



# FLOOD MEDICINE





# Classification

- Flash floods
- River floods (mostly seasonal)
- Coastal floods : associated with tropical cyclones, tsunami, storm surges





- Factors influencing the severity of the hazard are
  - Depth of water
  - Duration
  - Velocity
  - Rate of rise
  - Frequency of occurrence and season



# Main causes of Morbidity and Mortality

- Direct impact
  - Drowning
  - Injuries
  - Transmission of communicable diseases and increased risk for water and vector borne diseases



# Main causes of Morbidity and Mortality

- Indirect Impact
  - The impact on the health infrastructures and all lifeline systems
  - Can result in food shortages
  - The interruption of basic public health services (water, etc)
  - Contamination by toxic chemicals during floods is theoretically possible but no verifiable correlation has been observed or measured so far





# Infectious disease

- Water-borne diseases
- Vector-borne diseases



# Water-borne diseases

- Bacteria
- Virus
- Protozoa
- Helminths



# Bacteria

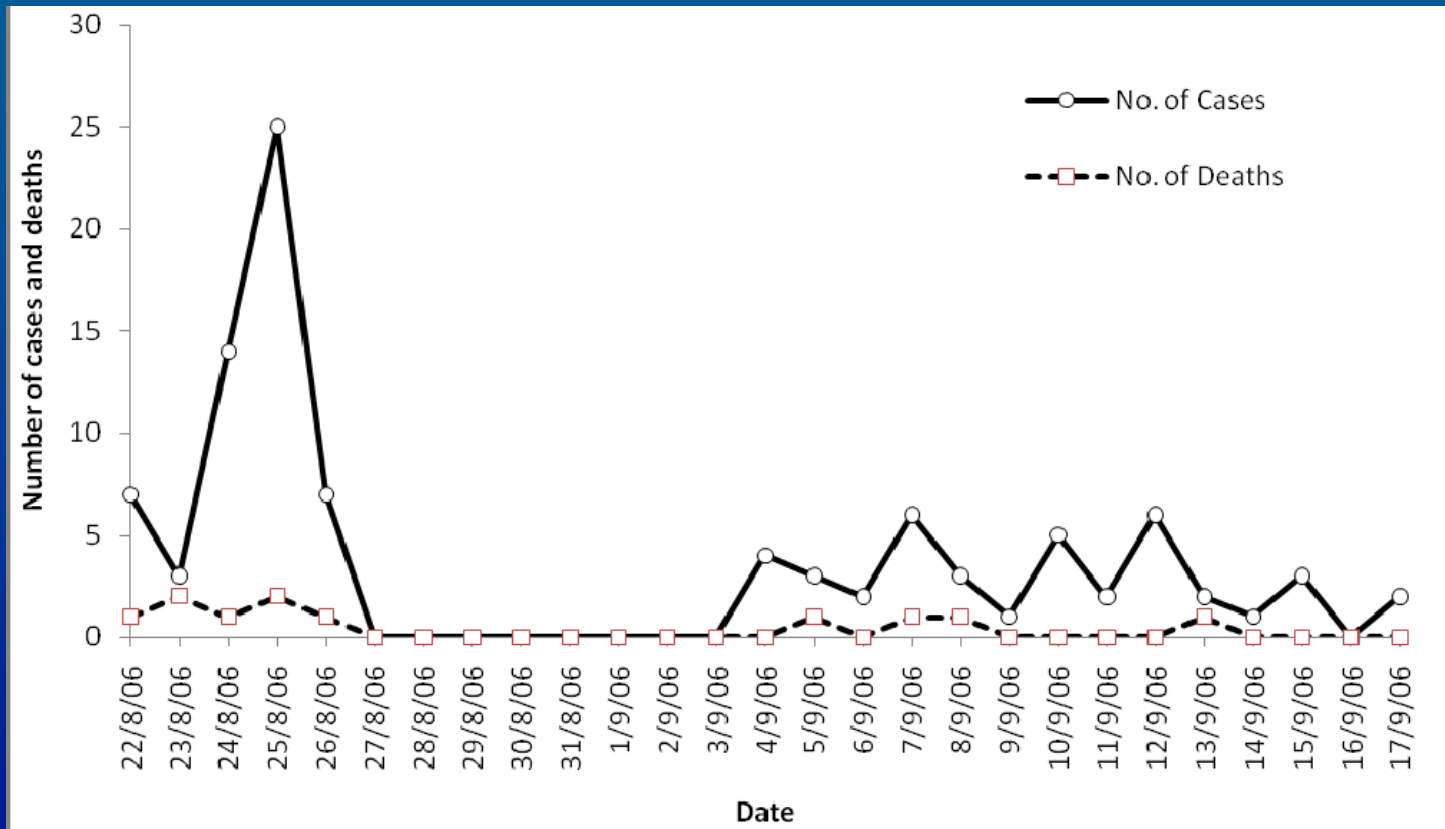
- Escherichia coli
- Salmonella
- Vibrio cholera
- Leptospirosis

- Diarrhea
- Supportive therapy
- ATB for cholera
  - Tetracycline, doxycycline, or ciprofloxacin



# Leptospirosis

## POST-FLOOD PROFILE OF LEPTOSPIROSIS CASES AT TEACHING HOSPITAL OF MUNICIPAL MEDICAL COLLEGE IN SURAT CITY



# An Outbreak of Leptospirosis after Severe Flood in Hat Yai in 2000

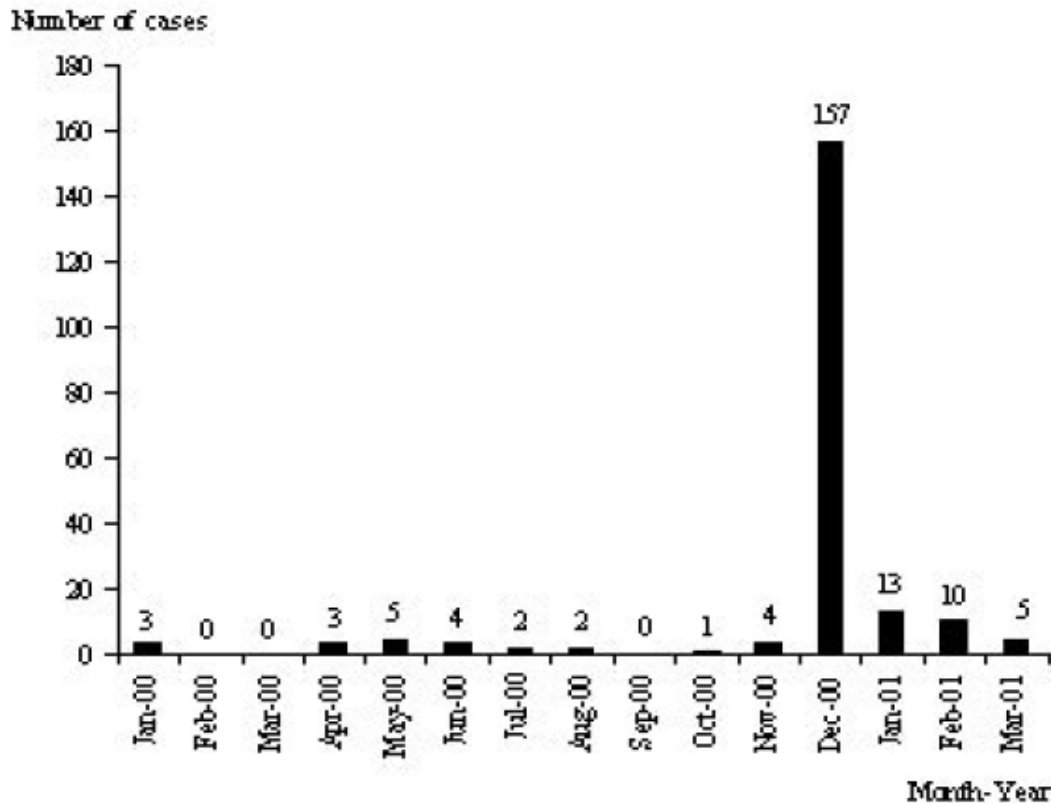


Figure. Positive cases of leptospirosis in Songklanagarind Hospital by indirect immunofluorescence assay (titer  $\geq 1:400$ ) during January 2000 to March 2001.

In the year 2000, from November 21-25, there was a severe flood in Hat Yai city



# Leptospirosis

- Leptospirosis is caused by pathogenic spiral bacteria *L. interrogans*
- The most important reservoirs are rodents, and rats are the most common source worldwide



# Route of infection

- Contact with the organism via infected urine or urine-contaminated media
- The organism enters the body via abraded skin or mucous membranes



# Clinical presentation

- The incubation period is usually 7-12 days
- Course of leptospirosis falls into 2 distinct phases
  - Septicemic or leptospiremic stage
  - Immune or leptospiruric stage



## Leptospiremic stage

- Lasts about 4-7 days
- Nonspecific flulike illness
- Fever, chills, weakness, and myalgias, primarily affecting the calves
- Organism may be isolated from blood cultures

## Leptospiruric stage

- Consequence of the body's immunologic response to infection
- Lasts 0-30 days or more
- Jaundice
- Renal failure
- Pulmonary hemorrhage or acute respiratory distress syndrome



# Weil syndrome

- Severe form of leptospirosis
- Occurs at the end of the first stage and peaks in the second stage
- Profound jaundice, renal dysfunction, hepatic necrosis, pulmonary dysfunction, and hemorrhagic diathesis



# Investigation

- Blood cultures: 7-14 d after exposure
- CSF cultures: within the first 10 days
- Urine cultures: for several weeks after the initial infection
- Serologic test: ELISA
- PCR



# Management

- Outpatients
  - Doxycycline (100mg) BID PO for ten days
- Hospitalized patients
  - Parenteral penicillin, doxycycline, and third generation cephalosporins



# Virus

- Hepatitis A
- Transmission by the fecal-oral route
- Supportive treatment



# Protozoa

- Microsporidia
- Entamoeba histolytica
- Giardia lamblia
- Toxoplasma gondii
- Cryptosporidium spp.
- Cyclospora cayetanensis



# Helminths

- Nematodes
- Flukes
- Tapeworms



# Vector-Borne Infections

- Numerous diseases are transmitted by **insect vectors**.
- Most are restricted to **the tropics and in more temperate regions**
- Several vector-borne tropical diseases are protozoal infections
- **By far, the most important vector-borne protozoal infection is malaria (Anopheles mosquitoes)**



- Many viruses also are transmitted by arthropod bites, mostly mosquitoes or ticks
- "arboviruses" (arthropod-borne viruses)
- Most of these viruses belong to the **Alphaviridae** family and to the **Flaviviridae** family



- Dengue hemorrhagic fever
- Japanese encephalitis
- Malaria



# Dengue fever

- Caused by the dengue virus (family *Flaviviridae*) transmitted by Aedes mosquitoes, principally *A. aegypti*
- The **incubation period** ranges from **3–14 days**, but most often it is 4–7 days





# Signs & Symptoms

- Typically asymptomatic(80%) or mild symptoms
- In a small proportion, the disease develops into the life-threatening dengue hemorrhagic fever(DHF) or Dengue shock syndrome(DSS)

# Symptoms of Dengue fever

2-7 days

Febrile phase

sudden-onset fever

headache

mouth and nose  
bleeding

muscle and  
joint pains

vomiting

rash

Flush skin or measles-like rash

diarrhea

1-2 days

Critical phase

hypotension

pleural effusion

ascites

gastrointestinal  
bleeding

2-3 days

Recovery phase

altered level of  
consciousness

seizures

itching

slow heart rate



# Diagnosis

- By **clinical**
- A probable diagnosis is based on the findings of fever +2 of  
: N/V, rash, generalized pains, low WBC, positive tourniquet test, or any warning sign

Abdominal pain
Ongoing vomiting
Liver enlargement
Mucosal bleeding
High hematocrit with low platelets
Lethargy

- Serologic test
- PCR



# Management

- No specific treatments
- Symptomatic treatment : ORT/IV fluid
- Monitor V/S, Hct, bleeding precaution
- PRC in unstable V/S with ↓ Hct



# Prevention

- Control of and protection from the bites of the mosquitoes
- Eradicate breeding site : emptying containers of water or adding insecticides or biological control agents



# Japanese encephalitis



- Caused by Japanese encephalitis virus (family **Flaviviridae**)
- One of the most important vectors is the mosquito **Culex tritaeniorhynchus**
- Incubation period of 5 to 15 days
- Most infected patients are **asymptomatic**



# Signs & Symptoms

- Fever, headache and malaise and other non-specific symptoms
- Acute encephalitic stage : fever, neck rigidity, cachexia, hemiparesis, convulsions and mental status change
- Life-long neurological defects such as deafness, emotional lability and hemiparesis may occur



# Treatment

- **No specific treatment**
- Supportive treatment with assistance given for feeding, breathing or seizure control as required
- Raised intracranial pressure may be managed with mannitol



# Malaria

- genus **Plasmodium**
- *P.falciparum*, *P.vivax*, *P.malariae*, *P.ovale*, *P.knowlesi*
- **Anopheles** mosquitoes
- Multiplication of *Plasmodium* parasites within RBC causing symptoms





## Symptoms of **Malaria**

**Central**  
- Headache

**Systemic**  
- Fever

**Muscular**  
- Fatigue  
- Pain

**Back**  
- Pain

**Skin**  
- Chills  
- Sweating

**Respiratory**  
- Dry cough

**Spleen**  
- Enlarge-  
ment

**Stomach**  
- Nausea  
- Vomiting

- Fever, chill
- Nausea, vomiting
- Fatigue
- Pain
- Anemia (hemolysis)
- Jaundice
- Hepatosplenomegaly
- Hemoglobinuria
- Renal failure
- Convulsions



# Diagnosis & Treatment

- Microscopic examination of blood films
- Antimalarial drugs & Supportive measures
- WHO guidelines for the treatment of malaria :  
[http://whqlibdoc.who.int/publications/2010/9789241547925\\_eng.pdf](http://whqlibdoc.who.int/publications/2010/9789241547925_eng.pdf)
- <http://www.cdc.gov/malaria/resources/pdf/algorithm.pdf>



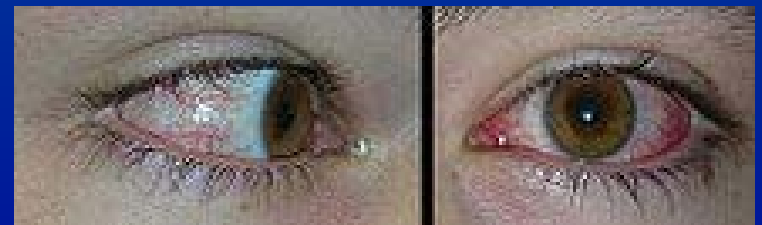
# Conjunctivitis

- Expose to contaminated water
- Infection : Bacteria, virus, fungus
- Allergic inflammation
- Chemical injury



# Signs & Symptoms

- Injected conjunctiva (red eye)
- Irritation
- Chemosis
- Tearing, Photophobia
- Discharge  
(Watery, mucopurulent)





# Management

- Spontaneous resolves in 65% of cases
- **Bacterial** : ATB eye drops, or ointment
- **Viral** : cold compresses, artificial tears
- **Allergic** : cool water, artificial tears, NSAIDs and anti-histamine, short course topical steroid in persistent cases
- **Chemical** : copious irrigation



# Prevention

- Avoidance
- Irrigation with clean water
- Hand hygiene
- Avoid touching patients eyes or sharing towels and washcloths.



# Wound infection

- Most wound infections are due to staphylococci and streptococci
- Beta-lactam antibiotics with anti-staphylococcal activity
  - Cephalexin
  - Dicloxacillin
  - BL/BI
  - Clindamycin



# Wound infection

- Contamination of wounds with water can lead to infections caused by waterborne organisms
  - *Aeromonas* spp.
  - Non-cholera *Vibrio* spp.
  - *Pseudomonas*
  - Other gram-negative rods





# Wound infection

- Aeromonas
  - Trimethoprim/sulfamethoxazole
  - Amoxicillin/clavulanate
  - Newer fluoroquinolones (levofloxacin, moxifloxacin, gatifloxacin)
- Pseudomonas and many other Gram-negative pathogens
  - Fluoroquinolones



# Wound infection

- Apply direct pressure to stop bleeding
- Examine wounds for devitalized tissue, and foreign bodies
- Irrigate wounds with saline solution
- Wounds that are not closed primarily because of high risk of infection should be considered for delayed primary closure
- Tetanus prophylaxis

# Animal and Insect Bites





# Management

- Irrigate wound
- Consider delayed primary closure
- Antivenum for poisonous snakes
- Tetanus prophylaxis
- Rabies prophylaxis for mammals bites
- ATB : staphylococci, streptococci  
gram negative rods, anaerobes



# Skin diseases during flood

- Infection
  - Fungal
  - Bacterial
- Inflammatory dermatosis
  - Eczema
  - Urticaria



โรคน้ำกัดเท้า (Hong Kong foot)



# Skin Diseases during Floods in Thailand

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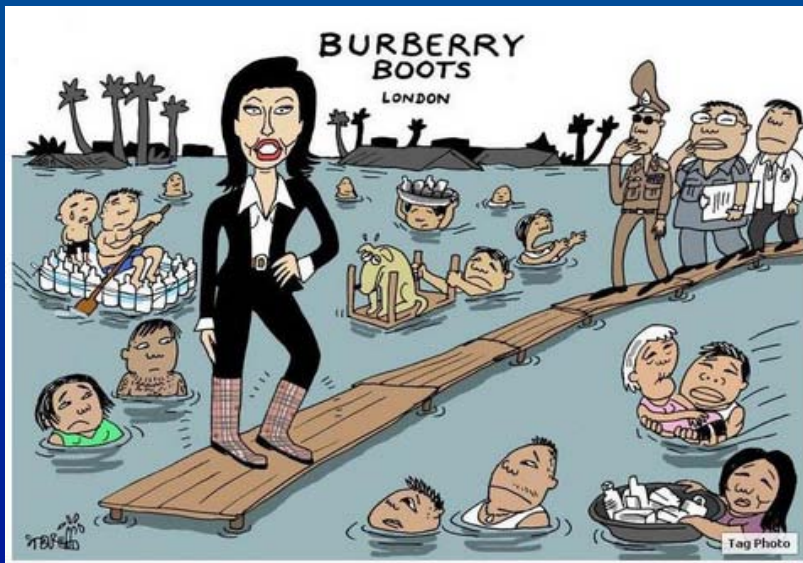
- 96 patients (38 males, 58 females)
- 16 present with itch and skin maceration at web spaces of toes
- Fungal C/S are positive in 2 specimens

*Conclusion: Eczema is the most common dermatosis during floods. Skin maceration at web space(s) of toes, which were thought to be fungal infection, are chronic irritant dermatitis with secondary bacterial colonization. Only a few cases were fungal infection. Microbiologic investigation should be done in these patients. Unfortunately, it is not practical in such a situation. Topical medications that have the combination of anti-inflammatory, antibacterial and antifungal properties are the most suitable medications.*



# General care

- ไม่ควรย่ำในน้ำสกปรก หากจำเป็นควรใส่อุปกรณ์ป้องกันหรืออาจทาขี้ผึ้งวาสลีนเคลือบบริเวณเท้าและง่ามเท้าก่อนไปย่ำน้ำ
- หลังย่ำน้ำสกปรกมาควรล้างเท้าด้วยสบู่และน้ำสะอาด ซับให้แห้ง





- ระยะแรกยังไม่มึเชื้รรา เป็นเพียงอาการระคายเคื้อง ควรใช้ยาทาสดื้ย รอยค้้อ่อนๆ เช่น 0.02% Triamcinolone cream ไม่ จำเป็นต้องใช้ยาม่าเชื้รรา เพราะยาเชื้รราบางชนิดจะทำให้เกิดอาการ ระคายเคื้องและเสบมากขึ้้น
- หากผิวนเปื้อยเป็นแผล อาจมีการติดเชื้ แบคทีเรีย จะทำให้เกิดอาการ อักเสบ บวมแดง เป็นหนองและปวด → การรับประทานยาปฏิชีวนะ ร่วมกับล้างแผลด้วยน้ำยาม่าเชื้



- หากปล่อยไว้นาน จะติดเชื้อรา ให้ใช้ขี้ผึ้งจัดเชื้อรา เช่น whitfield's ointment ซึ่งประกอบด้วย 3% salicylic acid+6%benzoic acid หรือครีมฆ่าเชื้อราอื่นๆ เช่น clotrimazole, ketoconazole, Tolnaftate ซึ่งอาจต้องทาต่อเนื่องเป็นเดือน



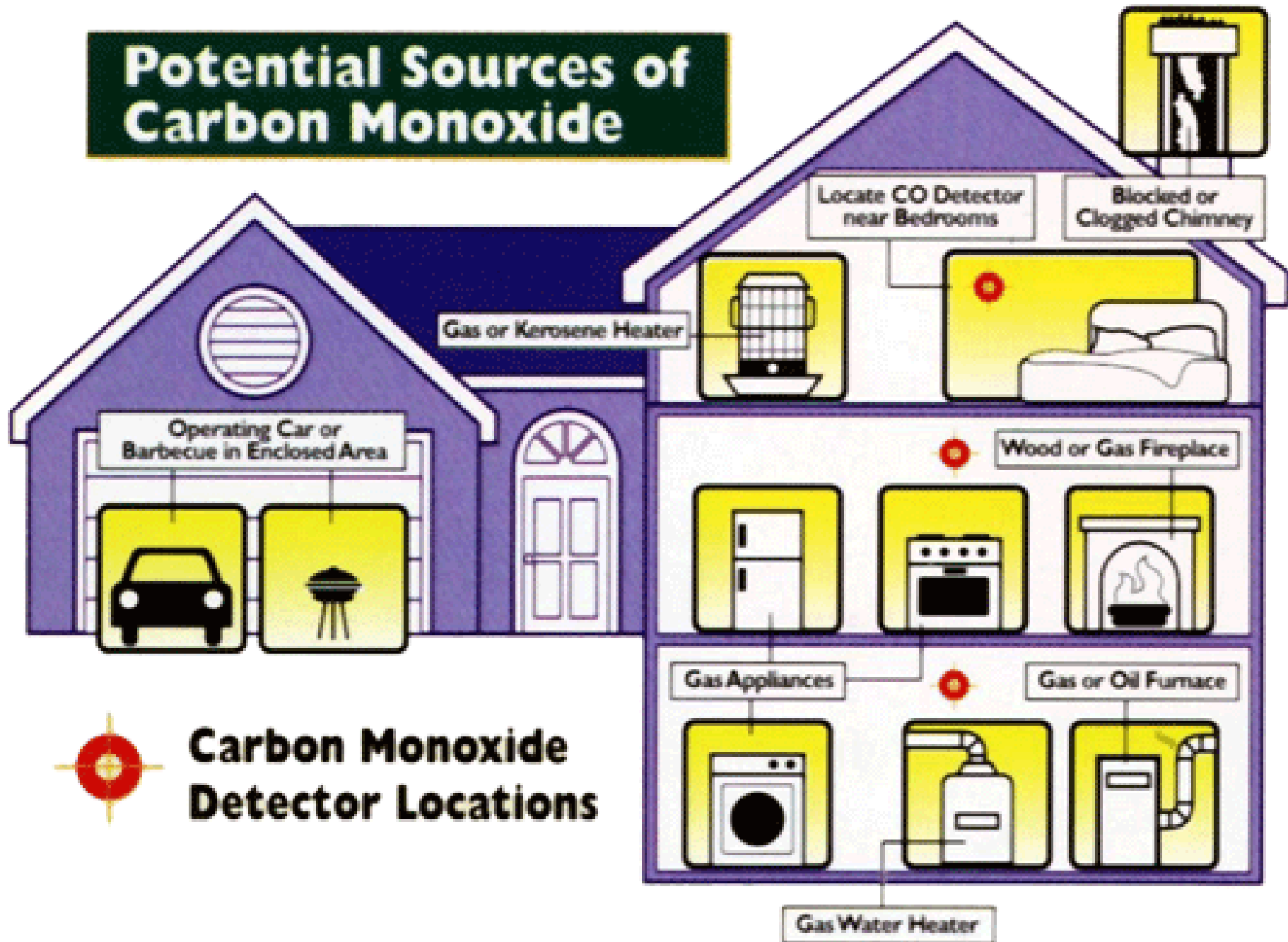
# CO poisoning

- Post-flood CO poisoning is a growing problem in developed countries.
- Found in combustion fumes generated by small gasoline engines, stoves, generators, lanterns, and gas ranges, or by burning charcoals and woods.



- Power outages following floods → alternative sources of fuels or electricity for heating, cooling, or cooking
- Enclosed or partly enclosed houses, garages or buildings without an adequate level of air ventilation

# Potential Sources of Carbon Monoxide





# Carbon monoxide

- Product of incomplete combustion of organic matter
- Colorless, odorless, tasteless, and initially non-irritating, it is very difficult to detect
- The affinity between Hb and CO is approximately 230 times stronger than oxygen



# Signs & Symptoms

Concentration	Symptoms
35 ppm (0.0035%)	Headache and dizziness within six to eight hours of constant exposure
100 ppm (0.01%)	Slight headache in two to three hours
200 ppm (0.02%)	Slight headache within two to three hours; loss of judgment
400 ppm (0.04%)	Frontal headache within one to two hours
800 ppm (0.08%)	Dizziness, nausea, and convulsions within 45 min; insensible within 2 hours
1,600 ppm (0.16%)	Headache, tachycardia, dizziness, and nausea within 20 min; death in less than 2 hours
3,200 ppm (0.32%)	Headache, dizziness and nausea in five to ten minutes. Death within 30 minutes.
6,400 ppm (0.64%)	Headache and dizziness in one to two minutes. Convulsions, respiratory arrest, and death in less than 20 minutes.
12,800 ppm (1.28%)	Unconsciousness after 2-3 breaths. Death in less than three minutes.



# Treatment

- Immediately remove the person from the exposure
- Life support
- Administering 100% oxygen
- HBO
- Treat complications : seizure, hypotension, cardiac abnormalities, pulmonary edema, and acidosis



Thank you

