

**DEPARTMENT OF HEALTH  
RESEARCH INSTITUTE FOR TROPICAL  
MEDICINE**



# **Curb the Chaos: Dealing with Infectious Diseases in the Aftermath of a Disaster**

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# Philippines: Disaster prone country

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- 2012 UN World Disaster report – Philippines is the 3<sup>rd</sup> most disaster prone country in the world, next to Tonga and Vanuatu
- Around 19 tropical cyclones or storms enter PAR in a typical year
  - 6 to 9 make landfall

# Philippines: Disaster prone country

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- More than 900 earthquakes annually
  - Only 106 (11%) earthquakes with a magnitude  $> 6$  since the 1600s
  - 2008 to 2015 - only three earthquakes were felt slightly in Metro Manila
  - January 2016 – 87 tremors recorded
    - 8/87 (9%) - magnitude of 5 or higher in the Richter Scale
- Only Palawan island has not been visited by destructive earthquakes



# Objectives

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- To discuss the most important infectious diseases which may arise after a disaster (floods, earthquakes) such as water-borne diseases, infections related to crowding, etc.
- To discuss practical interventions and prevention & control strategies which the pediatrician can utilize to prevent the spread of infections after a major disaster.

# Philippines was world's most disaster-hit country in 2011

By: Christine Ubalde, InterAksyon.com  
April 24, 2012 6:00 PM



*Floating survivors of typhoon Sendong*

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# Why is the Philippines prone to natural disasters?

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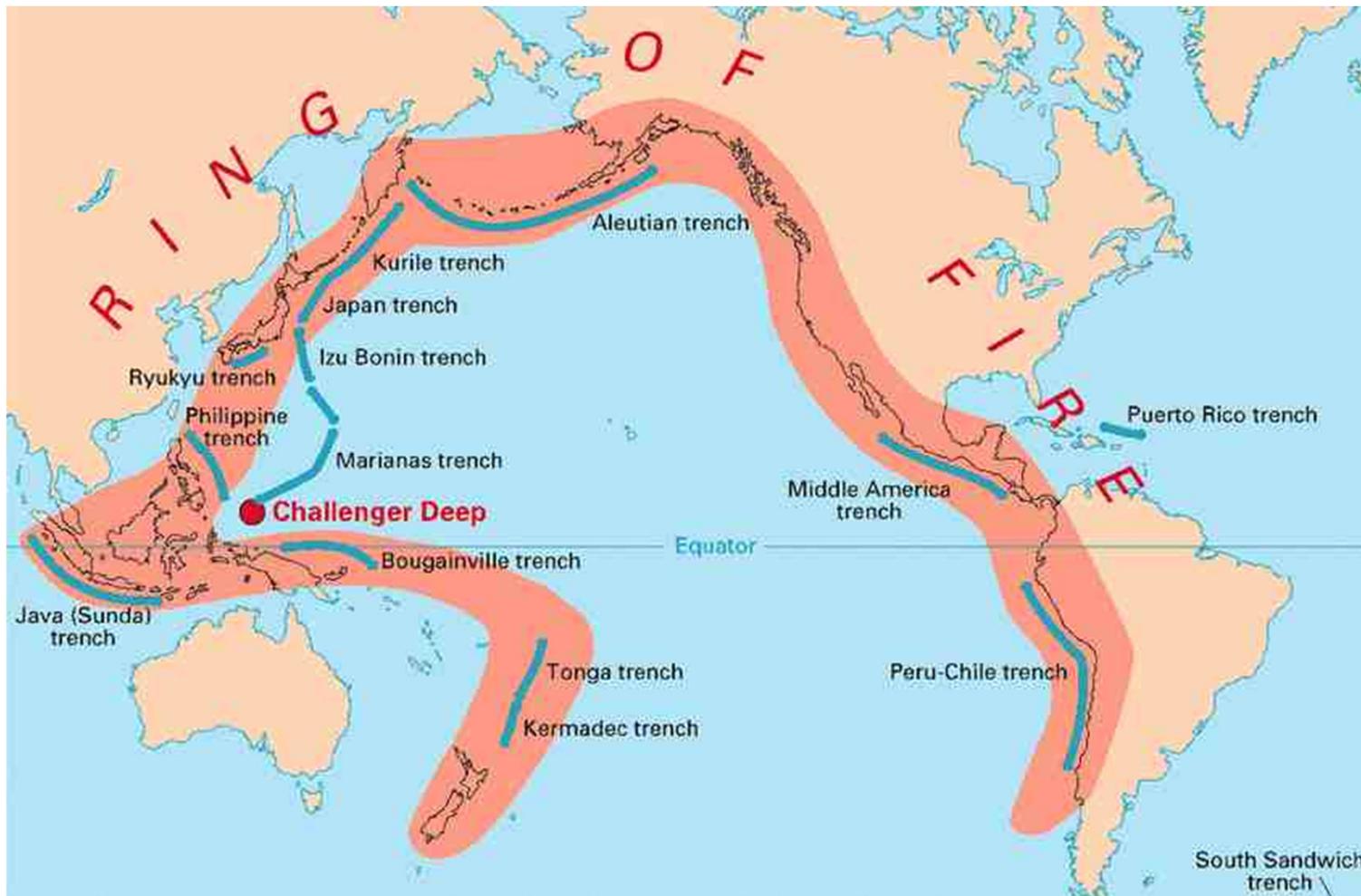
- Geography

- Island nation located in a part of the world that gets a lot of big tropical storms.
  - a rise in sea levels, extreme rainfall events, extreme heating events, increased ocean temperatures and a disturbed water budget
- Warm ocean waters – temperatures  $> 28^{\circ}\text{C}$  needed for typhoons to form. In the western Pacific, the waters normally above 28 degrees

National Geographic

- Geography

- Pacific Ring of fire - encompasses 452 volcanoes; home to > 75% of the world's volcanoes



# Why is the Philippines prone to natural disasters?



Deforestation

# Why is the Philippines prone to natural disasters?



- Developmental

- Lack of infrastructure needed to withstand disasters such as earthquake proof buildings
- Only 20% of the roads are paved
- Inadequate disaster preparedness system



National Geographic

# Top 5 Worst disasters



Disaster	Date	Casualty
Typhoon Yolanda (Haiyan)	Nov 8, 2013	6,300
1976 Mindanao earthquake	Aug 17, 1976	6,000
Typhoon Uring (Thelma)	Nov 5, 1991	5,956
1990 Luzon earthquake	July 16, 1990	2,412
Typhoon Pablo (Bopha)	Dec 4, 2012	1,901

Disaster	# affected
Typhoon Yolanda (Haiyan)	16,106,807
Typhoon Pablo (Bopha)	6,246,664
Typhoon Ondoy (Ketsana)	4,901,763
Typhoon Frank (Fengshen)	4,785,460
Typhoon Pepeng (Parma)	4,478,491







# Deaths from Disasters

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- Deaths associated with natural disasters, particularly rapid-onset disasters, are overwhelmingly due to blunt trauma, crush-related injuries, or drowning
- Deaths from communicable diseases after natural disasters are less common.

Watson et al, EID journal 2007



# SPEED reporting

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- Surveillance in **P**ost **E**xtrême **E**mergencies and **D**isaster
- An early warning system designed to monitor diseases, injuries and health trends that can be harnessed as a powerful tool by health emergency managers in getting vital information for appropriate and timely response during emergencies and disasters
- Syndromic reporting of 21 conditions

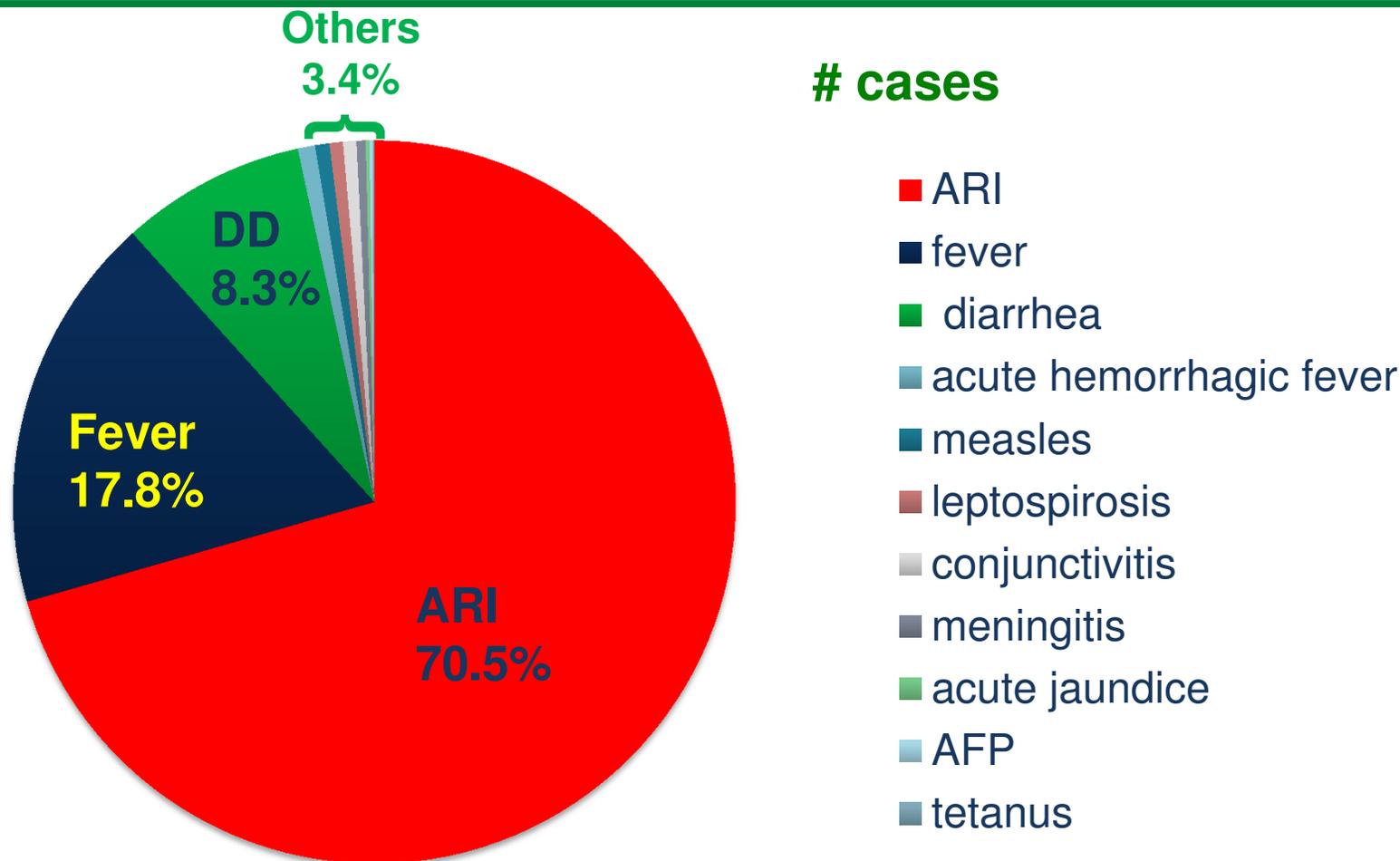
SPEED, Epidemiology Bureau, DOH

# SPEED YOLANDA



Totals for National from 11/08/2013 to 06/30/2014						
Disease	Under 5 Case	Under 5 Death	Over 5 Case	Over 5 Death	Total Consultations	Proportionate Morbidity
Difficulty in breathing and wheezing [AAA]	1,828	5	3,700	1	5,528	0.01
Loose stools with visible blood [ABD]	270	0	478	0	748	0.00
Paralysis of the limbs which occurred recently in a child < 15 years who is previously normal [AFP]	3	0	80	0	83	0.00
Fever with spontaneous bleeding (i.e. nose bleeding, gum bleeding) [AHF]	100	0	711	0	811	0.00
Yellow eyes or skin with or without fever [AJS]	33	1	283	1	316	0.00
Visible wasting, with or without bilateral pitting edema [AMN]	107	0	148	0	255	0.00
Animal bites [ANB]	1,101	3	5,451	4	6,552	0.02
Cough, colds or sore throat with or without fever [ARI]	61,820	1	88,010	31	149,830	0.34
Loose stools, 3 or more in the past 24 hrs with or without dehydration [AWD]	7,019	4	6,247	4	13,266	0.03
Eye itchiness, redness with or without discharge [CON]	354	4	1,146	0	1,500	0.00
Fever [FEV]	9,554	1	12,366	17	21,920	0.05
Fever with other symptoms not listed above [FOS]	1,127	1	4,474	8	5,601	0.01
Fractures [FRS]	86	0	875	0	961	0.00
High blood pressure ( $\geq 140/90$ ) [HBP]	36	6	21,398	22	21,434	0.05
Known Diabetes [KDM]	17	4	2,343	2	2,360	0.01
Fever with headache, muscle pains and any of the following: eye irritation, jaundice, skin rash, scanty urination [LEP]	60	1	471	1	531	0.00
Fever with rash [MEA]	746	1	788	0	1,534	0.00
In children >12mos: Fever with severe headache and stiff-neck / In children <12mos: Fever and bulging fontanels or refu [MEN]	109	0	1,391	0	1,500	0.00
Skin disease [SDS]	7,110	10	11,878	0	18,988	0.04
Spasms of neck and jaw (lock jaw) [TET]	4	0	118	1	122	0.00
Open Wounds and Bruises [WBS]	3,348	48	35,293	10	38,699	0.09
Total consultations in the health facility [TOT]	40,625	1	103,418	25	292,539	0.33

# Infectious diseases post typhoon



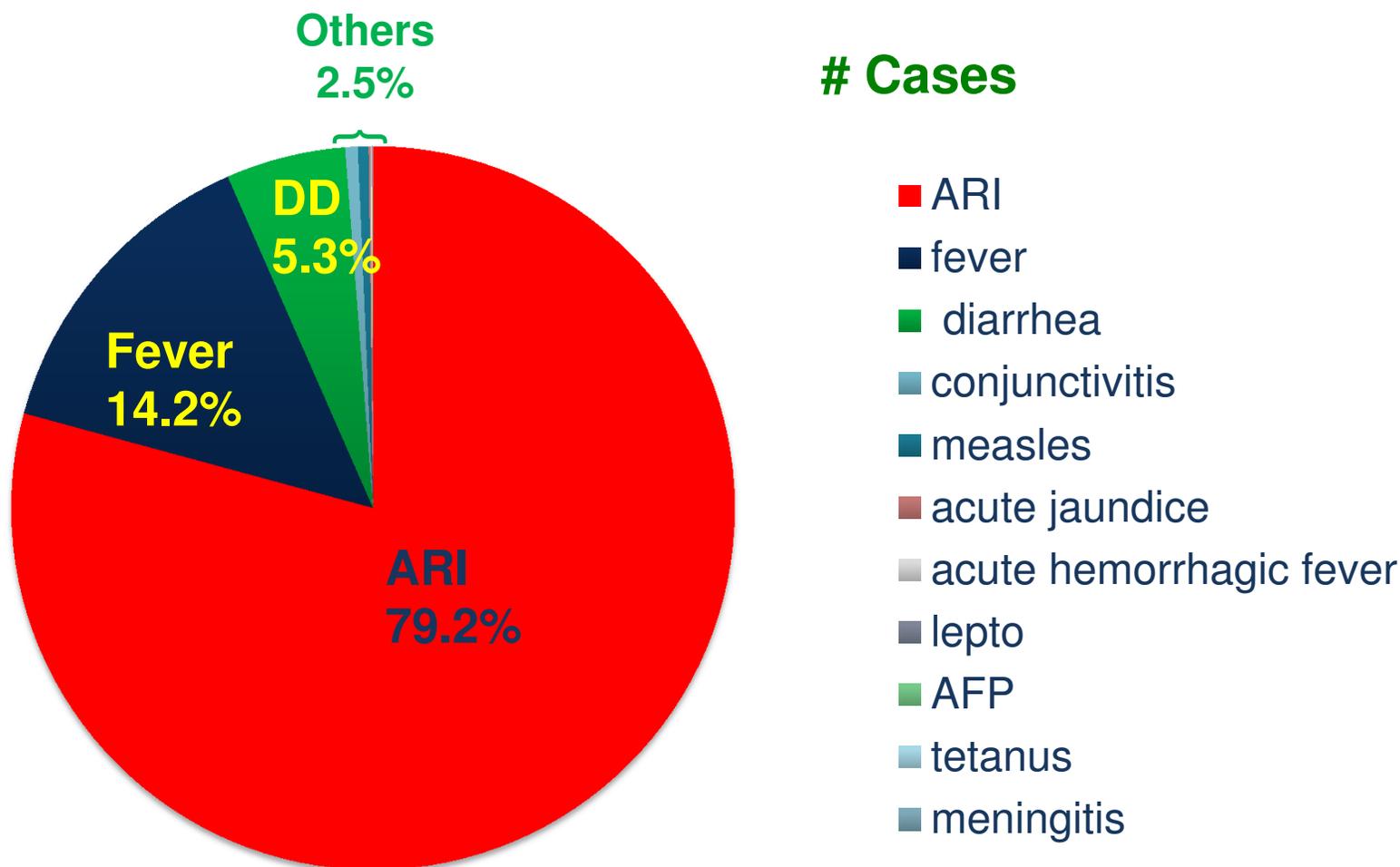
SPEED, Epidemiology Bureau, DOH

# SPEED BOHOL EARTHQUAKE



Totals for REGION VII (Central Visayas) from 10/15/2013 to 11/30/2014						
Disease	Under 5 Case	Under 5 Death	Over 5 Case	Over 5 Death	Total Consultations	Proportionate Morbidity
Difficulty in breathing and wheezing [AAA]	334	1	711	1	1,045	0.01
Loose stools with visible blood [ABD]	66	0	75	0	141	0.00
Paralysis of the limbs which occurred recently in a child < 15 years who is previously normal [AFP]	0	0	9	0	9	0.00
Fever with spontaneous bleeding (i.e. nose bleeding, gum bleeding) [AHF]	3	0	25	0	28	0.00
Yellow eyes or skin with or without fever [AJS]	6	0	30	0	36	0.00
Visible wasting, with or without bilateral pitting edema [AMN]	11	0	9	0	20	0.00
Animal bites [ANB]	94	0	413	0	507	0.01
Cough, colds or sore throat with or without fever [ARI]	15,165	0	22,222	0	37,387	0.42
Loose stools, 3 or more in the past 24 hrs with or without dehydration [AWD]	1,190	0	1,190	0	2,380	0.03
Eye itchiness, redness with or without discharge [CON]	73	0	193	0	266	0.00
Fever [FEV]	2,335	0	2,944	0	5,279	0.06
Fever with other symptoms not listed above [FOS]	242	0	1,182	3	1,424	0.02
Fractures [FRS]	21	0	218	1	239	0.00
High blood pressure ( $\geq 140/90$ ) [HBP]	1	0	5,392	3	5,393	0.06
Known Diabetes [KDM]	1	0	535	0	536	0.01
Fever with headache, muscle pains and any of the following: eye irritation, jaundice, skin rash, scanty urination [LEP]	2	0	8	0	10	0.00
Fever with rash [MEA]	54	0	172	0	226	0.00
In children >12mos: Fever with severe headache and stiff-neck / In children <12mos: Fever and bulging fontanels or refu [MEN]	2	0	1	0	3	0.00
Skin disease [SDS]	1,490	0	2,275	0	3,765	0.04
Spasms of neck and jaw (lock jaw) [TET]	0	0	6	0	6	0.00
Open Wounds and Bruises [WBS]	689	0	7,469	3	8,161	0.09
Total consultations in the health facility [TOT]	6,691	0	16,289	4	22,980	0.26

# Infectious diseases post earthquake



SPEED, Epidemiology Bureau, DOH



	<b>Typhoons</b>	<b>Earthquakes</b>
ARI	1	1
Fever	2	2
Acute watery diarrhea	3	3
Animal bite	4	5
Fever w/o Sx	5	4
Acute hemorrhagic fever	6	10
Measles	7	7
Leptospirosis	8	11
Conjunctivitis	9	6
Acute bloody diarrhea	10	8
Acute jaundice	11	9

SPEED, Epidemiology Bureau, DOH



# Risk factors for outbreaks post disaster

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- Natural disasters (regardless of type) that do not result in population displacement are rarely associated with outbreaks
- Population displacement – risk of outbreaks dependent on:
  - availability of safe water and sanitation facilities
  - degree of crowding
  - underlying health status of the population including level of immunity to vaccine preventable diseases
  - availability of healthcare services

Watson et al, EID journal 2007



# Risk factors for outbreaks post disaster

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- Change in environment
  - Changes result in introduction of new pathogens or already present pathogens get an increased opportunity to infect humans
  - E.g. While initial flooding may wash away existing mosquito- breeding sites, standing water caused by heavy rainfall or overflow of rivers can create new breeding sites

Muneer et al, Disaster Recovery Journal , 2014  
Saenz et al, Pre-hospital and Disaster Medicine 1995





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# ID associated with natural disasters

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- Human remains
- Water related
  - Diarrheal disease
  - Hepatitis A/E
  - Leptospirosis
- Crowding
  - Measles
  - Meningococccemia
- Vector-borne
  - Dengue
  - Malaria

Watson et al, EID journal 2007

# ID resulting from contamination associated with Human Remains

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- Human remains may contain blood-borne viruses/bacteria
- Do not pose a risk to the public, nor cause significant environmental contamination
- No additional practices/precautions for exposure to flood water containing human remains beyond what is normally required for safe food and drinking water, standard hygiene and first aid

# ID resulting from contamination associated with Dead bodies

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- For people who must directly handle remains, there may be a risk of exposure to bacteria or viruses
- Precautions in handling human remains
  - Use PPE – mask/face shield, gloves
  - Hand hygiene
  - Give prompt care to any wounds sustained during work with human remains



# Water related: Diarrheal disease

- Philippines – 3<sup>rd</sup> most common cause of morbidity
- Aceh, Indonesia (Dec 2004 tsunami)
  - 100% of survivors drank from unprotected wells; 85% of residents reported diarrhea in the previous 2 wks
- Muzaffarabad, Pakistan (2005 earthquake)
  - Outbreak of diarrhea with > 750 cases in a poorly equipped camp housing 1800 persons
- Haiti (earthquake)
  - Cholera epidemic n= 4722; 303 deaths (MR – 6.4%)
- USA (Hurricane Katrina and Allyson)
  - Diarrhea due to norovirus, vibrio, salmonella noted among evacuees

Watson, EID 2007; Ligon B. PIDJ 2006;  
Isidore et al, United Nations University, 2013

# Water related: Hepatitis A/E Virus infection

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- Fecal-oral route
- Pakistan (2005 earthquake)
  - 1200 cases of jaundice, many confirmed as Hep E
- Aceh Indonesia (Dec 2004 tsunami)
  - Clusters of hepatitis A and E
- Philippines
  - Typhoon Yolanda (national) - 316 cases of acute jaundice
  - Habagat (national) – 337 cases
  - Typhoon Pablo (Davao) – 68 cases

Watson et al, EID journal 2007  
SPEED, EB, DOH



# Water related: Leptospirosis

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- Direct contact with water, damp soil, mud or vegetation contaminated with rodent urine
- Flooding facilitates spread of organism because of proliferation of rodents
- Outbreaks occurred in Taiwan (2001); India (2000); Argentina (1998), Brazil (1996)
- Philippines
  - Yolanda – 531, Habagat – 1447, Pablo – 562; Bohol earthquake – 10
  - Leptospirosis more common after disasters resulting in flooding (typhoons > earthquakes)

Watson et al, EID journal 2007  
SPEED, EB, DOH



# Crowding: Measles

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- Dependent on baseline immunization coverage
- Pakistan (2005 earthquake) - > 400 clinical cases
- Philippines
  - Mt. Pinatubo eruption, 1991 - >18,000 cases
  - Typhoon Yolanda, 2013 – 1534 cases
  - Habagat, 2012 – 1036 cases
  - Bohol earthquake, 2013 – 226 cases
  - Typhoon Pablo, 2012 – 124 cases

Watson et al, EID journal 2007  
SPEED, EB, DOH



# Crowding: Meningitis

- Documented in populations displaced by conflict more than post-disaster
- Syndromic reporting of meningitis post-disaster, no lab confirmation
  - Fever with severe headache and stiff neck/ fever with bulging fontanel

Disaster	Year	# cases
Typhoon Yolanda	11-8-13 to 6-30-14	1500
Typhoon Pablo	12-3-12 to 5-31-13	69
Habagat	8-8-12 to 1-31-13	141

Watson et al, EID journal 2007  
SPEED, EB, DOH



# Vector borne diseases: Malaria

- Costa Rica (1991 earthquake)
  - increase in the malaria IR of 1,600% and 4,700% above the average monthly rate for the pre-earthquake period
  - changes in human behavior (increased exposure to mosquitoes while sleeping outside, and a temporary pause in malaria control activities), changes in the habitat that were beneficial to mosquito breeding (landslide deforestation, river damming, and rerouting), and the floods
  - Hampered implementation of malaria control program (surveillance, Tx, vector control)
- Malaria not included in SPEED

Watson et al, EID journal 2007

Saenz et al, Pre-hospital and Disaster Medicine 1995



# Vector borne diseases: Dengue

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## Typhoon Yolanda

- Control Measures
  - Surveillance, Dx and clinical management, vector control, mosquito surveys
- Results
  - 2013 - 3254
    - Nov 8 to Dec 31, 2013 – 164 cases
  - 2014 - 5227 cases (61% increase compared to 2013), 20 deaths (CFR 0.4%)
    - Epidemic threshold exceeded in Jan 2014
    - 79% positive by dengue RDT

Aumentado, WPSAR 2015



# Tetanus

- Disaster does not increase the risk for tetanus
- Associated with contaminated wounds, especially in populations where vaccination coverage is low
- Aceh, Indonesia (Dec 2004 tsunami)
  - Cluster of 96 cases with 20 deaths; peaked 2 ½ weeks after the tsunami

Disaster	# open wounds	# tetanus cases/%
Typhoon Yolanda	38,699	122 (0.31%)
Typhoon Pablo	9,044	15 (0.16%)
Habagat	16,410	210 (1.3%)

Sapir et al, Pre-hospital and Disaster Medicine, 2009  
SPEED, EB, DOH

# Animal bites



## Animals + Disaster = Biting

- USA (Hurricane Ike, 2008)
  - Top three trauma complaint seen at the National Disaster Medical System (NDMS) Disaster Medical Assistance Team (DMAT) base of operations
  - Most of the bites were severe and occurred within the first 72 hours after the hurricane
  - 55% were from dogs, 40% cats and 5% snakes
  - 80% were bitten by their own dog or cat
- Philippines – animal bite among top 5 causes of consultation post-disaster

Warner et al, Pre-hospital and Disaster Medicine, 2010  
SPEED, EB, DOH

# What can we do



# Immunization

- Prior to disaster
  - Complete all required immunizations



Rotavirus  
PCV  
MCV

# Post-exposure Immunization



- Measles

- Measles vaccine within 72 hours of exposure
- Ig – 0.25 ml/kg IM (0.5 ml/kg IM for IC host) within 6 days of exposure (temporary protection)
  - Susceptible contacts < 1 y/o, pregnant women, IC people
- Laboratory confirmation, esp for 1<sup>st</sup> case
- Outbreak situation
  - MMR for all exposed people or those who lack evidence of immunity
  - If given < 12 months, should not be counted towards 2 dose series

# Tetanus



HX of TT immunization	Clean, minor wounds		All other wounds*	
	DTaP, Tdap, Td, TT	TIG	DTaP, Tdap, Td, TT	TIG
< 3 doses	Yes	No	Yes	Yes
≥ 3 doses	No if < 10 yrs since last dose	No	No if < 5 yrs since last dose	No
	Yes if ≥ 10 yrs since last dose	No	Yes if ≥ 5 yrs since last dose	No

\* Wounds contaminated with dirt, feces, soil, saliva; puncture wounds; avulsions; wounds resulting from missiles, crushing burns, frostbite



# Varicella

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If without evidence of immunity

- Varicella vaccine - within 3-5 days after exposure may prevent or modify disease
  - 2<sup>nd</sup> dose should be given at age appropriate interval
- VZIg – 10 days after exposure
  - IC host, pregnant, preterm infants, newborns
  - Residing in same HH, face to face indoor play, adjacent beds in ward
- Acyclovir prophylaxis – beginning 7 days after exposure



# Water-borne Diseases

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- Chlorination of water
  - Free chlorine generally inactivates >99.99% of enteric bacteria and viruses
- General Infection Prevention and Control measures
  - Good personal hygiene
    - Avoid sharing personal items such as eating/drinking utensils, toothbrushes, and towels, especially with ill persons
  - Hand washing
  - Maintain clean living environment
  - Bathing/Laundry facilities
  - Safe food preparation techniques
- Hepatitis A mass vaccination – not recommended



# Diarrheal Diseases

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- Prevent dehydration
  - Oral rehydration
  - Breastfeeding
- Routine laboratory Dx not recommended
- Use of antimicrobials
  - not usually indicated; acute diarrhea is usually self-limited and their duration is not shortened by the use of antimicrobial agents.
  - Exceptions:
    - Suspicion of sepsis; outbreak of shigellosis, cryptosporidiosis or giardiasis; special needs (IC, preterms)

# Leptospirosis

Prevention includes the following:

1. Do not wade or swim in flood waters.
2. If exposure to flood waters is unavoidable, use protective gear (boots, goggles, overalls, and rubber gloves)



PIDSP Post Disaster Interim Advice, 2012

# Leptospirosis

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Prevention includes the following:

3. All food and drinking water should be protected against contamination.
4. Boil drinking water for at least 10-15 minutes. Physical filtration through ceramic or charcoal filters is not adequate for leptospirosis.
5. Protect food against rodent attack or contamination.
6. Antibiotic prophylaxis if children are exposed to flood waters

PIDSP Post Disaster Interim Advice, 2012



# Prophylaxis for Leptospirosis

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The following antibiotics are recommended

- Drug of choice: **Doxycycline** 4 mg/kg SD, max 200 mg
  - Proven efficacy for preventing clinical disease
- Alternative drugs
  - Azithromycin 10 mg/kg SD, max 500 mg
    - Efficacy for prevention seen in vitro and in animal models
  - Amoxicillin 50 mg qd for 3-5 days, max 500 mg q 6h
    - No trials for prevention but is a known alternative for Tx

PIDSP Post Disaster Interim Advice, 2012



# Prophylaxis for Leptospirosis

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- Given 1–2 days before and continuing through the period of exposure for people at high risk
- If exposed significantly for >7 days, repeat the dose after 1 week
- Monitor all those exposed for the occurrence of Sx since antibiotics are NOT 100% effective

PIDSP Post Disaster Interim Advice, 2012

# Prophylaxis for Leptospirosis



Risk	Exposure to flood/contaminated waters	Cuts/wounds	Drug
<b>LOW</b>	Single Hx	Absent	Doxycycline 2 capsules single dose within 24 to 72 hours
<b>MODERATE</b>	Single Hx	Present	Doxycycline 2 capsules OD for 3-5 days to be started within 24 to 72 hours from exposure
<b>HIGH</b>	Continuous exposure (> single exposure OR residing/rescuers in flooded areas OR swimming in flood waters OR ingestion of contaminated water	Present or absent	Doxycycline 2 capsules once weekly until the end of exposure



# Malaria

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- Insecticides
  - indoor residual spraying
  - retreatment/distribution of (insecticide treated nets (ITN)
- Early detection
  - track weekly case numbers
  - laboratory-based diagnosis
- Free medical care
  - artemisinin-based combination therapy
  - active search for fever cases



# Animal bites

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- Rabies- PEP depending on category of exposure
  - Category II – rabies vaccine
  - Category III – rabies vaccine and RIG
  - If previously immunized - boosters
- Pre-exposure Prophylaxis
  - Schedule – day 0, 7 and 28
  - In case of re-exposure, give booster doses on days 0 and 3



# Tips to Prevent Animal bites

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- Do not disturb or frighten a dog, particularly when it is eating or tied up
- Keep away from a dog when it is angry or scared
- Don't move if a dog approaches you
  - Stand still like a tree
  - If you fall over, curl up and stay as still and heavy as a rock
- Approach a dog slowly and quietly.
  - Ask owner permission to touch
- Do not make eye-to-eye contact with a dog

# Preparedness



- **Emergency kit**

- 3 day supply of water (1 gal/person/day) and food (canned goods, dry pasta, powdered milk etc)
- Health supplies – 3 days supply of medicines, medical supplies
- Personal care items – soap, toothbrush/toothpaste etc
- Safety supplies – first aid kit, blanket, whistle, multipurpose tool
- Electronics - flashlight, battery operated radio, cellphone with chargers, extra batteries
- Documents – family emergency plan
- Extra cash, maps of the area, extra set of car/house keys
- Baby supplies
- Keep contents of kit fresh – check expiration dates
- Place contents in easy to carry container (e.g. back packs)

# Preparedness



- Find out where your gas, electric, and water shut-off locations are, and how to turn them off
- Make a plan
  - How to contact each other
  - Meeting point
- Be informed
  - Find out how to get local emergency alerts
  - Learn about the community's warning signals
  - Tune in
  - National Preparedness plan



# Summary

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- Risk factors for outbreaks of ID post disaster include displacement and change in environment
- ARI, fever and diarrheal diseases most common
- Prevention
  - Infection control in evacuation sites
  - Immunization
  - Prophylaxis - leptospirosis
  - Preparedness plan



# Acknowledgement

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- Epidemiology Bureau, DOH
- Surveillance and Response Unit, RITM
- Health Emergency Management Unit, RITM



**Thank you**

# Management of Persons with ID in Evacuation Centers

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- Food service
  - Do not allow self-service buffets
  - Serve food in individual portions rather than shared “family-style”
  - Monitor food handlers for illness

# Management of Persons with ID in Evacuation Centers

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- Screening of new arrivals
  - Fever, cough, skin rash or sores, open wounds, vomiting, diarrhea
  - Persons with any of the above conditions should be admitted to the evacuation center only after appropriate medical evaluation and care
- If develop illness while in evacuation area
  - Transfer to separate area for sick individuals
  - HCW should use appropriate PPE
  - Monitor cases
  - Refer as needed

# Management of Diarrheal Disease at Evacuation center



Refer infants and toddlers for medical evaluation if any of the ff are present:

- Young age (e.g., aged <6 months) or weight <18 lbs
- Premature birth, Hx of chronic medical conditions or concurrent illness
- Fever >38 °C (infants <3 mos) or >39 °C (for children 3–36 mos)
- Visible blood in stool
- High output diarrhea
- Persistent vomiting
- Hx of signs consistent with dehydration
- Change in mental status (e.g., irritability, apathy, or lethargy)
- Suboptimal response to oral rehydration therapy already administered or inability of the caregiver to administer oral rehydration therapy