

streamline



Pesticide Exposure Pathways and Pediatric Health in Agricultural Communities

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Pesticide Exposure Beyond the Worksite

Each year, it is estimated that over a billion pounds of pesticides are used in the United States.¹ Pesticides are extensively used in agriculture to manage weeds, insects, and other pests that threaten crops. While discussions about pesticide safety often focus on workers during pesticide application or fieldwork, pesticide exposure has long been recognized as extending beyond the workplace into homes and agricultural communities.²

Children living in agricultural areas can come into direct contact with pesticides in several ways. They might inhale airborne chemicals drifting from nearby fields, touch residues that linger on clothing or skin, or be exposed at home if proper safety measures are not in place. Exposure can start even before birth (in utero), and children may also consume small amounts of pesticides present in their food.^{2,3}

Among these pathways, take-home exposure has been documented as an important source of household contamination. Residues can travel home on workers' clothing, shoes, skin, and vehicles, contaminating household environments and exposing family members, particularly children, to repeated low-dose exposure. This para-occupational pathway, commonly known as take-home pesticide exposure, can contribute to meaningful environmental health risks in agricultural communities. Children are especially vulnerable to pesticide exposure because of their smaller body size, developing organ systems, and behaviors such as frequent hand-to-mouth activity and time spent on floors where pesticide residues may accumulate.^{3,4} These findings reinforce the importance of environmental and occupational screening in pediatric care in agricultural areas, as well as education delivered by community health workers and outreach teams serving agricultural communities.

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Learning Objectives

After completing this article, participants will be able to:

1. Identify common pesticide exposure pathways among farmworker families.
2. Recognize clinical signs linked to chronic low-dose pesticide exposure in children.
3. Understand how to promote pesticide exposure prevention through workplace and household protections, and how to use community-relevant education to reduce pediatric exposure risk.

How Pesticides Enter the Home

Children in farmworker households may be exposed to pesticides even when they never enter an agricultural field. Pesticide residues can enter and persist in the home through multiple pathways, including take-home (para-occupational) exposure, pesticide drift from nearby fields, and in-home pesticide use.^{2,6}

In-home pesticide use may also contribute to children's exposure. Products for household pests, such as cockroaches, fleas, or rodents, can leave pesticide residues on floors, furniture, and other surfaces where infants and young children crawl and play. Improper storage, mixing, or application of these products may further increase exposure risk.^{2,3}



Take-home contamination occurs when pesticide residues are transported from the workplace into the household environment.

Residues may remain on:

- Work clothing
- Boots and shoes
- Skin and hair
- Washing machines
- Hats, sunglasses, bandanas
- Tools and equipment
- Vehicle seats and floors
- Other personal items in the fields or adjacent to the fields, like cell phones, lunch containers, backpacks, and water bottles



In agricultural communities, additional contamination may occur when pesticide drift settles on or near homes, or when pesticides are applied indoors to manage pests, particularly in housing with structural or maintenance challenges. **Once present in or around the home, residues can transfer to surfaces such as:**

- Floors and carpets
- Bedding and furniture
- Car seats
- Kitchen and bathroom surfaces

Young children are particularly vulnerable to this type of exposure. Infants and toddlers spend significant time on floors and frequently place their hands or objects in their mouths. Close contact with caregivers, such as being held after a work shift, may increase exposure through contaminated clothing or skin.^{2,3,6} Household contamination may also occur when work clothing is washed with family laundry or when work equipment is stored inside living areas.

Educational programs developed for farmworker communities emphasize practical prevention strategies such as removing work shoes before entering the home, changing clothing after work, and washing work clothes separately from family laundry.^{2,7} Understanding these pathways helps clinicians provide practical prevention counseling and highlights the importance of workplace

protections designed to reduce contamination before workers leave the job site.

Common Pesticide Classes and Pediatric Health Effects

Pesticides used in agriculture include several chemical classes with different mechanisms of action. The term "pesticide" includes insecticides, herbicides, and fungicides. Understanding potential health effects can help clinicians recognize possible pesticide-related illnesses in children. Clinical descriptions summarized below are of the most common insecticides and herbicides in use in the US, based on the American Academy of Pediatrics' Pediatric Environmental Health text.³

Evidence of Exposure and Biological Impact

Numerous studies have highlighted the presence of pesticide exposure among children living in agricultural communities. Arcury and colleagues examined pesticide metabolites among children in farmworker households in North Carolina and found repeated exposure to multiple pesticide classes, including organophosphates and pyrethroids.¹³ These findings were consistent across different sampling times, indicating ongoing environmental exposure rather than one-time events. Longitudinal research has highlighted concerns regarding the developmental impact of pesticide exposure. The Center for the Health Assessment of Mothers and Children of Salinas (CHAMACOS) study, a comprehensive birth cohort conducted in an agricultural area of California, has demonstrated associations between prenatal and early-life exposure to pesticides and negative neurodevelopmental outcomes, including effects on attention, behavior, and cognitive abilities in children.¹⁴ A follow-up CHAMACOS analysis by Bouchard and colleagues found that higher prenatal organophosphate exposure was associated with lower IQ scores in children at 7 years of age, further strengthening concerns about the cognitive effects of early-life pesticide exposure.⁸ More recent research has shed light on the possible biological effects linked to pesticide exposure. Lepetit and colleagues studied hair follicle cells in children from both rural and urban areas and observed increased DNA damage associated with higher levels of pesticide exposure.¹⁵ Hair follicle cells, which divide rapidly, can act as indicators of genotoxic stress. These results suggest that environmental pesticide exposure may be associated with measurable biological changes, even in the absence of acute poisoning. Overall, these studies indicate that pesticide exposure in agricultural communities is quite common and may lead to cumulative environmental exposure and biological stress in children living in farmworker households.

Case Study

A case presented during a Migrant Clinicians Network webinar on pediatric pesticide-related illness highlighted the clinical complexity and diagnostic challenges associated with take-home organophosphate exposure in infants.⁵

A 4-month-old infant living in a farmworker household presented to the emergency department with fussiness, decreased appetite, vomiting, diarrhea, lethargy, and poor respiratory effort. On the way to the hospital, caregivers reported episodes in which the infant's "eyes rolled back." Clinical examination showed limpness, miosis (pinpoint pupils), increased secretions, and respiratory compromise, with vital signs documenting a heart rate of 178 beats per minute (tachycardia), respiratory rate of 34 breaths per minute, and temperature of 98.6°F.

The infant had experienced five previous hospital admissions, including one in which organophosphate exposure had already been suspected. The sepsis workup was negative, and the infant received fentanyl, pralidoxime, and atropine during treatment, and laboratory evaluation demonstrated decreased red blood cell and plasma cholinesterase levels consistent with organophosphate exposure. Initial urine, blood, and breast milk samples were negative for pesticide metabolites, complicating early diagnosis. An environmental investigation later revealed that the infant's father and uncle were both farmworkers living with their families in a shared farm trailer. Both workers had been trained as pesticide handlers and assisted with moving pesticide containers in the fields, although they did not directly spray pesticides. Family members reported routinely wearing the same work clothing home from the fields before changing, but washed work clothes separately from household laundry. Additional environmental testing later detected organophosphate residues within the trailer environment. Investigators also noted that although the family later attempted to establish a decontamination area away from the main living space, workers sometimes returned home during lunch breaks and held the infant still in their work clothes.⁵

Overall, the findings suggest that the infant's illness was primarily attributable to repeated take-home pesticide exposure within the household, rather than a single isolated incident. These results highlight that persistent contamination in farmworker homes increases the risk of recurrent toxic exposures among young children.



Insecticides

Insecticides, a type of pesticide, are used to control crop-damaging or disease-spreading insects. They are applied to fruits, vegetables, and field crops, leaving residues on plants, soil, and equipment.^{1,2} Common types include organophosphates, pyrethroids, neonicotinoids, and carbamates, which primarily affect the nervous system and vary in toxicity and mode of action.^{1,2}

Class	Common Uses	Mechanism and Potential Health Effects on Children
Organophosphates	Used in US agriculture on fruits, vegetables, and herbs. Common examples include chlorpyrifos, malathion, and diazinon. Many have been restricted or phased out for residential use but remain in agricultural settings.	Inhibit acetylcholinesterase, an enzyme necessary for normal nerve function. Potential acute health effects include headache, dizziness, nausea, excess salivation, wheezing, and muscle weakness. Chronic exposure has been associated with possible neurodevelopmental effects in children, including impacts on attention, behavior, IQ and learning. ^{3,8,9}
Pyrethroids	Synthetic insecticides are widely used in both agricultural and residential pest control. They are frequently used as replacements for organophosphates in some settings and are widely applied to crops, homes, and public spaces.	Affect the nervous system. Potential health effects include skin irritation or tingling sensations, eye irritation, headache, and mild respiratory symptoms. Although generally less acutely toxic than organophosphates, repeated exposure may still affect the nervous system. ³
Carbamates	Used in agriculture and some pest control products.	Also inhibit acetylcholinesterase, causing acetylcholine to accumulate in the nervous system. Like organophosphates, they can overstimulate muscarinic and nicotinic receptors. Because inhibition is reversible, poisoning is usually shorter in duration, and recovery is often faster. Possible symptoms include nausea, vomiting, sweating, and weakness. ^{2,3,10}
Neonicotinoids	Commonly used as seed treatments on crops such as corn and soybeans and may also be found in residential pest control products.	Act on nicotinic acetylcholine receptors in the nervous system. Potential health effects may include fatigue, nausea, headache, dizziness, and possible neurologic symptoms with higher exposures. Human evidence on chronic, low-level exposure is still limited; however, some studies suggest possible associations with neurologic or developmental outcomes, particularly in children. ¹¹

Herbicides

Herbicides are used to control weeds and vegetation, and their toxicity varies by compound. Common herbicides widely used in crop production include glyphosate-based herbicides, triazines, bipyridyls such as paraquat, and chlorophenoxy herbicides such as 2,4-D.^{2,3}

Class	Common Uses	Mechanism and Potential Health Effects on Children
Glyphosate	Among the most used herbicides in agricultural settings. Widely applied in crop production and vegetation control.	Toxicity varies by formulation and route of exposure. Potential health effects may include skin or eye irritation, upper airway or respiratory irritation, and gastrointestinal symptoms after ingestion. Although glyphosate is generally considered less acutely toxic than many insecticides, exposure may still pose health concerns depending on formulation, route, and duration of exposure. ^{3,12}
Triazine	Widely used in agriculture to control broadleaf weeds and grasses. Atrazine is a common example.	Toxicity varies by compound. Potential health effects may include skin or eye irritation, respiratory irritation, and gastrointestinal symptoms. Some triazine herbicides, including atrazine, have also been studied for possible endocrine or developmental concerns with longer-term exposure. ²
Bipyridyl	Includes paraquat and diquat; used in agricultural weed control.	Associated with greater acute toxicity than many other herbicides. Potential health effects may include gastrointestinal injury after ingestion, kidney injury, and lung toxicity, particularly with paraquat. ^{2,3}
Chlorophenoxy	Includes 2,4-D and related compounds; commonly used in crop production and vegetation control.	Potential health effects may include skin or eye irritation, gastrointestinal symptoms, and neurologic symptoms with significant exposure. Because chlorophenoxy herbicides differ in toxicity and clinical effects, identifying the specific product involved is important when evaluating possible exposure. ^{2,3}



Clinical Recognition

Children residing in agricultural regions are routinely subjected to chronic, low-level pesticide exposure through environmental drift, take-home contamination, residential application, dietary intake, and prenatal contact; chronic exposure is more likely than acute poisoning.^{2,6} Consequently, it can be challenging to clinically identify pesticide-related illnesses. Pediatric patients often encounter low-dose pesticide exposure from diverse sources, and the resulting symptoms may be subtle, nonspecific, and easily confused with more common pediatric conditions.³

Possible clinical presentations may include:

- Headaches
- Dizziness or fatigue
- Nausea, vomiting, or diarrhea
- Abdominal pain
- Persistent cough, wheezing, or worsening asthma symptoms
- Skin or eye irritation
- Irritability or behavioral changes
- Attention difficulties or difficulties concentrating
- Learning challenges or school difficulties
- Developmental concerns or delays

In some cases, children may also present with neurologic or functional changes, such as clumsiness, tremors, excessive sleepiness, or changes from their usual behavior or activity level.^{2,3} These symptoms are nonspecific and may overlap with common pediatric illnesses. They may be intermittent or persistent and are often identified only when an environmental or occupational exposure history is obtained. Different pesticide classes may contribute to different clinical effects. For example, organophosphates and carbamates are associated with cholinesterase inhibition and may present with gastrointestinal symptoms, respiratory effects, and neurologic findings such as weakness or increased secretions (including excessive salivation, tearing, or nasal secretions), while pyrethroids are more commonly associated with skin irritation, paresthesia, and mild neurologic symptoms such as dizziness or tremor.^{3,18} Although acute pesticide poisoning may present with more

severe symptoms, such as excessive salivation, respiratory distress, muscle weakness, or seizures, these findings are less common in chronic or low-dose exposure scenarios.² Children in agricultural communities are more likely to present with subtle or nonspecific symptoms related to cumulative exposures over time rather than acute toxicity.

Children with underlying respiratory conditions may be particularly vulnerable to the respiratory effects of pesticide exposure. Pesticides can irritate the airways and may trigger asthma symptoms or make asthma more difficult to control. Helping families reduce pesticide exposure at home and in other environments may help decrease respiratory triggers.^{2,3}

Because pesticide-related illness is frequently underrecognized and symptoms may overlap with other diagnoses, obtaining an environmental and occupational exposure history is essential.¹⁶ Clinicians should maintain a high index of suspicion when evaluating children living in agricultural communities, particularly when symptoms are persistent, unexplained, or involve respiratory, neurodevelopmental, or behavioral concerns.^{2,3}

Taking an Occupational and Environmental History

Environmental and occupational screenings are essential when evaluating children living in agricultural communities. Screening for work-related and environmental exposures can help identify hidden causes of illness and can also be helpful after chemical accidents, environmental contamination, or natural disasters that increase the risk of harmful exposures.

Clinicians may consider asking caregivers simple questions such as:

- Does anyone in the household work in agriculture?
- What tasks do those household members perform at work?
- Are work clothes changed before entering the home?
- Are work clothes washed separately from household laundry?
- Do children ride in cars, trucks, or vans used to travel to farms or fields or used for farm work?

Although limited time and other clinical demands may prevent full environmental assessments in regular practice, even a few focused screening questions can identify important exposure risks. When concerns come up, clinicians can expand the evaluation using more comprehensive occupational and environmental health history tools or refer patients for additional environmental health consultation, as appropriate.

These simple questions can foster an open dialogue and collect important information in a non-judgmental way. Even brief screening questions can help identify potential environmental exposure pathways. Occupational health guidance emphasizes that understanding a patient's work environment is often essential for identifying risks of pesticide safety exposure.²



Two Lines of Defense

Reducing take-home pesticide exposure requires both workplace protection and household prevention strategies.

1. Prevention at the Worksite: Worker Protection Standard

The Worker Protection Standard (WPS) is a federal regulation designed to reduce pesticide exposure among agricultural workers.^{2,17}

The regulation requires employers to:

- Provide pesticide safety training
- Enforce restricted entry intervals
- Post pesticide application information
- Provide decontamination supplies
- Supply appropriate personal protective equipment
- Provide emergency assistance when exposure occurs

Clinicians can support prevention by helping patients understand these protections and encouraging them to participate in safety training programs. Educational materials and programs relevant to the community, including those delivered by community health workers/*promotores*, can reinforce WPS training and help workers translate workplace safety practices into household prevention strategies.⁷

2. Household Prevention Strategies

Clinicians can also provide practical guidance to reduce take-home contamination.^{2,3,7}

Recommended strategies include:

- Removing work shoes before entering the home
- Changing out of work clothing immediately after work
- Washing work clothes separately from family laundry
- Showering as soon as possible after returning home

Prevention counseling also needs to recognize the structural barriers many families face, such as shared housing, limited access to laundry facilities, or a lack of running water, which can slow adherence to certain recommendations. In these cases, community health workers and *promotores* are often essential in reinforcing prevention messages within farmworker communities and helping families adopt practical strategies suited to their daily realities and routines.



Conclusion

Pesticide exposure remains an important but often overlooked issue in pediatric environmental health within agricultural communities. While children might not work directly in the fields, they may be exposed through multiple pathways, including pesticide drift from nearby fields, take-home contamination, in-home pesticide use, dietary exposure, and prenatal exposure. Because symptoms related to this exposure can be subtle and nonspecific, health care providers should include occupational and environmental screening as part of routine checkups for children from farmworker families. Prevention strategies should focus on workplace safety, household risk reduction, and education that is relevant for the community being served. Recognizing multiple exposure pathways allows clinicians to enhance prevention counseling, promote safer home practices, and help lower pesticide exposure risks for children in agricultural communities.

Resources

Migrant Clinicians Network Webinar: Field to Clinic: Recognizing Pesticide-Related Illness in Children

Provides clinicians with practical guidance on recognizing, diagnosing, and managing pediatric pesticide-related illness, including exposure pathways, clinical signs, case-based learning, and exposure identification in agricultural communities.

www.migrantclinician.org/webinar/field-clinic-recognizing-pesticide-related-illness-children-2026-04-29.html

Migrant Clinicians Network Pesticide Webinar Series: How to Prevent Pesticide Poisonings in Farmworkers

This three-part webinar series covers diagnosis and management of pesticide illness, public health and legal issues, and culturally informed prevention for farmworker communities. It highlights the need to address both workplace and household risks.

www.migrantclinician.org/webinar/diagnosis-and-management-pesticide-related-illness-how-prevent-pesticide-poisoning

Worker Protection Standard (WPS) Pesticide Safety Training Curriculum and Resources

These resources offer materials and tools to help meet Worker Protection Standard requirements and minimize pesticide exposure among farmworkers.

www.migrantclinician.org/resource/worker-protection-standard-pesticide-safety-training-curriculum-and-resources.html

Juan, Abre los Ojos: Cómo Protegerse de los Pesticidas

This Spanish-language comic book provides practical, culturally appropriate education for farmworker communities on pesticide exposure prevention and take-home contamination.

www.migrantclinician.org/resource/juan-abre-los-ojos-como-protegerse-de-los-pesticidas-comic.html



Migrant Clinicians Network Pesticides Resource Page

Central hub for clinical tools, training materials, patient education resources, and pesticide prevention materials for clinicians serving agricultural communities.

www.migrantclinician.org/explore-environmental-and-worker-health/pesticides.html

EPA Recognition and Management of Pesticide Poisonings (6th Edition)

Comprehensive clinical guidance for diagnosing, managing, and preventing pesticide-related illnesses, including occupational exposure pathways and treatment considerations.

www.migrantclinician.org/announcement/now-available-epas-recognition-and-management-pesticide-poisonings-6th-edition.html

Pediatric Environmental Health Specialty Units (PEHSU)

PEHSU offers clinical consultation, education, and resources on children's environmental exposures, including pesticides.

<https://pehsu.net/>

Asthma Community Network

Provides evidence-based educational materials, tools, and community resources to help families manage asthma, reduce environmental triggers, and improve asthma outcomes for children and families.

www.asthmacomunitynetwork.org/

EPA Worker Protection Standard (WPS)

Overview of federal regulations designed to reduce pesticide exposure among agricultural workers, including training, protective equipment, and safety requirements.

www.epa.gov/pesticide-worker-safety/agricultural-worker-protection-standard-wps

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How Health Centers Can Support Vital Conditions for Healthy Lives

Practical resources for health centers to identify and respond to factors affecting farmworkers and agricultural communities

By **Claire Hutkins Seda**, Director of Communications, Migrant Clinicians Network

At the heart of rural communities in the United States are an estimated two to three million people who take seasonal farmwork jobs every year. These workers include migratory and seasonal agricultural workers (MSAWs), and the 400,000-plus workers who are arriving at farms this year under the H-2A program. The H-2A program is a federal guest worker visa program that enables workers from other countries to temporarily work at a specific agricultural location in the US before returning to their country of origin. The program has expanded rapidly from over 150,000 workers in 2016 to a projected 400,000 or more this year, based on the pace of the first half of the 2026 certification.^{1,2,3}

Farmwork is physically demanding, which requires a baseline of physical health to perform the job. Many people assume that daily physically demanding work leads to better health. However, many conditions in which farmworkers live and work can negatively influence their overall health, subjecting them to higher chronic disease burden. In a 2025 study, precarious employment conditions among farmworkers – organized by the researchers by material assets, work and living arrangements, job security, worker benefits, and social vulnerability – were scored and compared.⁴ The study used data from the National Agricultural Workers Survey to show that high scores of precarity were associated with increased chronic disease risk factors and cardiovascular disease. A 2022 study in California analyzed three California farmworker datasets to conclude that health concerns like obesity and hypertension were linked to food insecurity, income, and lack of

health care access.⁵ Although more research is needed, particularly on intervention studies and research on farmworker subgroups,⁶ it is clear that the conditions for health and well-being for farmworkers extend beyond physical activity.

The Rippel Foundation originally conceptualized “Vital Conditions for Health and Well-Being” as a framework to identify and address factors that affect health and well-being outside of the exam room. The framework includes seven factors to conceptualize holistic well-being and can be used to identify levers for community change and improvement to produce population-level well-being.⁷ In 2025, the National Association of Community Health Centers spotlighted these conditions, including stories from health centers on how communities identify and address each of the factors.⁸

Migrant Clinicians Network (MCN) has numerous resources to support health centers in addressing each of the vital conditions. Here, each vital condition is outlined based on definitions used by the framework, followed by a related MCN or trusted partner resource.

Basic Needs for Health and Safety

The basic requirements for health and safety include access to nutritious food, safe drinking water, fresh air, sufficient sleep, routine physical activity, safe and satisfying sexuality and reproduction, freedom from violence and addiction, and routine care for physical and behavioral health.

Health Network is MCN’s virtual care coordination system that assists individuals with ongoing health needs to access care for their conditions. In 2025, Health Network expanded to allow outreach workers and community health workers to enroll patients in addition to health care providers. MCN has bilingual one-page informational sheets to explain the Health Network process and to the types of patients Health Network can assist. Visit migrantclinician.org/healthnetwork.

MCN’s **Comic Books** in English and Spanish equip farmworkers with education on food and exercise like *Mi salud es mi Tesoro/My Health is My Treasure*, our diabetes comic book. Visit migrantclinician.org/comics



MCN’s **Respiratory Health and Protection Hub** provides numerous resources in English and Spanish including our air quality comic book (*Clear the Air!/Nadie sabe que respire... ¡Hasta que la falta el aire!*), an archived webinar, a train-the-trainer flipchart, facilitator’s guide, and radio PSA. migrantclinician.org/respiratory-health-and-protection



Humane Housing

Safe structures, adequate space, affordable costs, and proximity to other parts of one's life like school, work, food, recreation, and nature are included in this vital condition.

Farmworkers are often provided housing. H-2A workers exclusively live in housing provided by the grower. Proximity to farms and chemicals used on farms, farm isolation, and substandard construction can reduce housing quality. *Aunque cerca... sano* is MCN's comic book about children's exposure to pesticides in the home:

www.migrantclinician.org/resource/pesticides-nearby-healthy-guide-protect-children-pesticides-comic.html

Meaningful Work and Wealth

Job training, good-paying work, and savings are all highlighted in this vital condition. Farmworkers, particularly those whose first language is not English, may struggle to understand available job training, and warning labels on farm equipment or pesticides.



MCN provides extensive train-the-trainer materials to equip farmworking communities with the education they need to stay safe on the job. **Seguridad en las lecherías** is a bilingual dairy worker safety training kit for community health workers to train dairy workers, including evaluation tools, a step-by-step facilitator's guide, and a bilingual picture dictionary so farmworkers can learn key words about their safety equipment.



MCN recommends "Safeguarding Children in Agriculture: A National Action Plan 2025," from the National Children's Center for Rural and Agricultural Health and Safety⁹ to help farms protect children that are working, visiting, and that live on farms. The report is now available in English and Spanish: www.marshfieldresearch.org/nccrahs



Lifelong Learning

This vital condition promotes learning and education throughout one's lifespan, from early childhood experiences through adult education.

MCN offers comic books that cover a wide variety of health-related topics in English and Spanish, like: *How to Control your Hypertension*¹⁰, *Those Who Seek, Find: Learning About Health Services*¹¹, and *Clear the Air: Protect Yourself from Bad Air*.¹² Visit www.migrantclinician.org/comics.

Reliable Transportation

Reliable, safe, and accessible transportation would allow farmworkers to get to work, school, food, health care, and leisure locations safely and efficiently.



Health Outreach Partners offers a variety of transportation resources for community health centers, including their *Transportation Quality Improvement Toolkit*¹³, *Transportation Strategies to Improve Health Outcomes*¹⁴, and *The Importance of Screening for Transportation Barriers to Care*.¹⁵ Visit <https://outreach-partners.org/> to access resources and webinars.

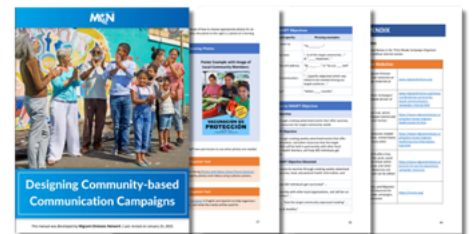
Thriving Natural World

Clean air, water, and soil, and healthy ecosystems protect the community from numerous threats including airborne or waterborne illness, flooding, and extreme heat.

Belonging and Civic Muscle

Social support, including freedom to follow the norms and customs, and speak the language of your family or community, and opportunities for civic engagement are included in this vital condition.

Creating a welcoming environment for farmworkers in our communities bridges differences and provides pathways for farmworkers to engage in community life and take advantage of community offerings. Health centers that collaborate with community-based organizations will be better positioned to support farmworker patients with referrals, social support and educational materials built for the farmworker community. MCN's in-depth, 70-page guide to building and launching community campaigns assists health centers in reaching and connecting with various members of their community and partnering with community-based organizations. Available in English and Spanish: www.migrantclinician.org/resource/designing-community-based-communication-campaigns-manual.html



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Everything You Need to Know about New World Screwworm

By **Rebekah Stewart**, PhD, MPH, NP-C, Clinical Educator & Care Coordinator, Migrant Clinicians Network



[Editor's Note: This article has been updated and edited from its initial publication on Migrant Clinicians Network's Substack, On the Move with MCN. Be sure to subscribe to MCN's Substack to receive articles in your email inbox: migrantcliniciansnetwork.substack.com/]

Imagine this.

You're a nurse practitioner working in a Federally Qualified Health Center on the outskirts of San Antonio, Texas. Your first patient on a hot Tuesday morning is a 25-year-old male who works with livestock. He is complaining of a painful wound on his lower left leg. He has no underlying health conditions but does recall sustaining a minor injury in the same location while working a few weeks ago. When you examine it, the wound looks like a deep pocket in his skin and when you grab a flashlight to look inside the pocket, you see something moving around at the base of the wound. When you get closer to the wound, you notice a foul smell and see several tiny cream-colored maggots inside. Although you've never seen it before, you immediately suspect myiasis or an infestation caused by New World screwworm (NWS) based on his occupation and the physical presentation. After the larvae are surgically removed, laboratory testing confirms your suspicion.

What is New World screwworm (NWS)?

NWS (*Cochliomyia hominivorax*) is a parasitic fly that lays its eggs in open wounds or in other body cavities with mucous membranes, such as the nose, ears, eyes, or mouth.¹ The eggs develop into parasitic larvae, more commonly known as maggots, that burrow (screw) into and feed on live tissue, such as skin, muscles, and organs. The larvae are very destructive, causing extensive tissue damage. Severe infestations, while rare, can be fatal. NWS primarily affects livestock, but the parasitic larvae can infest any warm-blooded animals, including humans. When NWS flies were present in the United States, they caused hundreds of millions of dollars in losses for the livestock industry annually.¹



Why have I never heard of NWS before?

The NWS fly was eradicated from the United States in 1966 using a biological control technique (sterilized insects) developed by the USDA's Agricultural Research Service.^{1,3} Through a cooperative binational program, the Panama-United States Commission for the Eradication and Prevention of Screwworm (COPEG) eradicated New World screwworm flies from Mexico to Panama by 2006 and subsequently maintained a permanent sterile fly barrier along the Panama-Colombia border until re-detection of NWS in 2022.³ The NWS fly has remained endemic in South America, Cuba, Haiti, and the Dominican Republic.

Why is it important to learn about now?

In August of 2022, NWS infestations were detected in animals in Panama.² In 2023, NWS detections in Panama increased to 6,500 cases in one year. Since then, NWS has reemerged in every country in Central America and Mexico affecting both animals and humans, which prompted countries in the region to declare an outbreak.⁴ By early July 2026, there have been more than 185,000 NWS cases in animals and 2,263 cases in humans in countries in Central America and Mexico. In early June, NWS was detected in livestock and dogs in Texas and New Mexico for the first time since eradication. As of publication, cases continue to be detected in Texas. Due to this ongoing outbreak, anyone who has recently lived in or visited these areas could be affected. Since the re-emergence, there has been one confirmed case of NWS in a person who returned to the United States after traveling to El Salvador.⁴



Why is this happening now?

One Health is a concept that recognizes the intertwined health of humans, animals, and the environment. Extreme weather fluctuations due to human-induced weather pattern shifts help spread species from tropical regions north. Freezing temperatures used to suppress NWS existence in the north, but warmer temperatures over extended spring and autumn along with warmer winters expands the stretch of habitat northward into the United States.^{5,6} Seasonal monsoon winds that had an early start in the US southwest may have helped arrival of NWS to the region and may increase spread over the course of the monsoon season.⁶

Currently, NWS infestations have been detected in livestock (cattle, sheep, and goats) and pet or herding dogs. Other farm animals and humans caring for the animals are at risk. Texas A&M Agrilife Extension recommends an "inspect, report, and protect" approach. Farmers and ranchers should frequently monitor animals for signs of NWS (see: Re-thinking Livestock Management to Consider Screwworm, 2025 resource below). Report to your state animal health official (link below in Reporting section) immediately if you believe an animal on your property is infested, and to your local or state health department if a family member or worker may have NWS.



Who is at risk?

Anyone present in an area with the NWS fly could be affected. Those at higher risk in those areas include:

- People who frequently work with livestock;
- People who sleep outdoors, especially during the day;
- Those with open sores or wounds (including wounds as small as a tick bite) as the flies will lay eggs on open sores;
- Vulnerable populations, including people who are immunocompromised, those at extremes of age, and people experiencing malnutrition; and
- People who have a medical condition that renders them unable to swat away flies.

How can people who are in outbreak areas prevent infestation?

- Clean and cover all wounds, no matter how small or the location on the body or scalp.
- Wear loose-fitting, long-sleeved shirts and pants to limit exposed skin and use the Environmental Protection Agency-registered insect repellants: www.epa.gov/insect-repellents.
- If possible, avoid spending time where livestock are located or housed in rural areas.
- Avoid sleeping outdoors, especially during the day.
- Protect sleeping quarters with screens or bed nets.

What are the symptoms of NWS myiasis?

- Feeling maggots/larvae moving within a skin wound or sore, ears, nose, eyes, or mouth.
- Seeing maggots around or in open sores.
- Painful skin wounds or sores.
- A foul-smelling odor from the site of the infestation.
- Unexplained skin wounds or sores that do not heal or that worsen within a few days.
- Bleeding from open sores.

What can we tell our communities?

- NWS is currently in Texas and New Mexico. Everyone who lives or works in or around those states should be vigilant.
- Inspect animals for wounds or signs of infestation and use prevention methods. Animal infestations increase the risk for spread to humans and other animals.
- If a community member suspects infestation, encourage them to seek medical care immediately.
- If a patient discovers larvae in their wound, they should not try to remove any maggots or eggs masses themselves as this could result in NWS spreading in your area.

Treatment

- Use standard precautions when treating wounds and handling larvae.
- Remove and kill ALL visible larvae and eggs in patients with suspected NWS. This may require surgical removal. Failure to kill and properly dispose of all larvae or eggs may result in the new introduction and spread of NWS in the local environment. (See specimen handling and submission, below.)
- Reexamine treated lesions after 24–48 hours to confirm no live larvae remain. Remove and safely dispose of any remaining larvae as described below.

Diagnosis

There are many morphologically similar species of flies that can cause myiasis. Submission of larvae is critical for morphological diagnosis and species identification. Diagnostic confirmation for suspected human cases is available through CDC's Diagnostic Parasitology Laboratory, DPDx, at dpdx.cdc.gov.

Specimen Handling & Submission

Submit larvae for clinical diagnosis and confirmation at CDC.

- Send at least 10 larvae.
If you have fewer than 10, submit them all.
- If you have more than 10, send at least 10.
- If multiple stages of larvae are present in the lesion, try to include a representative sample from each stage. Email dpdx@cdc.gov for specimen submission instructions.
- Place larvae and eggs in a leak-proof container with 70% ethanol. The volume of liquid should be sufficient to fully submerge larvae and eggs.
- The ethanol will both kill and preserve them for identification.
- 70% (or greater) isopropanol or 5%–10% formalin are acceptable alternatives.
- Do not dispose of any larvae or eggs in the trash or outside on the ground.
- Collect the remaining larvae and eggs in a separate leakproof container, submerge them in alcohol, place the container into a zip-top plastic bag, and seal it. Dispose of the sealed bag in the trash.

Reporting Suspect Cases

- Report all suspected human cases immediately to the local or state public health department:

Epi on Call
libraries.cste.org/after-hours-contact/

followed by CDC at
404-718-4745
parasites@cdc.gov

- Human infestations can be an indication of local circulation of flies and possible infestations in animals. Areas where human infestations are identified will need to be evaluated by agriculture and public health officials for implementation of control measures.
- Direct clinical inquiries and patient management-related questions to your local or state public health department (Epi on Call) or to CDC's Parasitic Diseases Hotline at parasites@cdc.gov or 404-718-4745.
- Direct clinical inquiries outside of regular business hours to CDC's Emergency Operations Center at 770-488-7100.
- Direct non-clinical questions to newworldscrewworm@cdc.gov.
- Report cases in livestock or pets to your state animal health official: usaha.gov/wp-content/uploads/2026/02/STATE_ANIMAL_HEALTH_OFFICIALS.pdf.



Health Network as a Resource

Health Network is Migrant Clinicians Network's virtual care coordination program. When patients move before receiving test results, completing treatment, or finding a new specialist, their health suffers. Health Network connects patients to care at their next destination, so that migration does not have to be an impediment to care. If a patient is moving or considering moving, be sure to pre-enroll that patient in Health Network so we can pick up their care coordination on your behalf. For example, a patient treated for NWS myiasis who intends to move for farmwork may need follow-up to ensure the wound heals properly. They can get assistance from Health Network.

Read how Health Network works and its recent expansion in this article:
migrantclinician.org/streamline/health-network-gps-guides-patients-through-our-health-system.

Learn more and access enrollment forms on our Health Network page:
migrantclinician.org/our-work/health-network.html.

Learn more:

- New World Screwworm Outbreak, from CDC: www.cdc.gov/new-world-screwworm/situation-summary/index.html
- Communication Resources | New World Screwworm | CDC: www.cdc.gov/new-world-screwworm/communication-resources/index.html
- Resurgence of New World Screwworm in the Americas: What Healthcare Providers Need to Know | COCA | CDC: www.cdc.gov/coca/hcp/trainings/resurgence-new-world-screwworm.html
- HHS and USDA Confirm Singular Traveler-Associated New World Screwworm Case; Precautionary and Proactive Surveillance Ongoing | USDA: www.usda.gov/about-usda/news/press-releases/2025/08/26/hhs-and-usda-confirm-singular-traveler-associated-new-world-screwworm-case-precautionary-and

- New World Screwworm: What You Need to Know | USDA | APHIS: www.aphis.usda.gov/sites/default/files/screwworm-brochure-english.pdf
- Current Status of New World Screwworm | Screwworm.gov: www.aphis.usda.gov/livestock-poultry-disease/stop-screwworm/current-status?page=1
- Rethinking Livestock Management to Consider Screwworm - Texas A&M AgriLife Extension Service: agrilifeextension.tamu.edu/rethinking-livestock-management-to-consider-screwworm/
- What to Do if You Suspect New World Screwworm in Your Herd - Texas A&M AgriLife Extension Service: agrilifeextension.tamu.edu/what-to-do-if-you-suspect-new-world-screwworm-in-your-herd/
- Companion Animal Care in the Face of the New World Screwworm (NWS) Threat - Texas A&M AgriLife Extension Service: agrilifeextension.tamu.edu/companion-animal-care-nws/
- Cuidado de animales de compañía frente a la amenaza del Gusano Barrenador del Nuevo Mundo (GBNM) - Texas A&M AgriLife Extension Service: agrilifeextension.tamu.edu/companion-animal-care-nws/
- Wildlife Monitoring and Management for New World Screwworm - Texas A&M AgriLife Extension Service: agrilifeextension.tamu.edu/wildlife-monitoring-and-management-for-new-world-screwworm/
- Monitoreo y manejo de fauna silvestre para el gusano barrenador del Nuevo Mundo - Texas A&M AgriLife Extension Service: agrilifeextension.tamu.edu/monitoreo-y-manejo-de-fauna-silvestre-para-el-gusano-barrenador-del-nuevo-mundo
- Weather-related Emergencies and Disaster Management - Information Hub | Migrant Clinicians Network: www.migrantclinician.org/weather-related-emergencies-and-disaster-management-information-hub

Easily access all the resources noted in this article by visiting MCN's Streamline page where we have links to all resources and citations organized by article.
Visit www.migrantclinician.org/streamline.

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Health Center in Cidra, Puerto Rico

Steps to a Resilient Patient Navigation Program: Lessons Learned from Puerto Rican Community Health Centers

By **Marysel Pagán Santana**, DrPH, MS, Director of Environmental and Occupational Health, Migrant Clinicians Network

Hurricanes and other extreme weather events can disrupt cancer prevention, screening, diagnosis, treatment, medications, and follow-up, especially when power, transportation, and communications are unreliable. These disasters often trigger displacement and movement, prompting people to move in different ways (including those who are forced to evacuate, those who are moving for other reasons but become impacted by storms, or those who move into a disaster zone to help with recovery).¹ Health navigation and care coordination can help prevent people from “falling through the cracks,” especially when clinics are closed or patients are relocating. Having a resilient patient navigation program focuses on keeping up with the care of the patients, even if they must move.

What does patient navigation look like during disasters?

When a climate emergency impacts a community, it typically also affects health care delivery. The impact can range from operational challenges faced by the clinic, such as infrastructure damage; loss of essential services like electricity, water, and internet; staff shortages; and increased patient volume, to challenges experienced by patients themselves, including transportation needs; difficulty navigating sheltering,

response, and recovery processes; loss of medications; and behavioral health instability. This is where patient navigators play an essential role, guiding patients to the right care, at the right time, in the right place, when regular systems have become fragmented.

Patient navigators are often effective during emergencies because their role is created to be culturally sensitive, language responsive, and are particularly connected to their patients’ needs. This means that often they have a clear understanding of the challenges the community might face and the appropriate overall responses, and most of the time they know the right questions to ask to be able to address those challenges. Because of their connection to the community and the knowledge they carry, these navigators are primed to be key factors when it comes to emergency preparedness. Through a patient navigation program, for weather disasters that can be forecasted, navigators can have plans, pre-enrollment, consent and medical records ready in case their patients need support. Because they often need to conduct a risk and social vulnerability assessment of their patients as part of their work, they are able to identify those who are more likely to need support when disaster strikes. This allows them to be quick and responsive when the care is indeed needed.





What should we expect when we implement community and clinic preparedness navigation programs?

When a clinic implements navigation programs which get integrated into the overall emergency preparedness and response activities, the community benefits from comprehensive pre-disaster planning that centers on maintaining services and protecting patient health. This includes communication and disease management strategies discussed by navigators with their enrolled patients, and pre-enrollment of patients who might be at risk of losing care or overall connection to services. These programs often allow the community itself to support the preparedness process by working with the clinic to share resources and information, which has the dual benefit of securing community buy-in and ensuring that plans accurately reflect the needs of the community. We can sustain these programs by implementing these pillars:

In addition to those pillars, it is important that we have systems in place that foster the protection of patient information, adequate staff training, and strong communications systems among teams (both clinical and non-clinical).

Lessons learned from Puerto Rico, nine years after hurricanes Irma and María

Nine years after hurricanes Irma and María, Puerto Rico is still learning and coping with the effects of these disasters. Studies have shown that these events deeply impacted cancer patients and populations at risk of cancer by limiting care services and also by disrupting cancer prevention and surveillance efforts.^{2,3} Screening for cancer dropped precipitously and patients were left needing to relocate because of damaged infrastructure. Almost 10 years later, the recovery process has focused heavily on rebuilding with resilient infrastructure like solar panels, generators, and other equipment to maintain operations. However, to build a resilient navigation program, more than infrastructure must be built.

A recent research project carried out by Migrant Clinicians Network and supported by the Prevent Cancer Foundation uncovered how patient navigation now operates in Puerto Rico, what lessons clinics have learned, what challenges they are still facing, and what areas still need to be improved.

The results are uneven. For example, the findings indicate that, despite recent investments in infrastructure and equipment, some clinics have discovered that some of their new

equipment needs repairs that they cannot afford. The findings also revealed a lack of comprehensive inclusion of patient navigators into emergency preparedness and response plans, limiting the important impact that patient navigators can have to support their communities.



When asked about the needed resources to assist long-term implementation and improvements to patient navigation programs, clinicians in Puerto Rico responded uniformly, calling for:

- 1) better training for staff, including for administrative staff on the integration of navigators, and for frontline staff like CHWs and outreach workers on how to provide and incorporate patient navigation; and
- 2) stable and dedicated funding sources for both human resources as well as emergency preparedness and planning.

These findings highlight opportunities to strengthen communities' responses to extreme weather events by investing in long-term, sustainable patient navigation programs that are integrated into emergency management plans. Further, the emergency management plans should take into account the cost of maintaining critical equipment and other resources needed to continue serving their communities during and after disasters.

Health Centers and Emergency Weather Response

Infrastructure	Relationships with Communities & Partnerships	Clinical Training & Support	Mental Health, Well-being & Support for HC Staff
Facility assessments	Community outreach programs	Weather-health curricula	Staff wellness programs
Backup power, communications and water systems	Local government partnerships	Heat illness protocols	Climate anxiety resources
Water and air filtration	Environmental justice coalitions	Air quality and extreme temperature response plans	Peer support networks
Cooling/heating upgrades	Patient education initiatives	Disaster triage and patient navigation procedures	Burnout prevention
Supply chain planning	Vulnerable population mapping	Telehealth capacity building	Resilience training
Emergency preparedness plans	Health Center Integration with community resources	Language and cultural appropriateness	Employee assistance programs

Based on MCN and NACHC Pillars (2023)

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In English with live simultaneous interpretation into Spanish.

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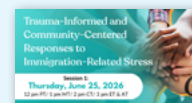
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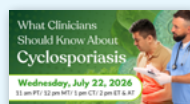
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