii) A comprehensive community outreach program, which shall be filed annually with the [MDARD] director.
(iii) Prior written notification.[60]

Although the applicator may typically choose any one of the strategies described above, an applicator must "[p]rovide prior written notification to persons who request it."[61] Furthermore, upon request, the applicator must provide general information to community members regarding the intended pesticide application.[62]

Notifications provided under rule 11 must include specific details about the applicator, pesticide, application method, dates of application, a contact person for questions, and reentry restrictions if applicable.[63] Where pesticides are applied to outdoor public recreation areas, such as campgrounds and playgrounds, notices must be posted for at least 24 hours at the primary point of entry.[64]

Opportunity to Opt Out of Spraying

Rule 11 further requires commercial applicators to "[e]xclude mosquito pesticide applications from the property of those persons who request to be excluded."[65] In other words, property owners and residents may choose to

opt their property out of community-wide mosquito spraying. In addition, the Pesticide Use Regulation requires that pesticides must be applied in a manner that minimizes exposure of non-target humans, animals, and property.[66] For example, the rules state that pesticide application is prohibited when weather conditions are likely to cause "off-target drift."[67] In addition, an applicator must employ a "drift management plan" if off-target drift is likely based on the application method or atmospheric conditions.[68] A drift management plan may include a variety of measures, including establishing a "no-spray buffer zone … [which] may be treated with nonpowered equipment."[69]

As a result of these provisions, Regulation 637 was implemented in the context of the 2019 EEE response to not only require the mosquito control applicator to exclude the properties of individuals who opted out of spraying, but also to exclude a 1,000 foot by 1,000 foot buffer zone surrounding the property.[70]

Public Health Emergencies

The Pesticide Use Regulation recognizes that circumstances may exist which constitute a public health emergency necessitating expedient action. Accordingly, rule 11 waives notification requirements for a community commercial applicator "in the event of a public health emergency as determined by [MDHHS]."[71] However, the rule does not define a "public health emergency," nor does it establish a process through which MDHHS may make the determination. Likewise, the Public Health Code does not utilize or define the phrase "public health emergency."[72] The lack of definition of "public health emergency" seems to have resulted in some degree of confusion during the 2019 EEE response, as MDHHS recognized that a public health emergency existed[73] but did not have a clear process for publicly rendering its determination. Ultimately, the department issued a memo to LHDs characterizing the EEE outbreak as "an emergent threat to Michigan's public health"[74] and described the situation as an emergency in at least one public-facing document.[75]

When notification requirements are waived pursuant to an emergency determination, an applicator is no longer required to employ one of the three notification methods set forth for mosquito control applicators (i.e., personal contact, a comprehensive communication outreach program, or prior written notification). However, the notification waiver under rule 11 does not apply to the rule's opt-out provision, meaning that the applicator would still need to honor property owners' and residents' requests to exclude their property from spraying.

If the notification requirements are waived pursuant to an MDHHS emergency determination, an applicator may choose to adopt a more expedient notification method, such as press release or similar; this appears to be the strategy adopted by MDHHS and LHDs in their efforts to quickly notify the public of intended spraying. Although an applicator might choose to provide no advance notification at all, this approach might raise concerns for community members, as well as elected officials, and could encourage legal action. In particular, community members' trust in their local health department might be weakened should they see, hear, or learn that aerial spraying has occurred over their property without any attempt to at least provide some notice. Ethical and policy considerations are discussed more extensively below.

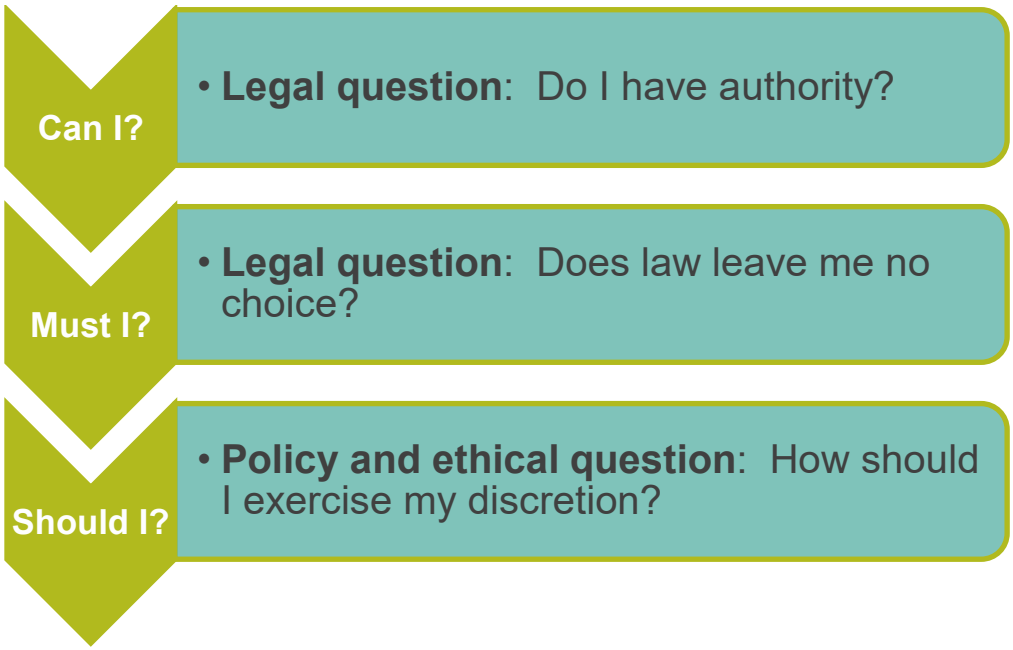
Emergency Management Act

The Emergency Management Act was not ultimately deployed in Michigan's 2019 EEE response, but it is an important tool that may be utilized in the future. Under the statute, Michigan's governor has legal authority to declare a state of disaster or emergency in the state.[76] An emergency is defined as "any occasion or instance in which the governor determines state assistance is needed to supplement local efforts and capabilities to save lives, protect property and the public health and safety, or to lessen or avert the threat of a catastrophe in any part of the state."[77] Upon declaring a state of emergency, the governor is authorized to exercise a range of

expansive emergency powers, including power to "[s]uspend a regulatory statute, order, or rule prescribing the procedures for conduct of state business, when strict compliance with the statute, order, or rule would prevent, hinder, or delay necessary action in coping with the disaster or emergency."[78] Thus, if the governor declared the EEE outbreak an emergency under the Emergency Management Act, she could suspend any Pesticide Use Regulation provisions (including the opt-out provision) that impede necessary spraying.

Public Health Decision-Making and Policy and Ethical Considerations

As illustrated in the figure below, three questions are relevant to a health official's decision to act and what action to take.



Local health officials for EEE-affected counties had authority—but were not mandated—to include their counties in the MDHHS-led aerial mosquito spraying program. When a particular public health action is legally permitted ("Can I?") but is not legally required ("Must I?"), public health officials generally have considerable discretion in determining whether and how to take the action ("Should I?"). Policy and ethical considerations are crucial to properly exercising this discretion.

In the context of EEE, local health officials had to make important decisions quickly and had to balance competing policy and ethical principles. For example, in determining whether to include their jurisdiction in the aerial spraying program, local health officials had to assess and balance the public health threat posed by the presence of EEEV-infected mosquitoes in their communities with residents' fears about pesticide use and exposure. Moreover, while some community members may be opposed to spraying, if the local health official declines to participate in the spraying program offered by the State, other community members may decide that the health department failed to protect their community from a known hazard.

Once the Pesticide Use Regulation's notification requirements were waived due to MDHHS's public health emergency determination, local health officials then had to balance expediency in the face of an urgent threat

(e.g., notifying the public of the intended spraying and the right to opt out via press release or other generalized communications) with maximizing public notification and transparency through individual contact. These decisions illustrate a common challenge for public health officials: the tension between community public health needs and individual needs.

One of the foundational ethical frameworks that should guide public health decision-making is the precautionary principle, which encompasses "an obligation to protect populations against reasonably foreseeable threats, even under conditions of uncertainty."[79] When both action and inaction pose potential risks, as in the EEE context (i.e., the threat of EEE versus public concern about the safety of the proposed spraying), public health officials must balance the relative risks of all proposed courses of action. Dr. Joel Tickner has listed several measures to help manage these risk trade-offs:

- Explore alternative courses of action that may involve less risk, and potentially leave the more risky action as a last resort;
- Openly acknowledge uncertainties, including those related to risks;
- Employ "a broader system lens and long-term focus" to assess and address a problem's root causes;
- Involve the community in dialogue about the decision, particularly before "prompt action" is required;
- Have in place surveillance systems, which, for instance, could potentially allow less risky preventive actions to be taken sooner; and
- Ensure public health officials critically examine their decisions and decision-making process after the fact.[80]

It may not be possible to implement some of these measures in real time in response to an urgent threat, or certain measures may need to be implemented alongside or after taking other steps. For example, a health department might use aerial spraying to eliminate an immediate threat while simultaneously taking steps to establish an integrated mosquito control program that includes, for example, elimination of mosquito habitats, larval mosquito control strategies, and implementation of surveillance systems.[81]

Others have echoed the importance of these considerations, adding that public health officials' decisions must also reflect the "least restrictive/intrusive alternative" that is likely to achieve public health goals (thereby preserving individual autonomy as much as possible), ensure fair distribution of the "benefits and burdens of public health action," and prioritize transparency and accountability to the public.[82] In addition to its ethical import, transparency also serves crucial practical functions, including fostering public trust in public health officials.[83] Public trust is essential to a public health agency's effectiveness and must be prioritized even when not legally required.[84]

To aid public health officials in balancing competing interests like these, some public health agencies have formed ethics committees to conduct ethical analyses.[85] Public health officials may also utilize the Network's public health decision-making tool.

Conclusion

Michigan's 2019 EEE outbreak presented an array of legal and ethical challenges that are common in public health and particularly in circumstances involving uncertainty about the magnitude of a public health threat and

the legal bounds for decision-making. These challenges include navigating overlapping jurisdiction and balancing community public health needs with individual rights. When the law authorizes but does not require a particular public health action, public health officials must balance often-competing policy and ethical principles to determine an appropriate course of action. The Network's public health decision-making tool provides a useful guide for quickly evaluating risks to make time-sensitive decisions. Although prompt action may be necessary to respond to urgent threats, adherence to the precautionary principle further requires public health officials to consider and employ follow-up measures (e.g., surveillance systems, root cause analysis) to prevent and/or mitigate future urgency in response to the same or similar threats.

SUPPORTERS

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[58] Mich. Admin. Code R. 285.637.11(5).
[59] Mich. Admin. Code R. 285.637.11(5)(a).
[60] Mich. Admin. Code R. 285.637.11(5)(b).
[61] Mich. Admin. Code R. 285.637.11(5)(c)(i).
[62] Mich. Admin. Code R. 285.637.11(5)(c)(iii).
[63] Mich. Admin. Code R 285.637.11(5)(e).
[64] Mich. Admin. Code R. 285.637.11(5)(f).
[65] Mich. Admin. Code R. 285.637.11(5)(c)(ii).
[66] Mich. Admin. Code R. 285.637.4(k), Mich. Admin. Code R. 285.637.10.
[67] Mich. Admin. Code R. 285.637.4(i).
[68] Mich. Admin. Code R. 285.637.10(3).
[69] Mich. Admin. Code R. 285.637.10 (3)(e).
[70] MDHHS FAQ – Update, *supra* note 26.
[71] Mich. Admin. Code R. R. 285.637.11(5)(h).
[72] *See* Mich. Comp. Laws § 333.1101 et seq.
[73] MDHHS EEE Overview Presentation, *supra* note 22.
[74] MDHHS Memorandum, *supra* note 23.
[75] MDHHS FAQ, *supra* note 9.
[76] Mich. Comp. Laws § 30.403.
[77] Mich. Comp. Laws § 30.402(h)
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