



How to Prevent Pesticide Poisoning in Farmwork

Diagnosis and Management of Pesticide-Related Illness

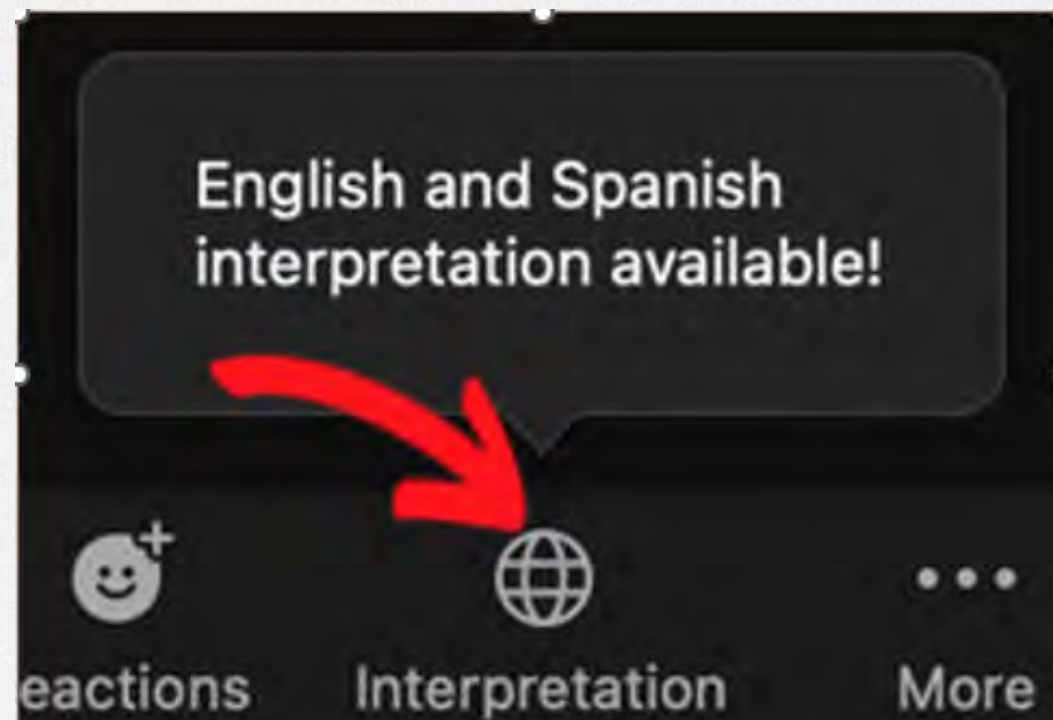
Tuesday, October 1, 2024

Brett Shannon, MD, PhD

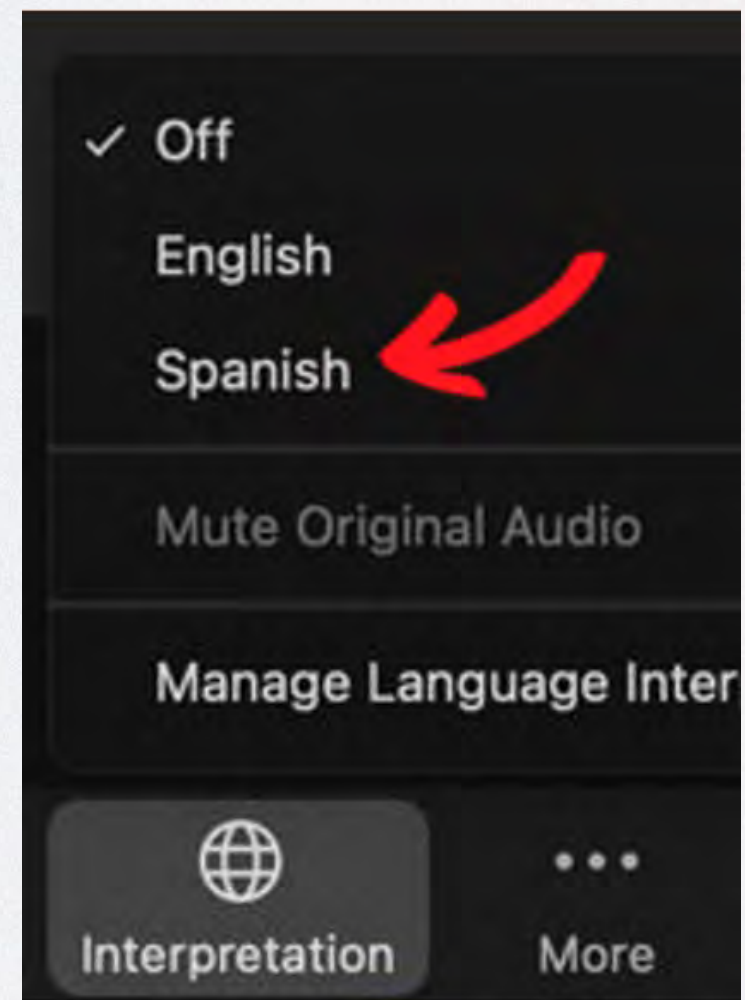
Use of Simultaneous Interpretation in Zoom

If you want to listen to the presentation in Spanish...

1) Locate the Interpretation Globe icon



2) Click the Interpretation Globe and select "Spanish"



If you want to listen to the presentation in Spanish from a smartphone...

1. Touch the three dots that say "More"

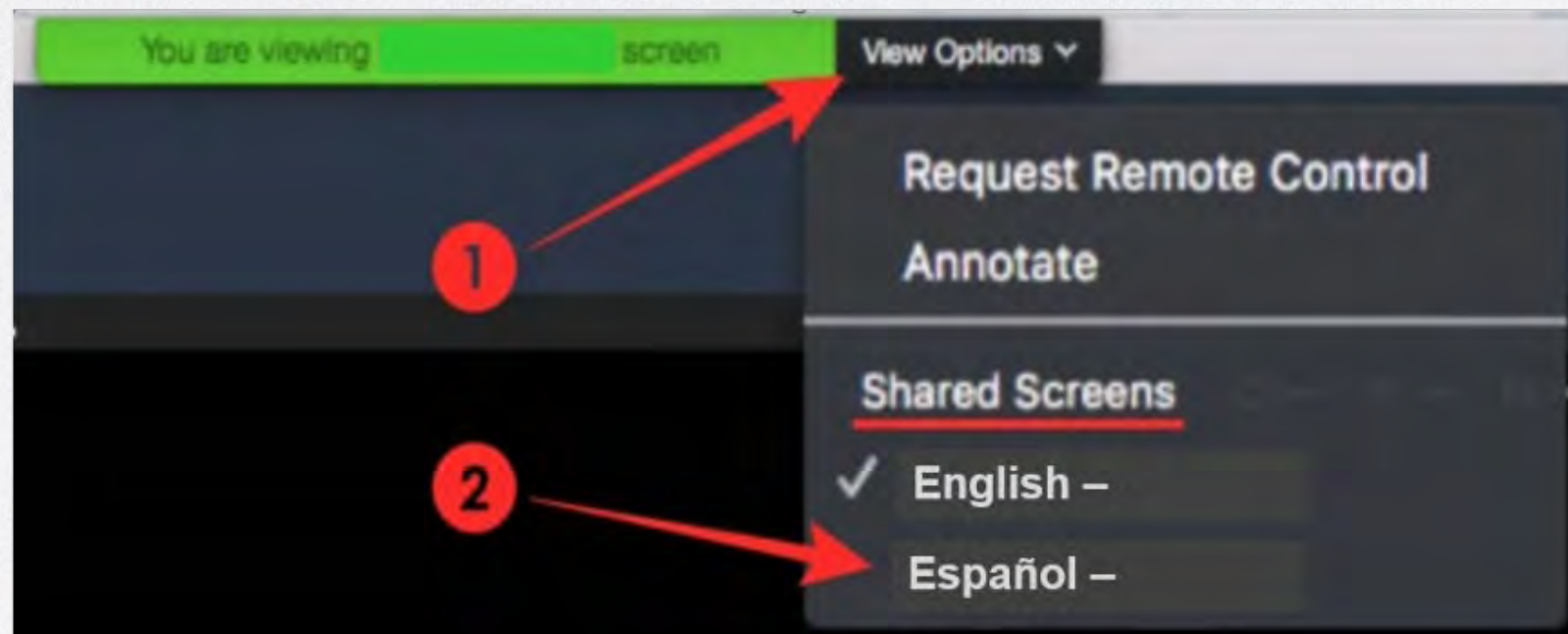
1. Select "Language Interpretation"

1. Select "Spanish"

Selecting Your Viewing Language in Zoom

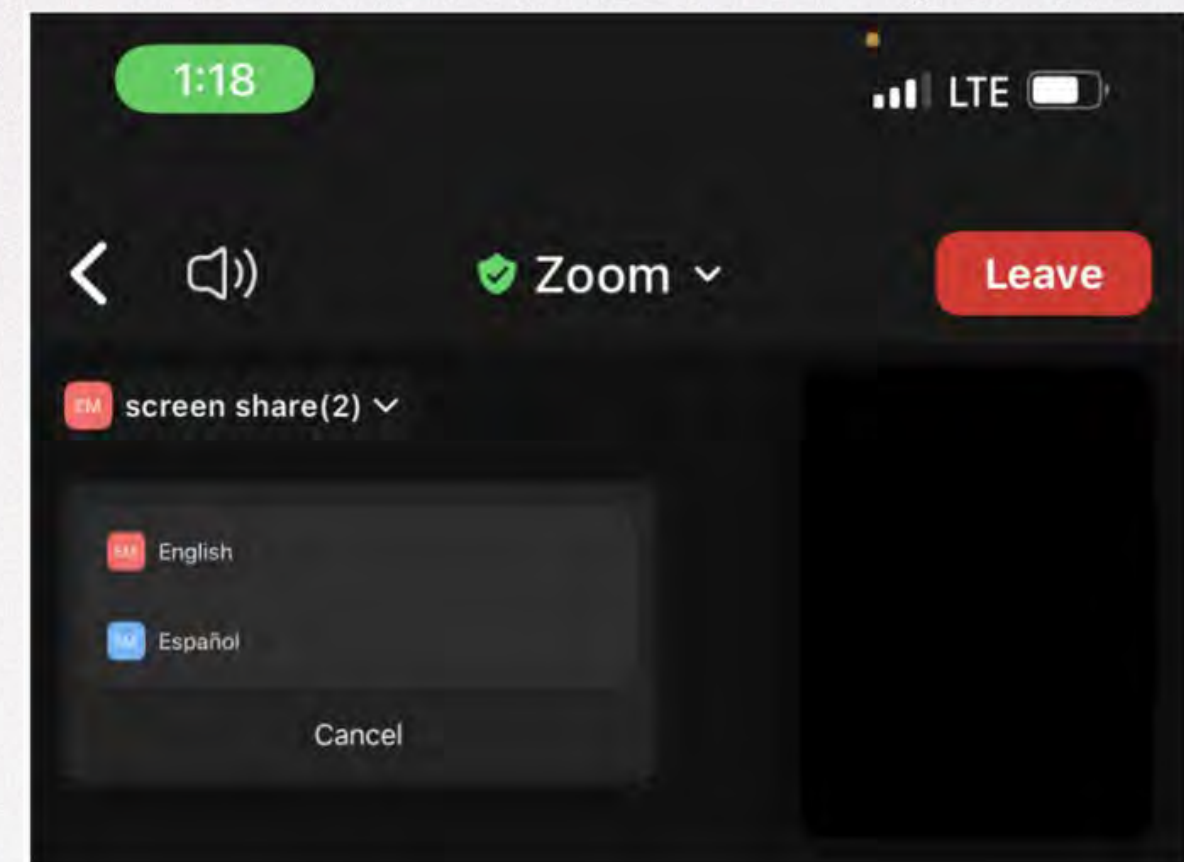
If you want to view the Spanish-language presentation...

- 1) At the top of the screen click on "View Options"
- 2) A dropdown menu will appear
- 3) Select "Español"



If you want to view the Spanish-language presentation from a smartphone...

1. Touch the screen to make the options appear
2. Touch the three dots that say "More"
3. Select "Language Interpretation"
4. Select "Español"
5. Touch "Done"



Continuing Education

Migrant Clinicians Network is accredited as a provider of nursing continuing professional development by the American Nurses Credentialing Center's Commission on Accreditation.

This session, *Diagnosis and Management of Pesticide -Related Illness* , is approved for 1.0 hour of online/virtual AAFP Prescribed Elective credits.



Participants completing this educational activity (80% time in session) and completion of the post session evaluation will be awarded 1 Contact hour.

Disclosure of Relevant Financial Relationships

We have no relevant financial relationships that relate to this presentation, nor do we have any relevant financial relationships with ineligible companies whose primary business is producing, marketing, selling, reselling, or distributing healthcare products used by or on patients.

This presentation was supported by an independent medical education grant by the University of Illinois Chicago. No relevant financial relationships were identified for any individuals with the ability to control content of the activity.



Acknowledgement



The University of Illinois at Chicago stands on the original homelands of the Miami, Three Fire Peoples, the Bodewadmi, Ojibwe, and Odawa, who have been stewards of this land for generations. Illinois is also home to a diverse Native community of more than 75,000 tribal citizens, many of whom live in the Chicago area.



MIGRANT FARMWORKERS REPEATEDLY DOUSED WITH TOXIC PESTICIDES

During the afternoon of July 23, 2019, a **helicopter sprayed toxic pesticides on migrant farmworkers** working in **central Illinois' cornfields**, clearly visible in neon orange hats and backpacks.

Two weeks later, many of those **same farmworkers were again sprayed** with pesticides, **this time twice within a half-hour**. The farmworkers, employed by Iowa-based **Pioneer Hi-Bred International Inc.**, included numerous **teenagers, workers in their 60s, and a pregnant woman**.



sprayed with pesticides in Illinois sue pioneer Hi - Bred and pesticide applicators

Bronchiolitis Revealing Pyrethroid Poisoning in a 2-Month-Old Infant

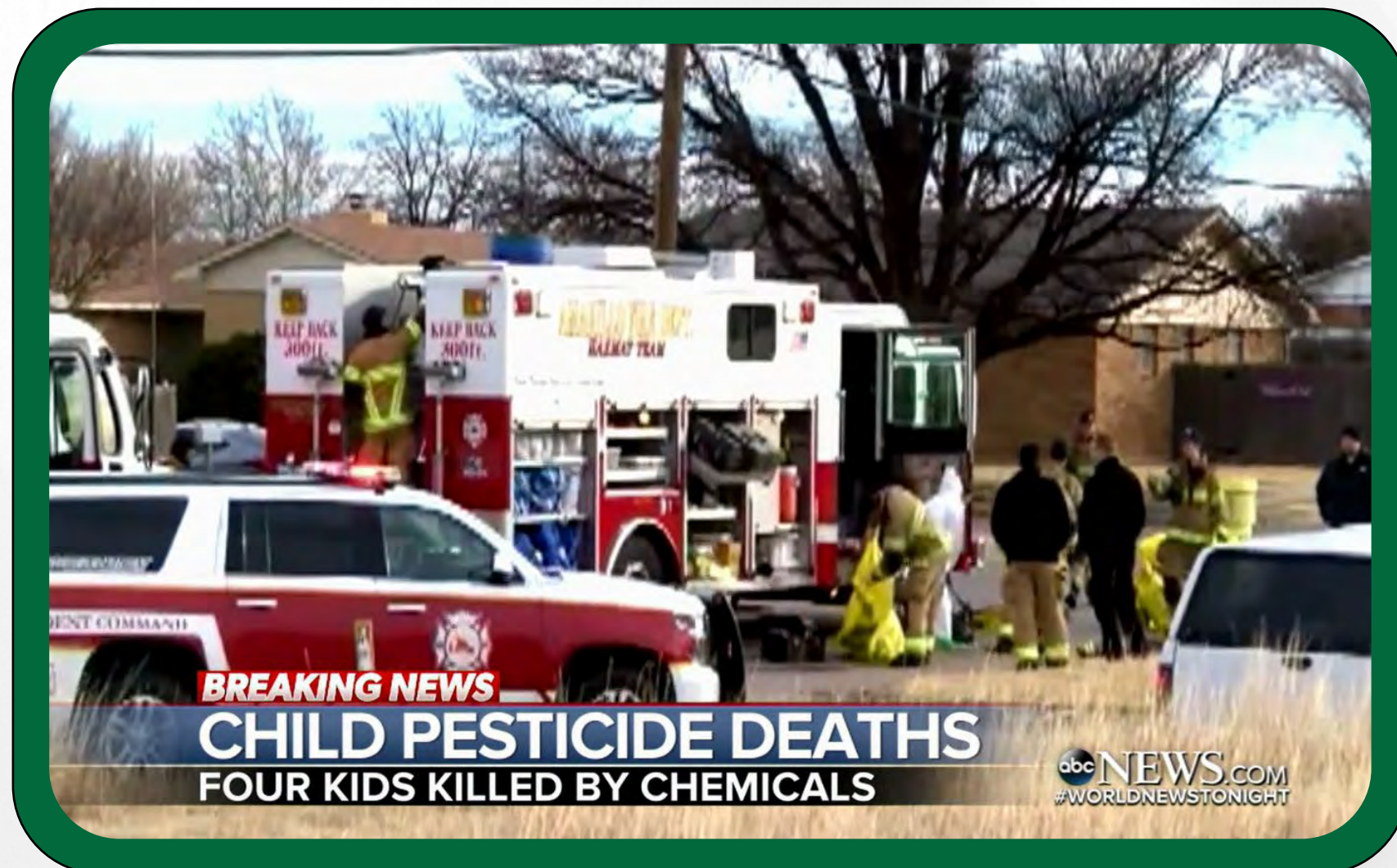
The infant was exposed after the grandmother, who is not literate, sprayed the room where he was sleeping. This accidental exposure occurred because of the lack of knowledge of the precautions mentioned on the insecticide bottle.

The vast majority of domestic poisonings by pyrethroids are of little or no severity. In more than half of the cases, there are no symptoms. However, in case of inhalation of aerosol in a confined environment there is a risk of bronchospasm in sensitive subjects



WATER Poured ON RODENTICIDE CAUSED 4 DEATHS IN A TEXAS HOME

The deaths of four family members in a Texas mobile home that authorities said was due to fumes from a rodenticide have put the spotlight on a chemical called aluminum phosphide, which can turn into a deadly gas called phosphine gas. In Monday's deadly incident in Amarillo, Texas, surviving family members said they had used a pesticide containing the chemical to kill mice under the home, according to local fire officials. Authorities said the chemical turned deadly when a family member sprayed water on the pesticide to try and clear it from under the mobile home.



Learning objectives

- Describe 3 classes of pesticides, exposure scenarios, and their clinical effects;
- Manage or triage pesticide -related illness cases;
- Discuss what is known about chronic effects of low-level pesticide exposures.



Table 17D. Substance Categories Most Frequently Involved in Adult (≥ 20 years) Exposures (Top 25)^a

Substance (Major Generic Category)	All substances	% ^b	Single substance exposures	% ^c
Analgesics	149,532	12.96	69,333	10.01
Sedative/Hypnotics/ Antipsychotics	128,982	11.18	42,540	6.14
Antidepressants	71,367	6.19	24,389	3.52
Cleaning Substances (Household)	69,376	6.01	54,666	7.89
Cardiovascular Drugs	63,229	5.48	25,556	3.69
Alcohols	54,128	4.69	12,829	1.85
Bites and Envenomations	44,580	3.86	44,133	6.37
Pesticides	42,737	3.70	38,861	5.61
Anticonvulsants	33,720	2.92	12,391	1.79
Cosmetics/Personal Care Products	33,009	2.86	30,516	4.41
Antihistamines	29,962	2.60	14,557	2.10
Hormones and Hor- mone Antagonists	29,317	2.54	17,780	2.57
Stimulants and Street Drugs	25,559	2.22	12,065	1.74
Chemicals	23,504	2.04	19,552	2.82

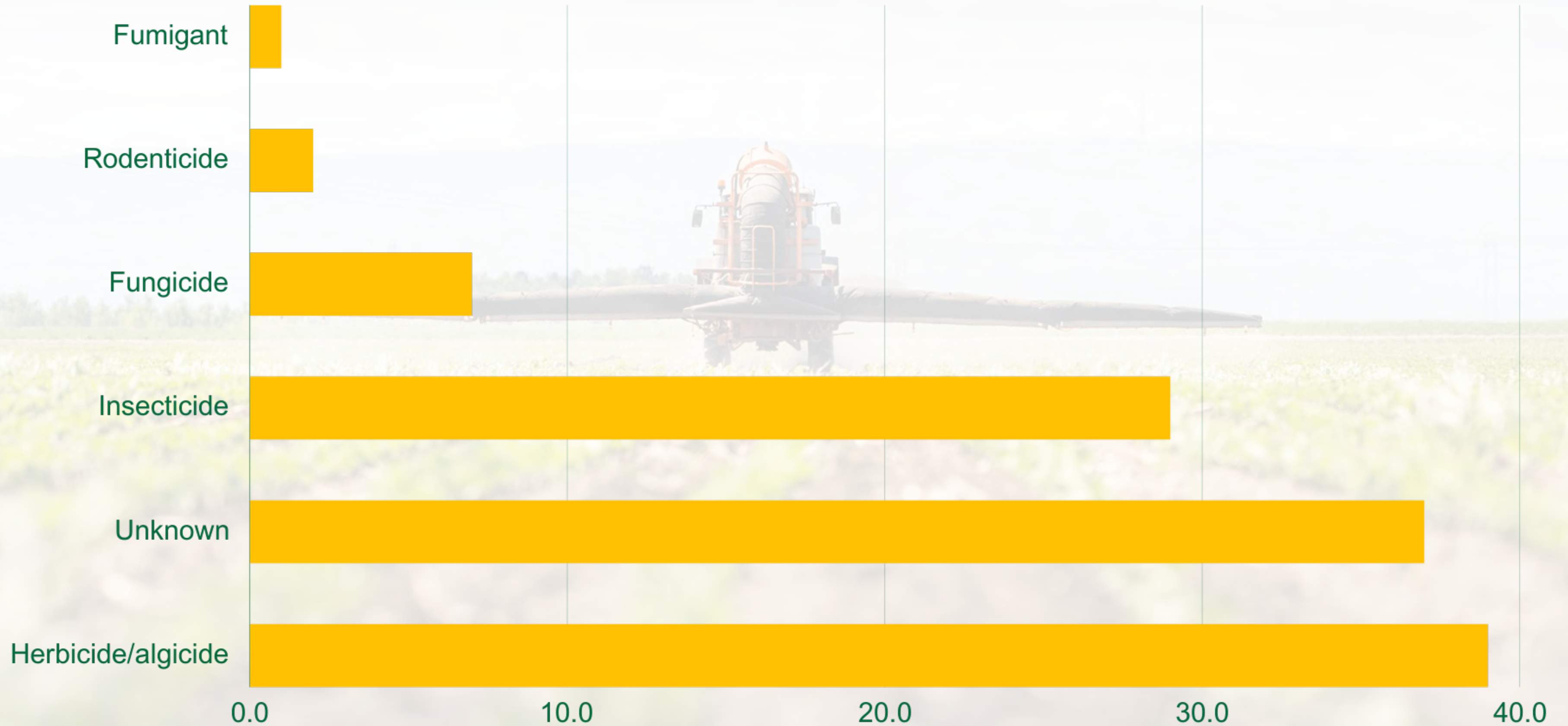
POISON CENTER DATA

Main exposures in adults?

- **Consider ...**

- **Medical error**
- **Suicide**
- **Substance abuse**
- **Work-related**
- **Home repair**

Occupational Pesticide Related Illness in Illinois 2016-2017 - Pesticide Involvement by Functional Class



Pesticide = Any substance or mixture of substances intended for preventing, destroying, repelling or mitigating any pest



Insecticides



Fumigants



Herbicides



Rodenticides



Fungicides

3 CLASSES OF PESTICIDES

ORGANOPHOSPHATES

PYRETHRINS

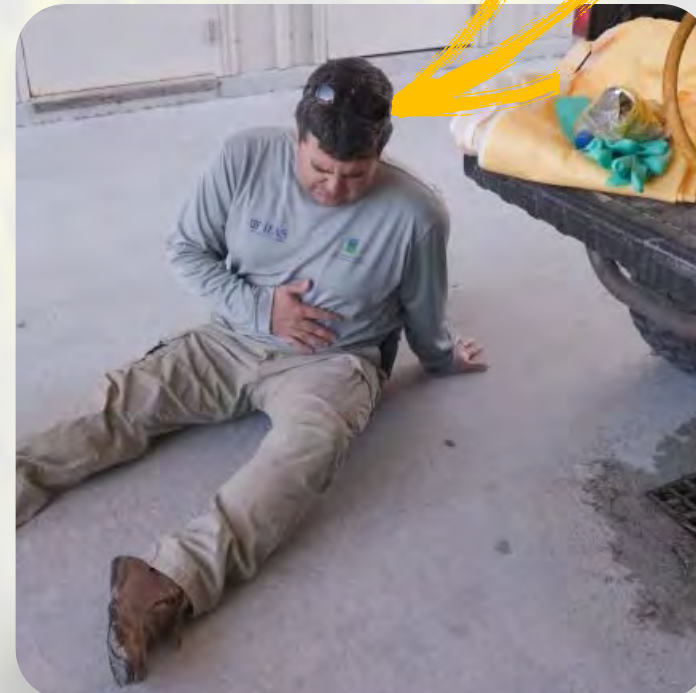
RODENTICIDES

- Older rodenticides
- Anticoagulants
- Cholecalciferol

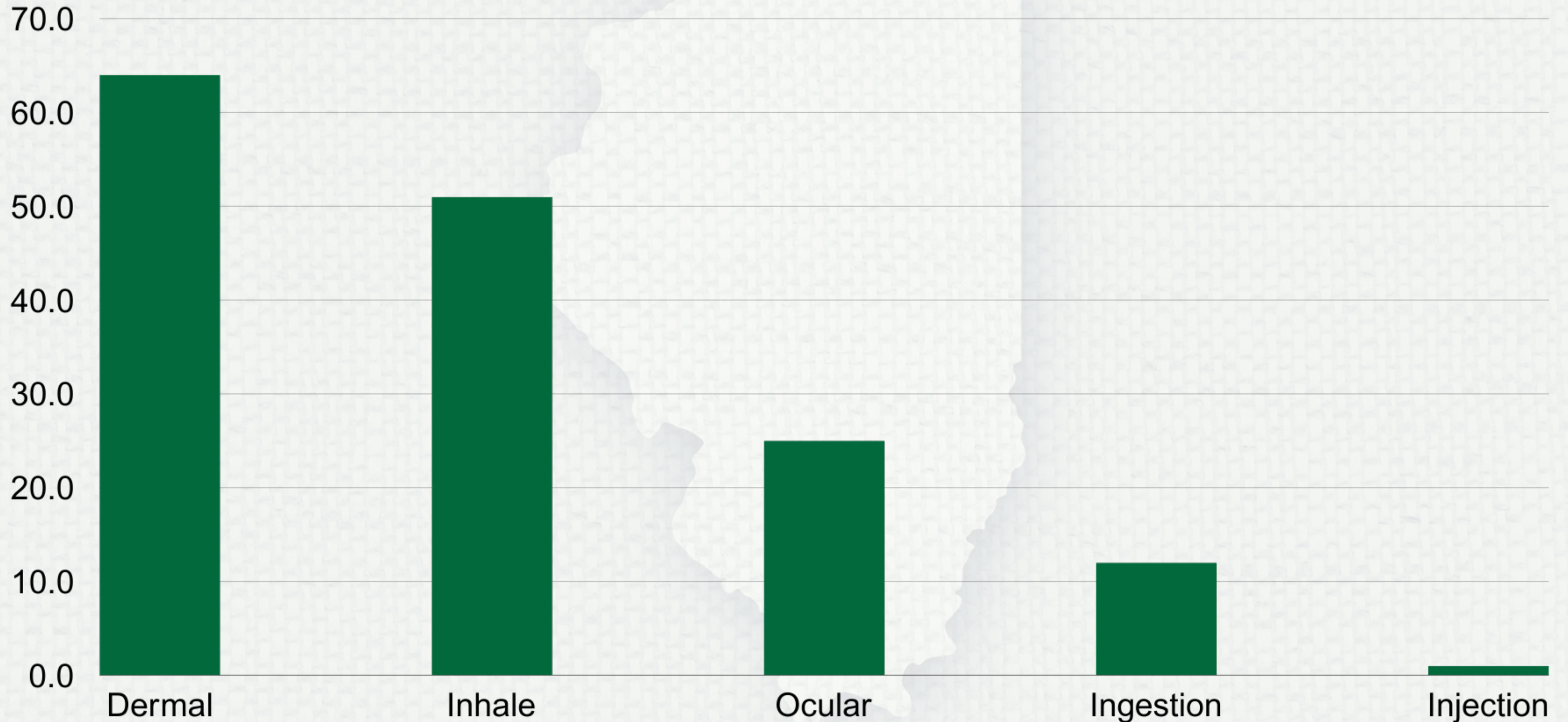




COMMON EXPOSURE SCENARIOS



Occupational Pesticides Related Illness in Illinois 2016/2017 - Route of Exposure to Pesticide



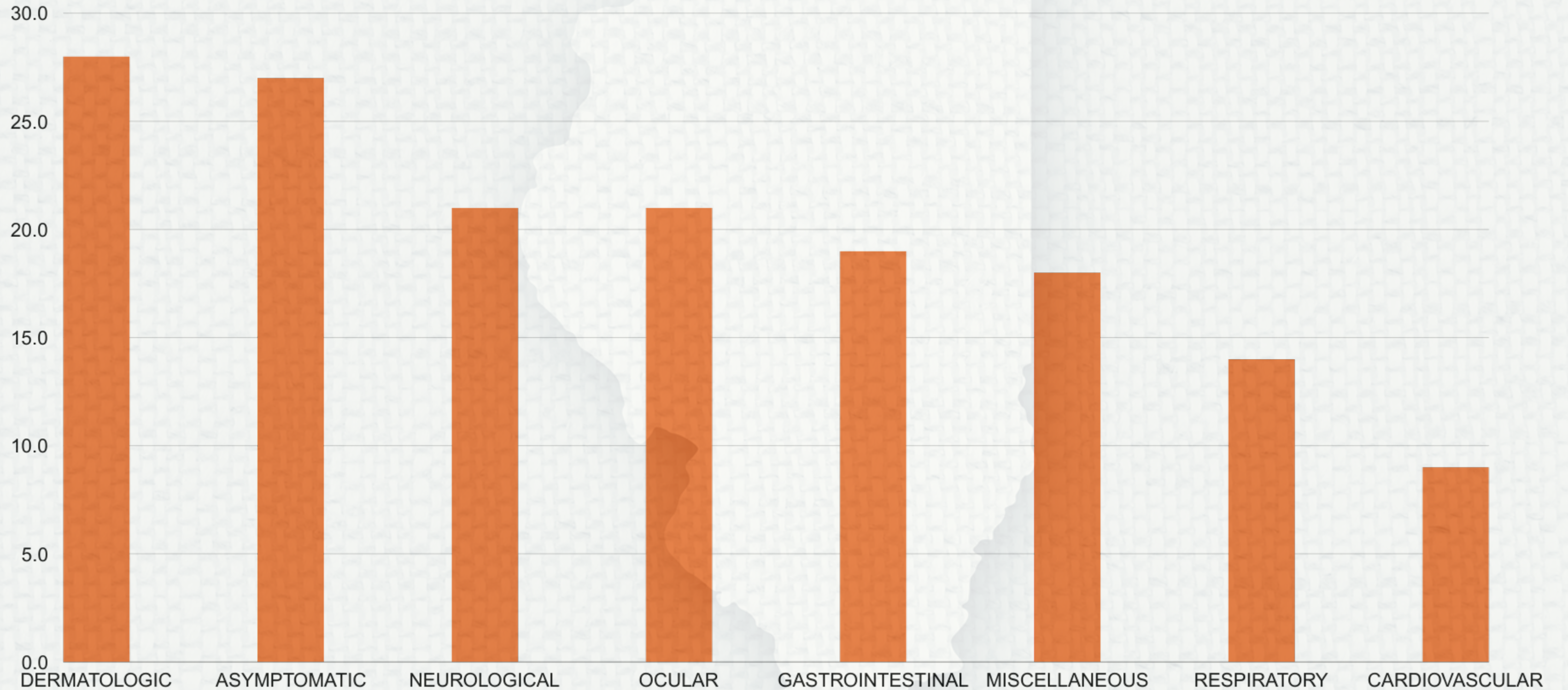
TOXICITY CONSIDERATIONS

Will depend on...

- Dose = quantity x frequency
- Route of exposure
- Distribution
- Metabolism
- Elimination
- Individual sensitivity (age, gender, health status, genetics, concurrent exposures)



Occupational Pesticides Related Illness in Illinois 2016-2017 - Frequency of Signs and Symptoms by Organ System Affected



TOXICITY CONSIDERATIONS

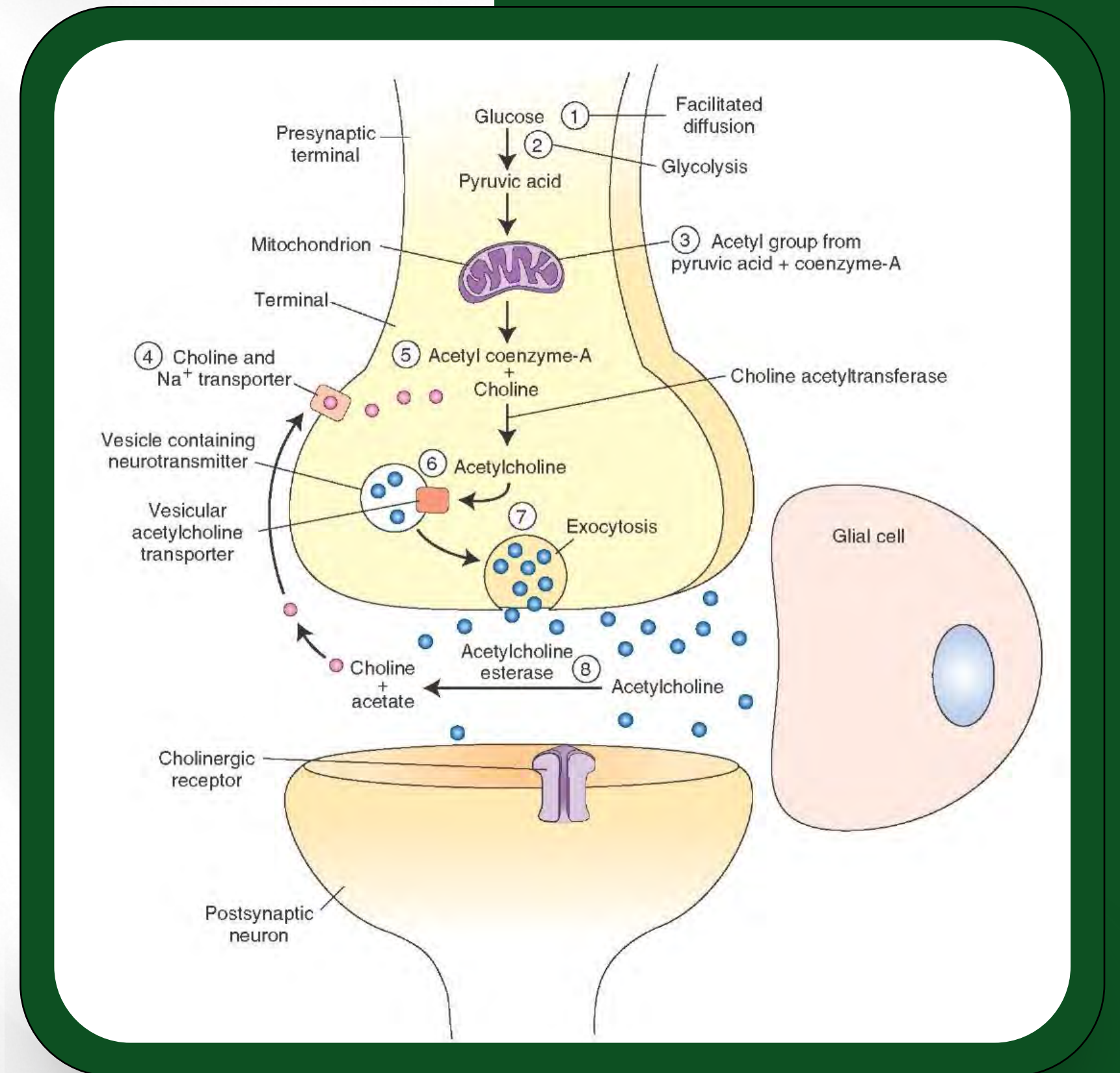
- **Acetyl choline**

- main neurotransmitter of the autonomic nervous system
(sympathetic and parasympathetic)
- Neuromuscular & Neurosecretory junctions

- **The enzyme “cholinesterase”** speeds the hydrolysis of acetylcholine and stops neurotransmission

- **Organophosphates inactivate cholinesterase**

by phosphorylation of the active site of the enzyme -Create cholinergic excess



Organophosphate poisoning - acute effects

Miosis

Diaphoresis

Salivation

Lacrimation

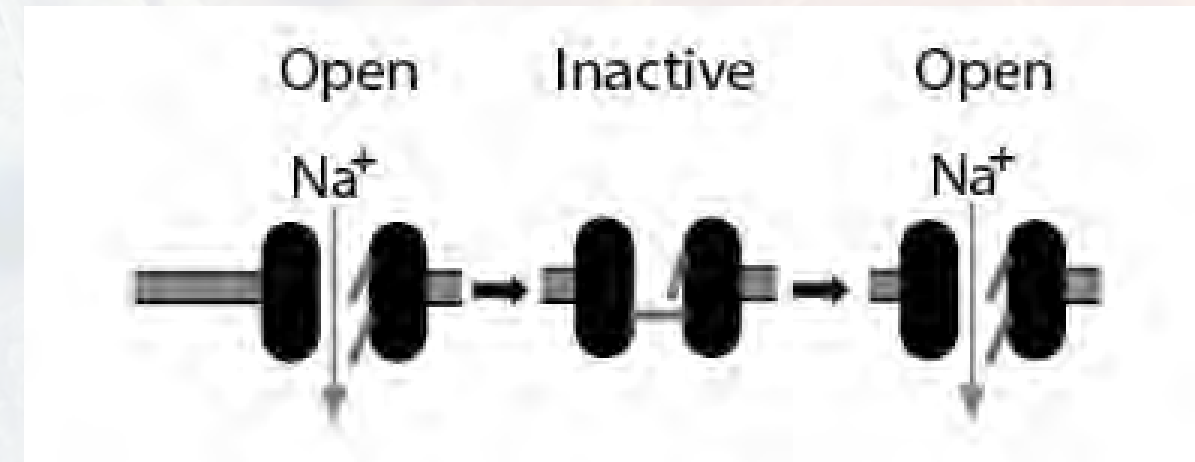
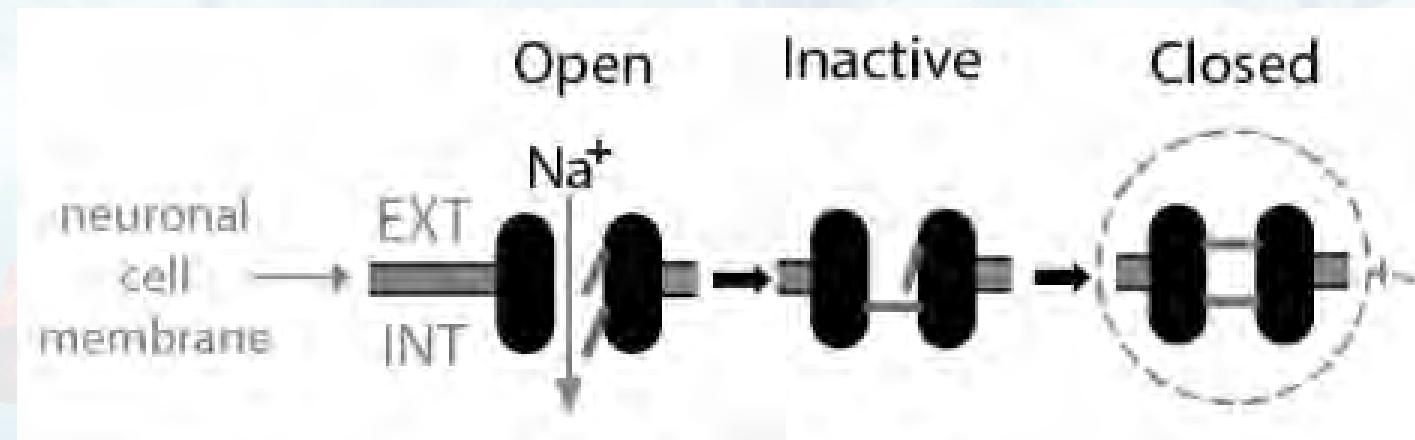
Urination

Defecation

Gastric emptying



Pyrethroids - Mechanism



Na Channels

Normal Function
Pyrethroids

Closed - Blocked with

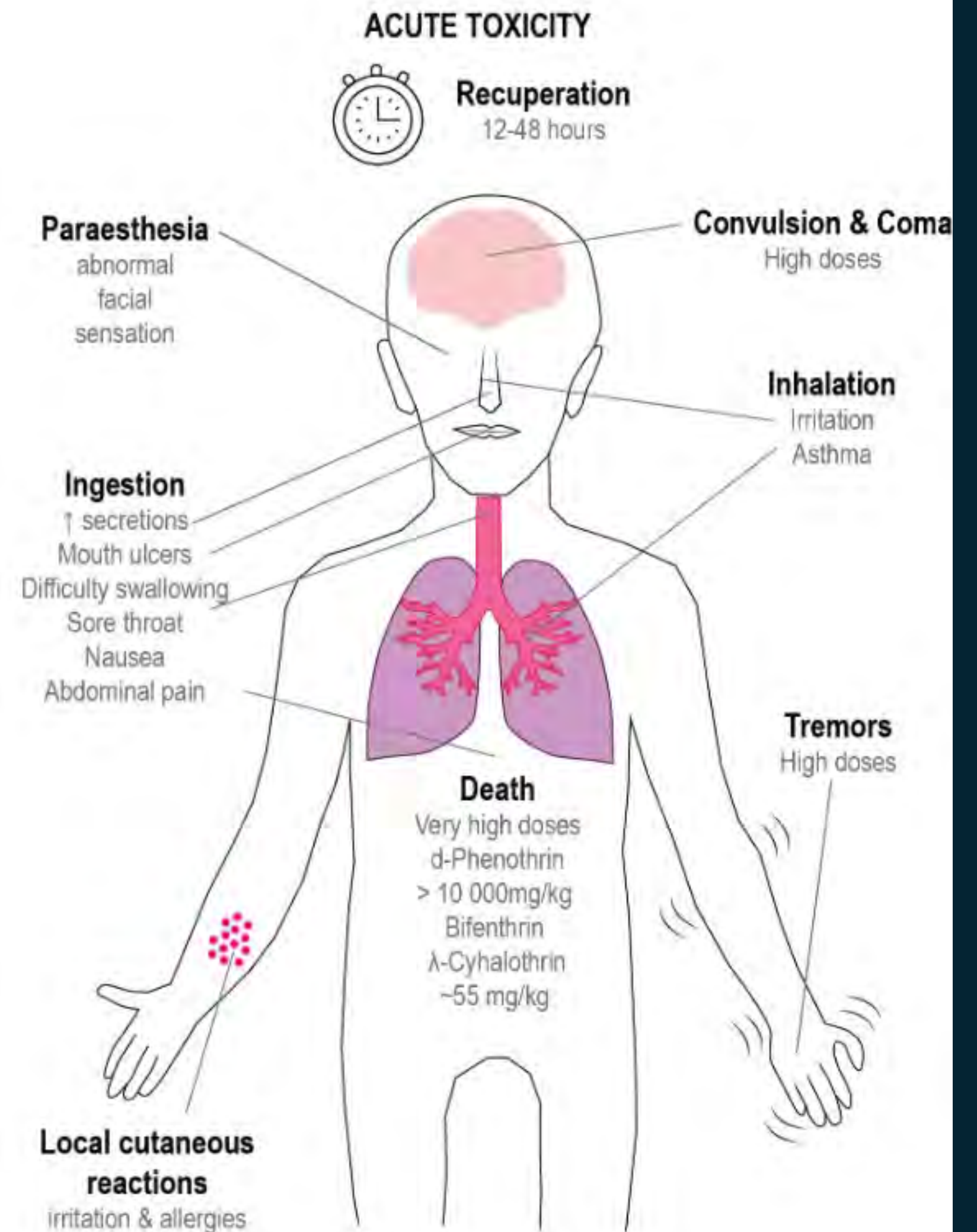
PYRETHROID POISONING - ACUTE EFFECTS

Type I syndrome "T syndrome"

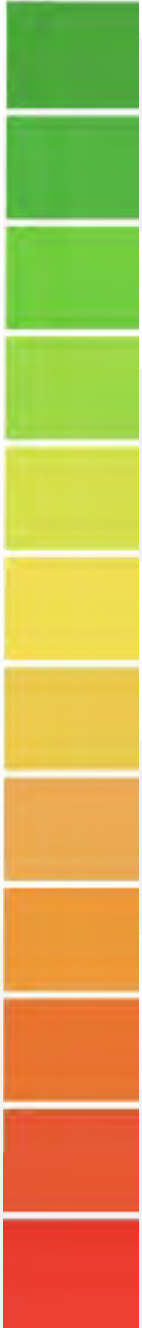
- Severe fine tremor
- Paresthesia (dermal exposure)

Type II syndrome "CS syndrome"

- Choreoathetosis
- Salivation



Pyrethroid poisoning - acute effects

- 
- **Suspicious cases** = abnormal facial sensation, contact dermatitis
 - **Mild poisoning** = systemic symptoms (dizziness, headache, nausea, fatigue)
 - **Moderate poisoning** = altered consciousness, muscular fasciulations of limbs
 - **Severe poisoning** = convulsive attacks, coma, pulmonary oedema

Anticoagulants – Mechanism & Use

Rodenticide Category	Active Ingredient	Target Pests
2nd Generation Anticoagulants	brodifacoum	Possums, hedgehogs, rats, mice
	bromadiolone	
	difenacoum	
	difethialone	
1st Generation Anticoagulants	Warfarin	Mice, rats, squirrels, gophers
	Diaphacinone	
	Chlorophacinone	
Acute Toxicants	Zinc Phosphide	Gophers, ground squirrels, field mice
	Strychnine	

Anticoagulants

Rodenticide Category	Signs and Symptoms
2nd Generation Anticoagulants	Mild-to-severe life-threatening hemorrhage can occur. (epistaxis, hematuria, GI bleeding, ecchymoses, and hematomas.)
1st Generation Anticoagulants	Bruising or bleeding Potentially asymptomatic with toxic doses
Acute Toxicants	Cardiac arrhythmias, refractory shock, or cardiac arrest Muscle rigidity, opisthotonus, trismus, and facial grimacing (risus sardonicus) –



Principles of Triage and Treatment – Acute significant poisoning

GOOD



**GCS 15/15 have a
<5% risk of death**

**GCS <10/15 have a
60% risk of death.**



BAD

Data Collection on an Acute Pesticide Exposed Patient



Pesticide Label and/or Safety Data Sheet (SDS)



A fresh urine sample



Copy of pesticide application record



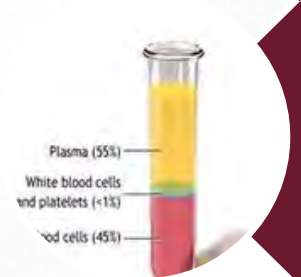
Any contaminated clothing



10 cc whole blood, anticoagulated with sodium heparin



Other options



5 cc plasma anticoagulated with sodium heparin

Fingernail Residue

Saliva Sample

Hair Sample

Skin wipe

The objective of atropine antidotal therapy is to antagonize the effects of excessive concentrations of acetylcholine at end-organs having muscarinic receptors. Atropine does not reactivate the cholinesterase enzyme or accelerate disposition of organophosphate. Recrudescence of poisoning may occur if tissue concentrations of organophosphate remain high when the effect of atropine wears off, and multiple doses will be required. Atropine is effective against muscarinic manifestations, but it is ineffective against nicotinic actions, specifically muscle weakness and twitching, and respiratory depression. Despite these limitations, atropine is often a life-saving agent in organophosphate poisonings. Favorable response to a test dose of atropine can help differentiate poisoning by anticholinesterase agents from other conditions.

Test Dosage of Atropine

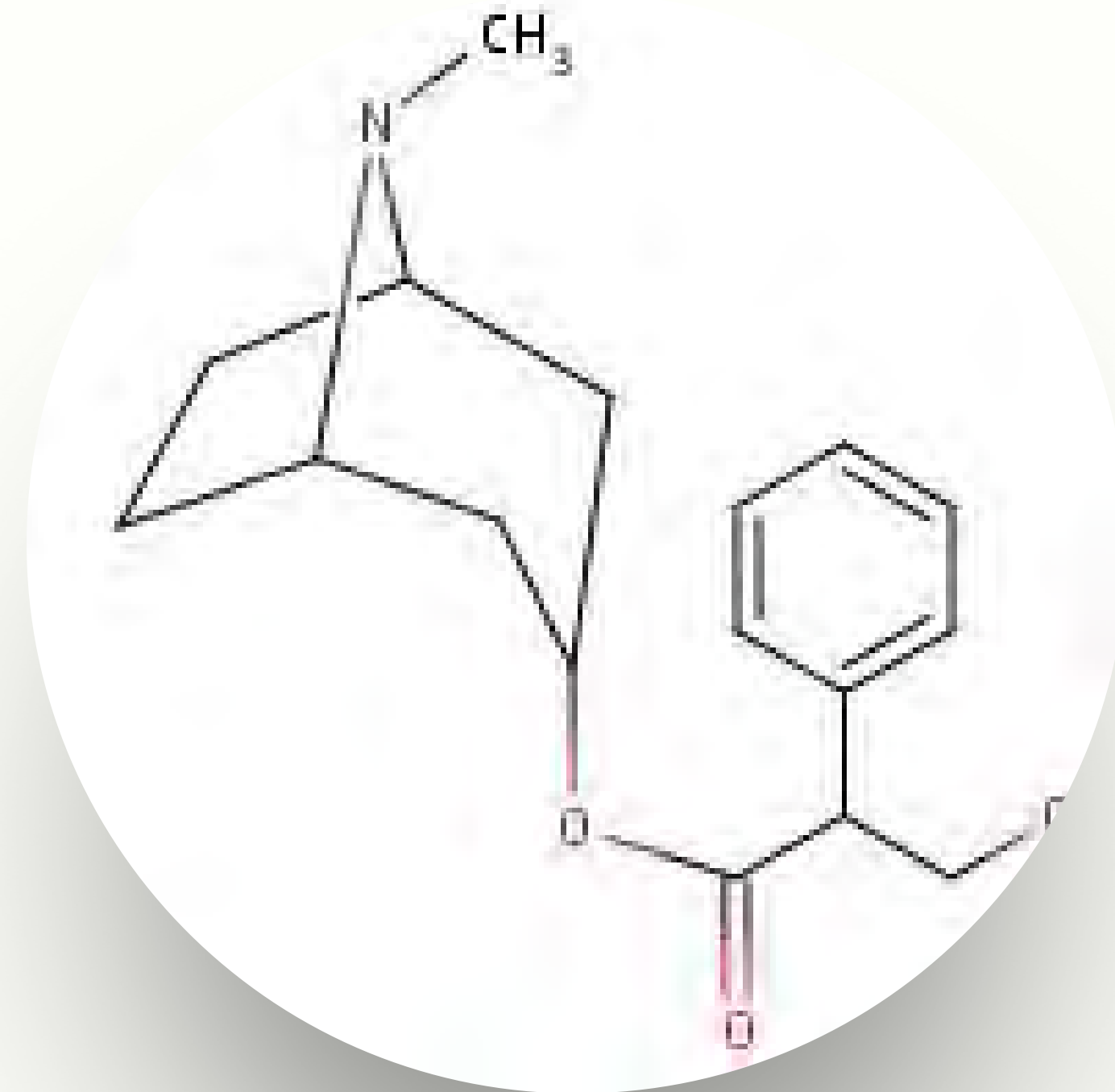
- **Adults: 1 mg**
- **Children under 12 years: 0.01 mg/kg**

Note, however, that lack of response with no evidence of atropinization (atropine tachycardia), may also indicate a more severe poisoning. The adjunctive use of nebulized atropine has been reported to improve respiratory distress, decrease bronchial secretions and increase oxygenation.²¹

Dosage of Atropine

In *moderately severe poisoning* (hypersecretion and other end-organ manifestations without central nervous system depression), the following dosage schedules have been used:

- **Adults and children over 12 years: Initial dose 1-3 mg IV. Repeat in 3-5 minutes if no change in clinical symptoms. Dose may be doubled with each administration until the patient is atropinized. Once adequate atropinization has been achieved, the patient can be maintained on an atropine continuous infusion at about 10%-20% of the loading dose and titrated to effect.**^{4,14,15,18}
- **Children under 12 years: There is less agreement regarding pediatric dosing. Recent studies recommend beginning with 0.02 mg/kg body weight, and doubling the dose every 5 minutes until atropinization is achieved.¹⁴ Patients seen in a pediatric ICU setting were given 0.05 mg/kg every 15 minutes.²¹ Since children sometimes present differently than adults and have more CNS findings, aggressive atropinization should proceed when there are muscarinic signs such as bradycardia, salivation, diarrhea and miosis that can be observed to change with adequate atropine.²¹**



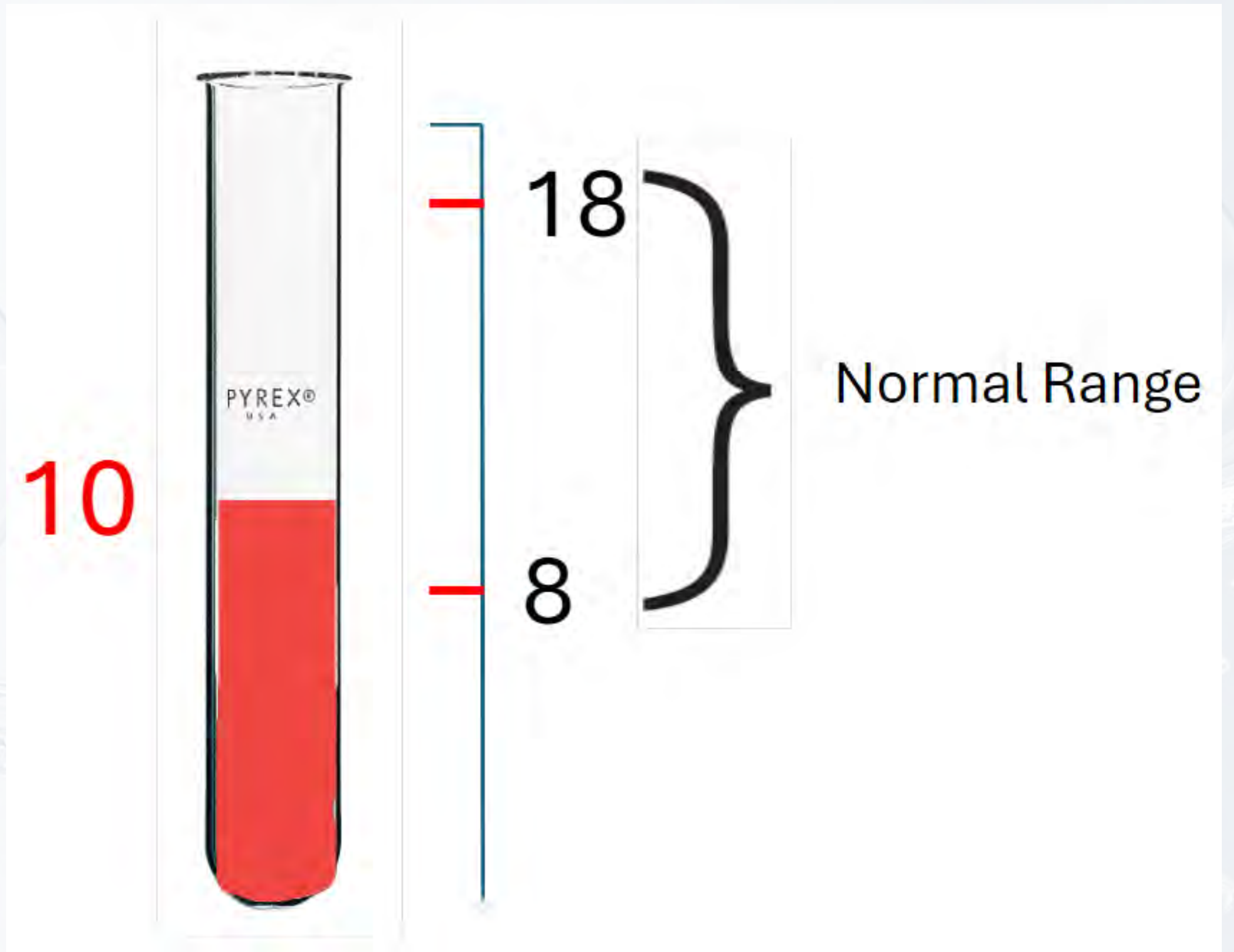
2-pam or Not 2 -pam?

4. Consider pralidoxime in cases of mixed carbamate/organophosphate poisoning and cases of an unknown pesticide with muscarinic symptoms on presentation (see **Chapter 5, Organophosphate Insecticides**, subsection *Treatment*, item 5, page 49.^{22,23} Pralidoxime has been used in some cases of carbamate poisoning, although other cases have resolved from supportive care alone.^{24,25} Pralidoxime is probably of little value in N-methyl carbamate poisonings and is not indicated in isolated carbamate poisonings. **Atropine alone usually is effective.**
5. Decontaminate concurrently with whatever resuscitative and antidotal measures are needed to preserve life. Contamination of the eyes should be removed by flushing with copious amounts of clean water. For asymptomatic individuals who are alert and physically able, skin decontamination should occur as previously outlined in **Chapter 3, General Principles**. Specifically, skin and hair should be washed with soap and water. Attending personnel must take precautions including rubber gloves to avoid contamination. Contaminated clothing should be promptly removed, bagged and laundered before returning, and items such as shoes, boots and headgear should be discarded.

Page 59

What else can we do?

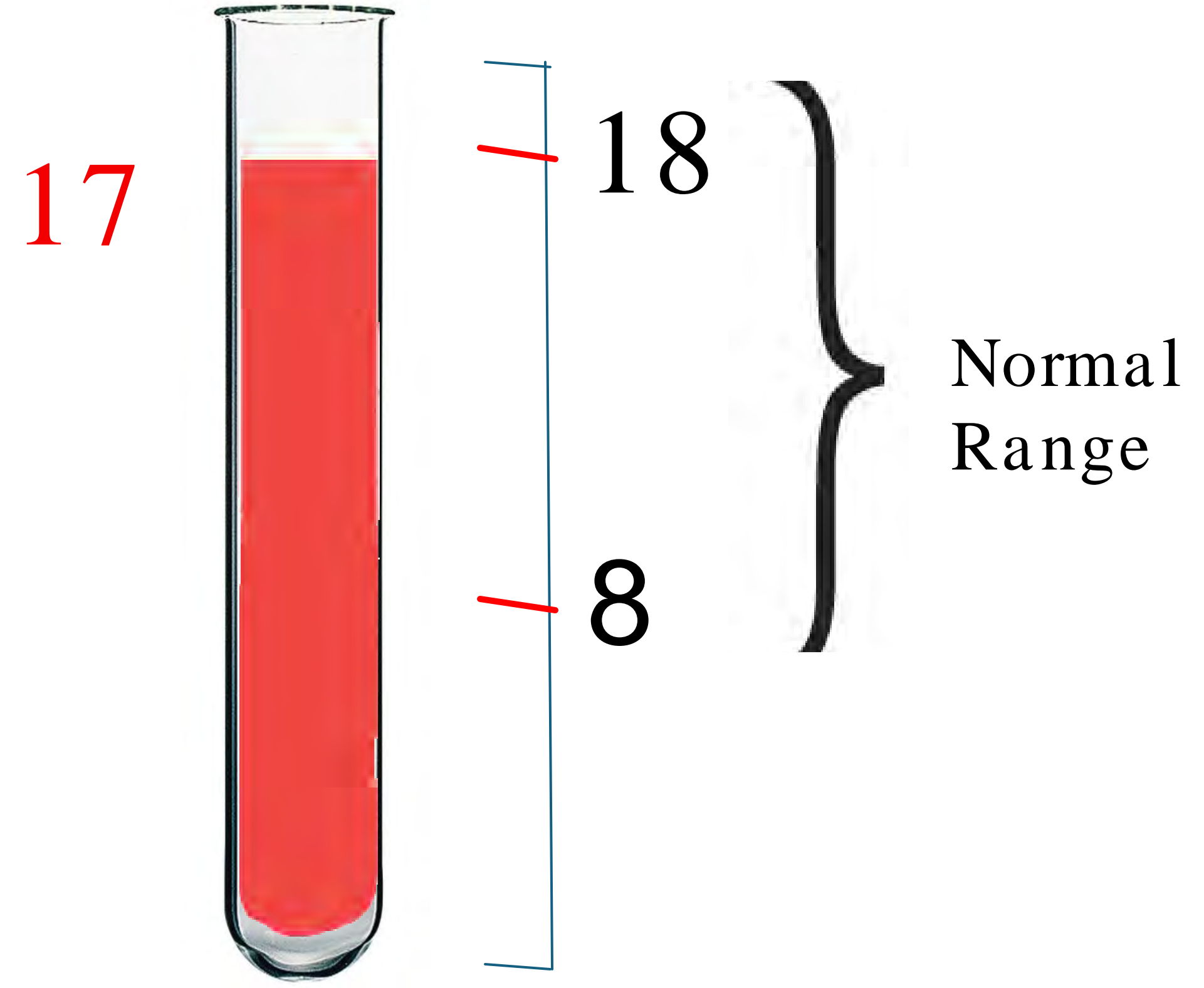
Organophosphate poisoning triage and Treatment



Does this rule out
Organophosphate poisoning?



Cholinesterase Test



1. Organophosphate poisoning triage and Treatment

Red cell (true) and serum (pseudo) cholinesterase

- 20% - 50% reduction in an individual's baseline cholinesterase level indicates excessive exposure.
- Signs and symptoms may not appear in some individuals until the cholinesterase level has declined by 80%

1. Organophosphate poisoning triage and Treatment

What are two explanations for a normal ChE in the presence of a clear cholinergic syndrome?

1. A true depression of a normally high ChE level
2. It is not a OP poisoning



Photo © US Navy

ACUTE PYRETHRIN POISONING MANAGEMENT

- Management is largely supportive and symptomatic because there is no available antidote

RODENTICIDE POISONING

TRIAGE DECISION;

- **patient's age**
- **intent**
- **route of exposure**
- **estimated dose**
- **time since exposure**



Rodenticide poisoning

- Referral immediately if:
 - Signs of bleeding or bruising (symptomatic patients)
 - Intentional exposure (eg, self-harm, misuse, abuse, or malicious intent)
 - High dose exposures
 - unintentional toxic ingestions (estimated dose >1 mg)
 - ingestions of an unknown amount for administration of activated charcoal is also appropriate if treatment can be accomplished within one hour of exposure.

Rodenticide poisoning

- Three key points
 - The absence of signs or symptoms of bleeding does not exclude a potentially toxic ingestion.
 - The onset of anticoagulation effects after acute ingestion can range from immediate onset to up to 48 hours. Laboratory evaluation for coagulopathy at less than 48 hours after exposure in asymptomatic patients can miss some patients who ingested a toxic dose
 - The duration of anticoagulation after overdose can be prolonged for several months.

Exposures Resulting in Deaths in Patients Admitted to Hospitals, Illinois (2000-2009)

Substance (based on ncodes and ecodes)	Died	CFR
Alcohol - Related Illness, Psychoses, Toxic Effect	2480	0.72%
Stimulants and street drugs	2031	0.47%
Hormones and hormone antagonists	1519	1.64%
Analgesics	574	0.42%
Sedative/hypnotics/antipsychotics	348	0.20%
Anticoagulants	194	3.72%
Fumes/gases/vapors	137	2.82%
Cardiovascular drugs	92	1.44%
Antidepressants	53	0.31%

Clinical considerations

Red Flags

Biomedical factors
(pathology, comorbidities)

Yellow Flags

Psychosocial (beliefs, coping,
stress, supports)

Blue Flags

Socioeconomic factors
(Job status, insurance
benefits, litigation)

Black Flags

Occupational factors (working
conditions, job content,
working environment)

Poisons Centers

Confidential treatment advice
Free to public
24/7 availability



Specially -trained doctors, nurses, and pharmacists



1-800-222-1222



Hotline

Chronic effects after acute poisoning

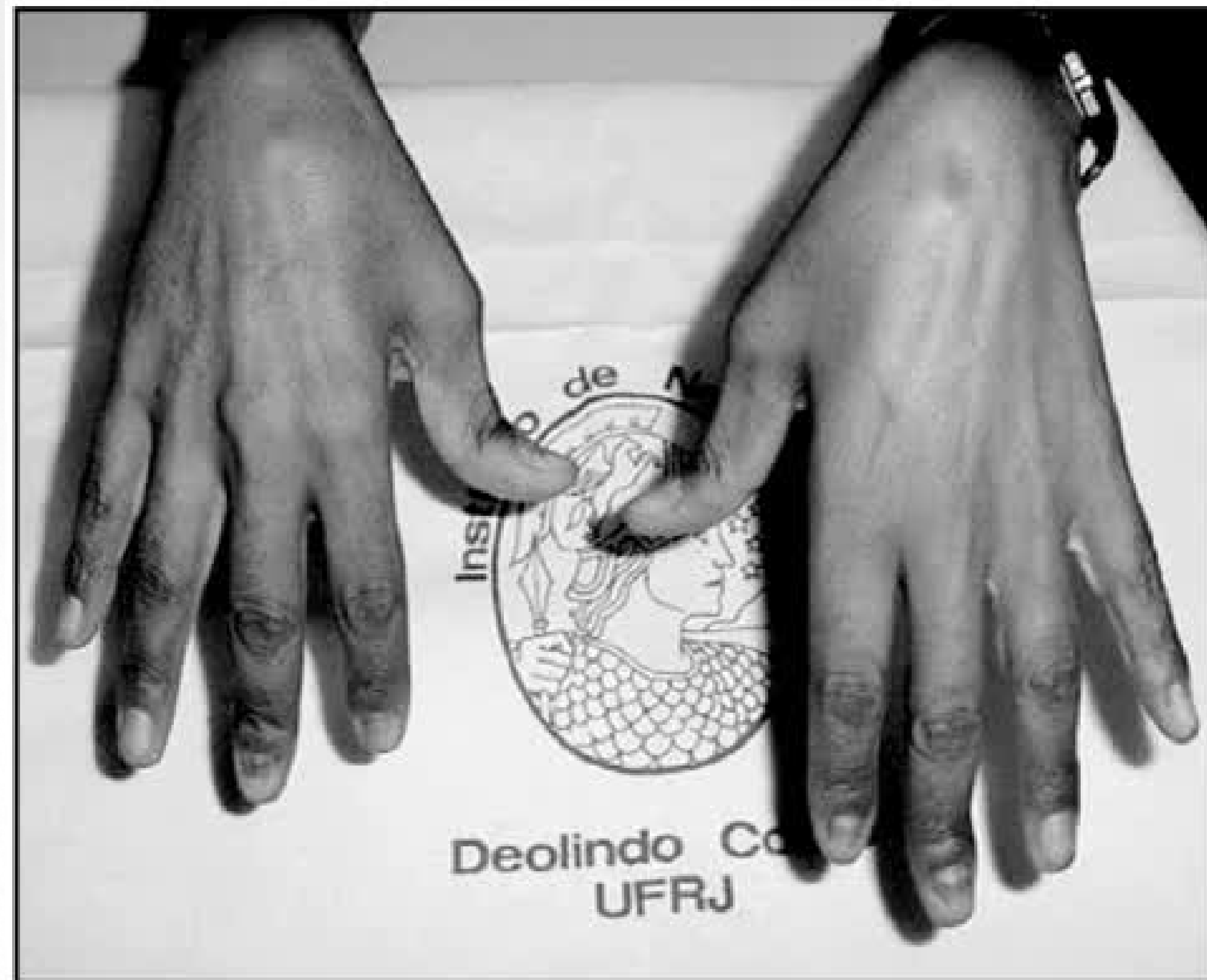


Fig 1. Dorsal surface of hands showing interosseous atrophy.

Chronic effects following chronic exposure

- Children - Associated with neurodevelopmental toxicity in gestational or early postnatal exposure
- Adults – Duration of exposure of pesticides related to symptoms such as headaches, fatigue, dizziness, depression, numbness in hands and feet
- Cancer – data supports associations between occupational pesticide exposure and cancers in both adults and children

Resources to share





You can choose to attend one or more of the following webinars.

How to Prevent Pesticide Poisoning in Farmworkers

Session 2:
Public Health & Legal
Considerations in Pesticide-
Related Illness in Farmworkers



Thursday, November 7, 2024

1:00 pm PT / 3:00 pm CT / 4:00 pm ET / 5:00 pm AT

How to Prevent Pesticide Poisoning in Farmworkers

Session 3:
Culture is key! Prevention of
Farmworker Pesticide-Related
Illness Using Cultural
Contextual Education



Thursday, December 5, 2024

1:00 pm PT / 3:00 pm CT / 4:00 pm ET / 5:00 pm AT



https://us02web.zoom.us/webinar/register/WN_H31JfmdqQmaf0KFUy4jrA

Registration Closes
Thu, 12/05/2024 @ 5:00 pm

Evaluation

Diagnosis and Management of
Pesticide-Related Illnesses



Your evaluations are extremely important to us! MCN uses your responses to help us guide, adapt, and improve our online educational offerings. Please take a few minutes to submit the evaluation for this presentation. If you wish to receive a Certificate of Continuing Education or Successful Completion, submission of the evaluation is required.