The Continued Threat of Infectious Diseases to the U.S. Military

PRESENTED BY:

Stephen Thomas, M.D.

Chief of Infectious Disease, SUNY Upstate Medical

MODERATED BY:

Steve Redifer

2021-01-15

Homeland Defense & Security Information Analysis Center

HDIAC is sponsored by the Defense Technical Information Center (DTIC). Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the Defense Technical Information Center. DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

info@hdiac.org
https://www.hdiac.org

UPSTATE
MEDICAL UNIVERSITY
State University of New York

Infectious Disease Threats to the US Military

Stephen J. Thomas, MD
Division of Infectious Diseases
Institute for Global Health and Translational Sciences
State University of New York Upstate Medical University

JAN 2021

Disclosures

- Active Consulting / Advisory Boards
  - Sanofi Pasteur
  - Pfizer
  - Takeda
  - Merck
  - PrimeVax
- Safety Board
  - Takeda
  - Moderna

Upstate Medical University, Syracuse, NY

Outline

- Historical Perspective on Infectious Diseases Emergence
- Drivers of Emerging Infectious Diseases

- Specific Infectious Disease Threat to the US Military

Infectious Diseases - Historical Perspective

Painting showing the plague in Constantinople. (Credit: Walters Art Museum)

Plague of Justinian 541 A.D. - 100M

Scene of the plague in Florence. (Credit: DeAgostini/Getty Images)

The Black Death 1346 - 50M

U.S. Army Camp Hospital No. 45, Aix-Les-Bains, France, Influenza Ward No. 1. c.1918

Influenza 1918 – 50M

6th Cholera Outbreak
1899 - 1.5M

The Origins of Emerging Infections

- Domestication of livestock (10,000-15,000 years ago)
  - Facilitated cross-species transmission (zoonotic)
  - Encouraged settlement living

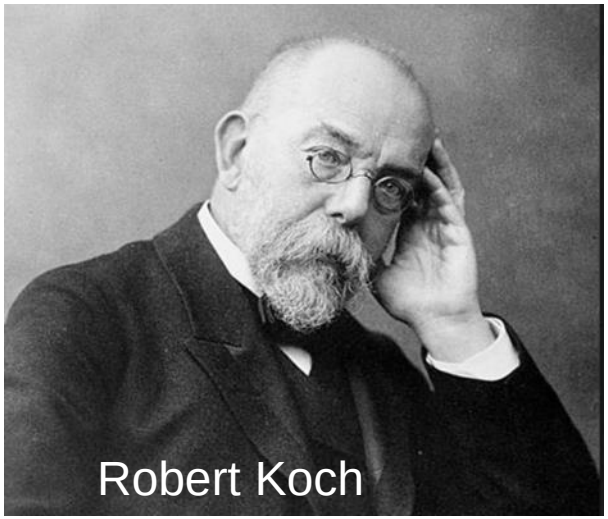
- Settlements became cities
  - Packed w/ susceptible people
  - Required civil services

Christopher Columbus

- Migration, trade, exploration, conquest
  - Transported pathogens
  - Introduced pathogens to new susceptible people

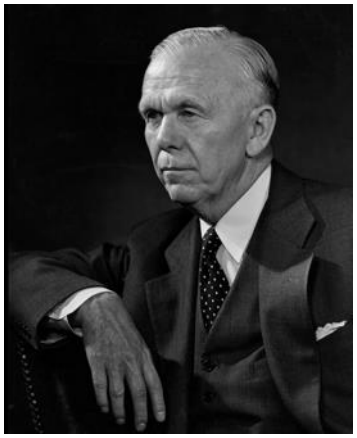
Advancing Our Understanding

- 19th- 20th century advances reduced infection risk
  - Sanitation / Food handling / Pasteurization
  - Germ theory / Penicillin / Vaccines


Robert Koch

- Vision of the ‘eradicationist’ emerges
  - Natural selection drives decline in organism virulence
  - Paradigm of commensalism and equilibrium w/ host

Advancing Our Confidence



1948: George Marshall (US SECSTATE)
- world has the means to eradicate infectious diseases

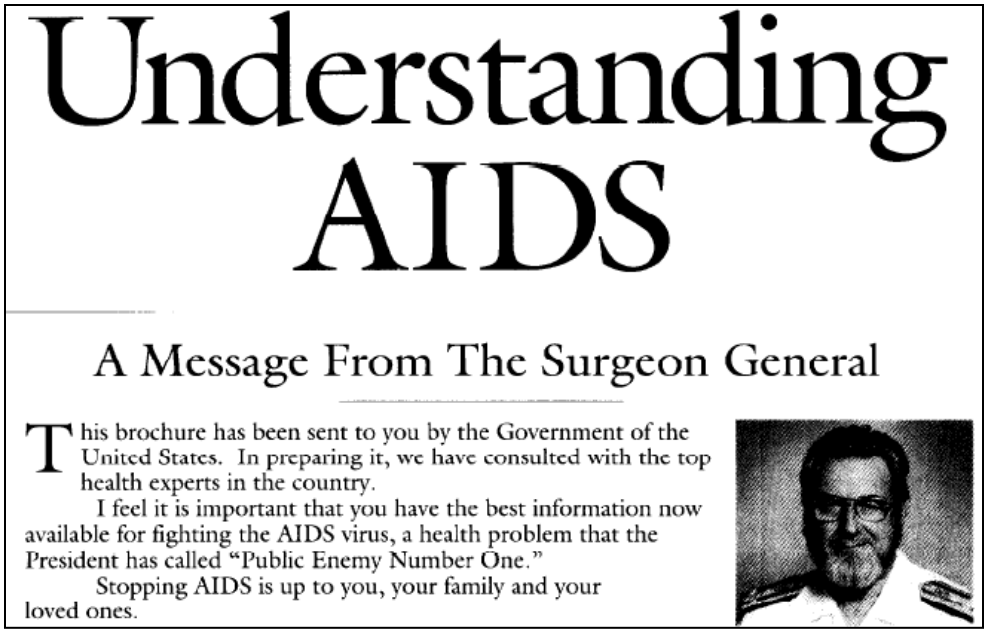
1955: Paul Russell (Rockefeller Foundation)
– *Man's Mastery of Malaria*

FIGURE 43.—Col. Paul F. Russell, MC.

1969: William Stewart (US Surgeon General)
'close the book on infectious diseases'

HIV Required Us to Re-Focus

- 1981: HIV/AIDS recognized as new disease entity
- 1983: Peter Piot warns AIDS in Africa is heterosexual dz.
- 1988: US Surgeon General's mass communication



Understanding AIDS

A Message From The Surgeon General

This brochure has been sent to you by the Government of the United States. In preparing it, we have consulted with the top health experts in the country.

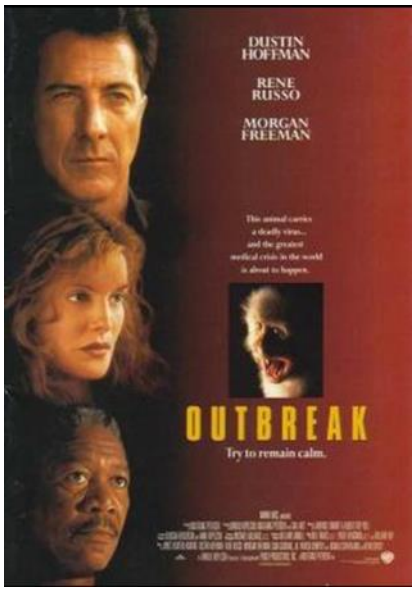
I feel it is important that you have the best information now available for fighting the AIDS virus, a health problem that the President has called "Public Enemy Number One."

Stopping AIDS is up to you, your family and your loved ones.

Interest in Infectious Diseases Returns

- 1992: National Academy of Sciences Institute of Medicine
  - *Emerging Infections: Microbial Threats to Health*
- 1994: US Centers for Disease Control and Prevention
  - Founded *Emerging Infectious Diseases* journal
- 1996: US President Bill Clinton
  - '[infectious diseases] one of the most significant health and ***security challenges*** facing the global community'

Ebola Outbreak – 1995 - Kikwit

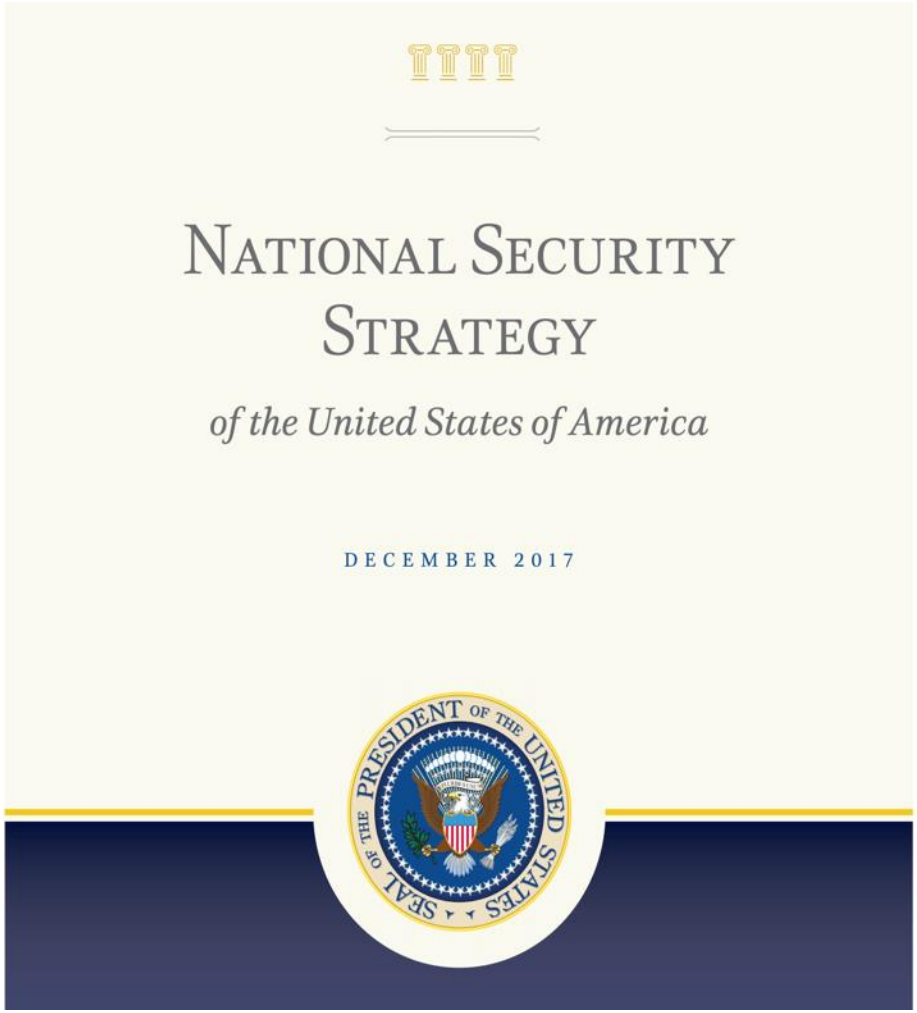


Released 10/1995

Look to the Past to Understand the Future

Joshua Lederberg, PhD

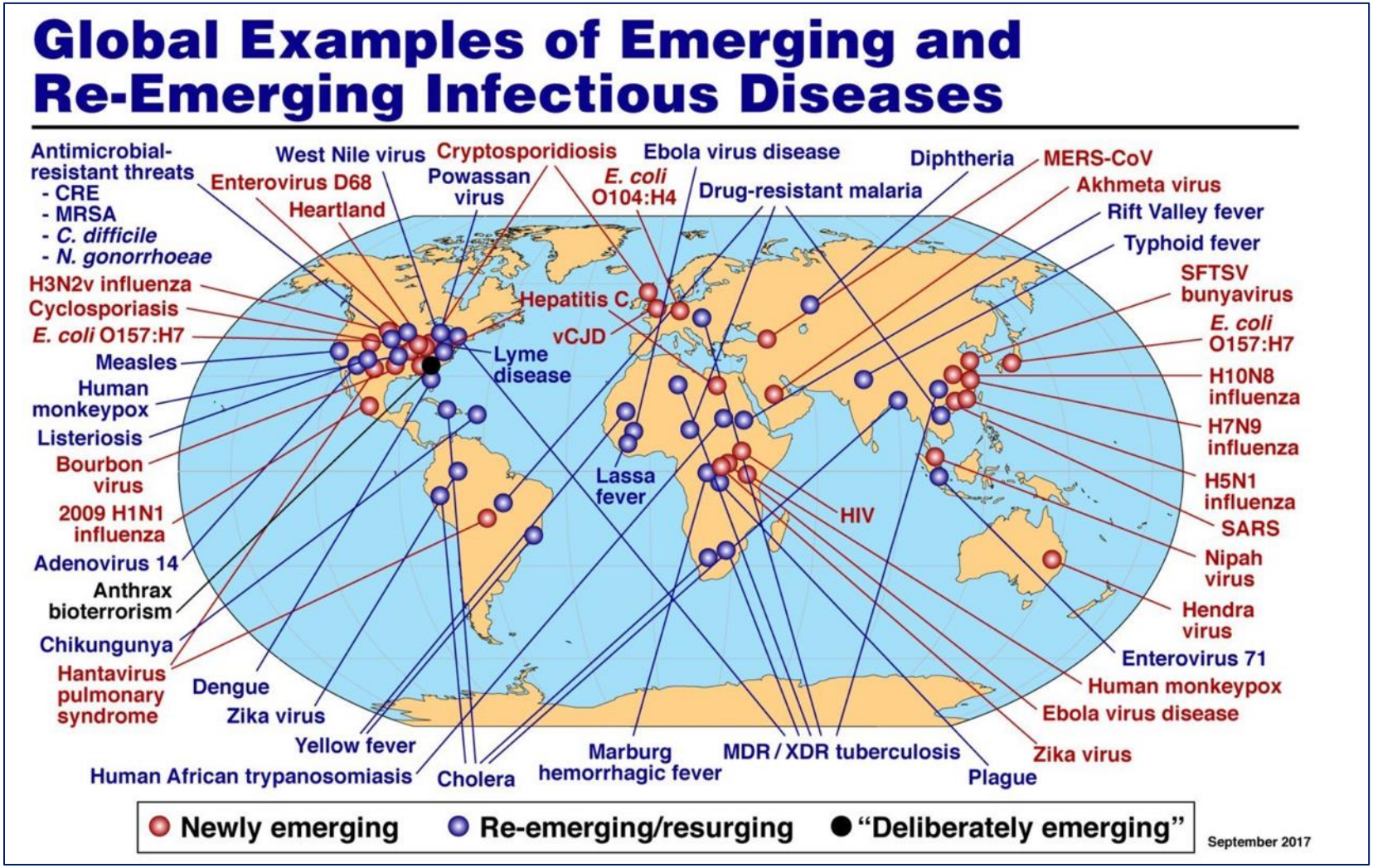
'[communicable diseases] remain the major cause of death worldwide and ***will not be conquered during our lifetimes*** *. . . We can also be confident that* ***new diseases will emerge****, although it is impossible to predict their individual emergence in time and place'*



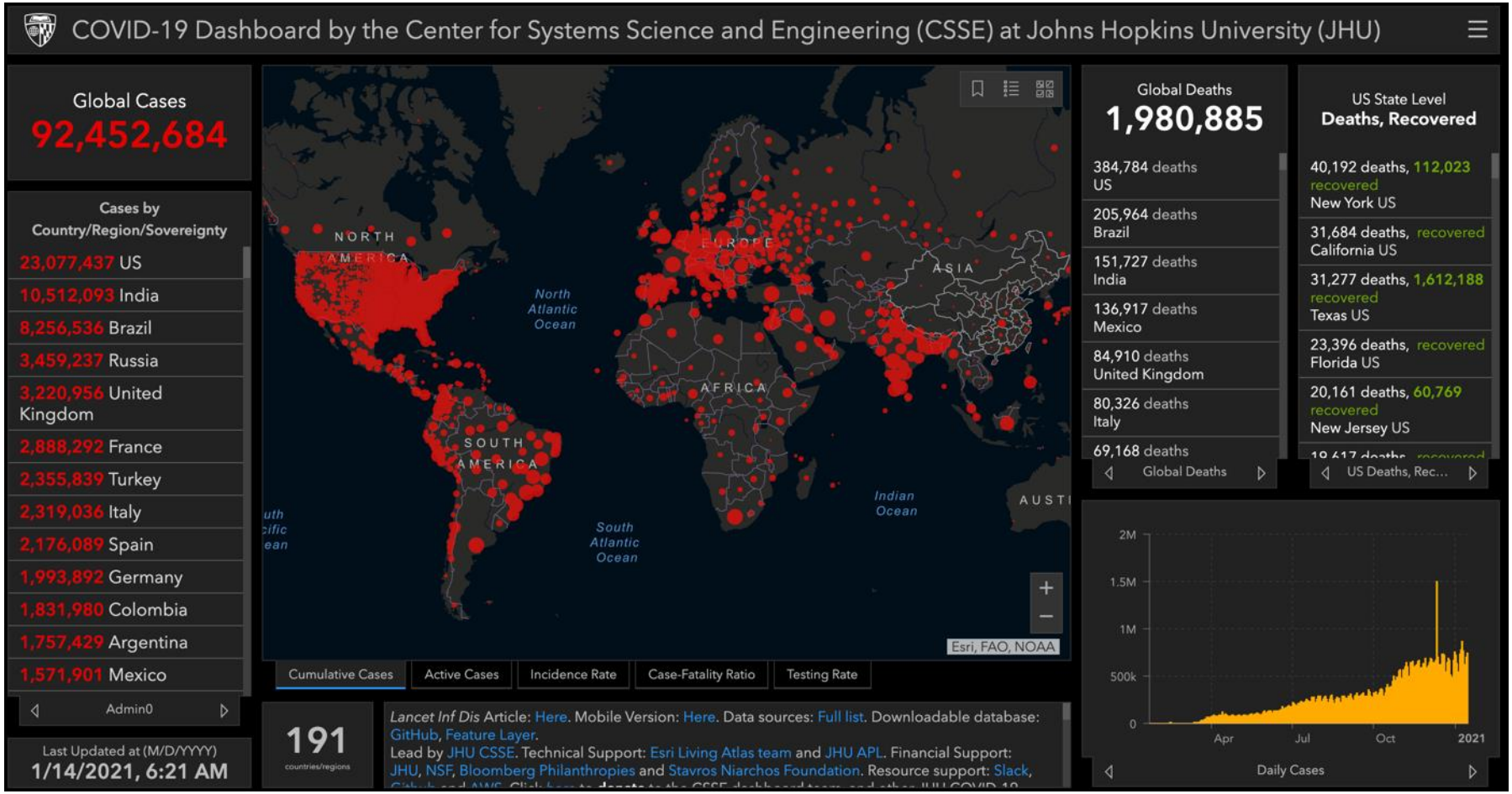
DETECT AND CONTAIN BIOTHREATS AT THEIR SOURCE:

- *We will work with other countries to detect and mitigate outbreaks early to prevent the spread of disease.*
- *We will encourage other countries to invest in basic health care systems and to strengthen global health security across the intersection of human and animal health to prevent infectious disease outbreaks.*
- *And we will work with partners to ensure that laboratories that handle dangerous pathogens have in place safety and security measures.*

What is the Global ID Threat Today



SARS-CoV-2 and COVID



What is Driving the ID Threat

Poverty in Malawi fuels deforestation

Ebola-hit DRC faces 'perfect storm' as uptick in violence halts WHO operation

WHO/Twitter A WHO team in the Democratic Republic of the Congo in response to ebola outbreak.

Emerging infections: a perpetual challenge

David M Morens, Gregory K Folkers, Anthony S Fauci

www.thelancet.com/infection Vol 8 November 2008

Panel: **Factors involved in infectious disease emergence[4-6]**

Often differing for newly emerging, re-emerging, and deliberately emerging diseases, these selected factors include genetic, biological, social, political, and economic determinants

1 International trade and commerce
2 Human demographics and behaviour
3 Human susceptibility to infection
4 Poverty and social inequality
5 War and famine
6 Breakdown of public-health measures
7 Technology and industry
8 Changing ecosystems
9 Climate and weather
10 Intent to harm
11 Lack of political will
12 Microbial adaptation and change
13 Economic development and land use

Infectious Diseases and the US Military

MAJ Walter Reed

REPORT

The U.S. Department of Defense and Global Health: Infectious Disease Efforts

October 2013

BOX 2. DOD EFFORTS RELATED TO GLOBAL HEALTH ADDRESS A RANGE OF INFECTIOUS DISEASES[10]

Bacterial Infections
- Campylobacter jejuni
- Cholera
- Enterotoxigenic Escherichia coli (ETEC)
- Leptospirosis
- Murine typhus
- Q Fever
- Salmonella
- Scrub typhus
- Shigella
- Tuberculosis

Parasitic Infections
- Cryptosporidia
- Cyclospora
- Leishmaniasis
- Malaria

Viral Infections
- Chikungunya
- Dengue
- Hepatitis A & E (Viral Hepatitis)
- HIV/AIDS
- Influenza
- Japanese encephalitis
- Noroviruses
- Yellow Fever

The broader classes of:
- Antimicrobial resistant organisms
- Enteric diseases (diarrheal diseases, gastrointestinal infections)
- Febrile and vector-borne infections
- Respiratory infections
- Rickettsial diseases
- Sexually-transmitted infections

NOTES: Some of these groupings overlap.

Yellow fever

Malaria

Enteric diseases

Mortality Surveillance for Infectious Diseases in the U.S. Department of Defense (1998–2013)

TABLE I. Deaths Resulting From Infectious Agents, Active Duty U.S. Military Personnel, 1998–2013

Disease Category	Total Deaths	Agent Found (%)	Primary Cause of Death, Agent Found (Number of Cases)
Respiratory	64	38 (59.4)	Pneumonia (36), Other (2) (Table III)
Acute Respiratory Distress Syndrome (ARDS)	3	0 (0.0)	Diffuse Alveolar Damage (ARDS)
Myocarditis/Pericarditis	39	2 (5.1)	Adenovirus (1), Fungal (1)
Blood Borne	33	33 (100.0)	Hepatitis C (15) and B (11), HIV (6), Herpes Simplex Virus (1)
Central Nervous System (CNS) Disease	28	21 (75.0)	Meningitis (13), Encephalitis (6), Rabies (2) (Table IV)
Septicemia	27	24 (88.9)	Sepsis (20), Toxic Shock Syndrome (4)
Vector Borne	8	8 (100.0)	*Hantavirus* (3), *Ehrlichia* (2), Malaria (2), Crimean-Congo Hemorrhagic Fever (1)
Other Infections	15	14 (93.3)	Brain Abscess (4), Epstein-Barr Virus (4), *Coccidioides immitis* (3), *Taenia solium* (2), Aortic Abscess (1)
Total	217	140 (64.5)	

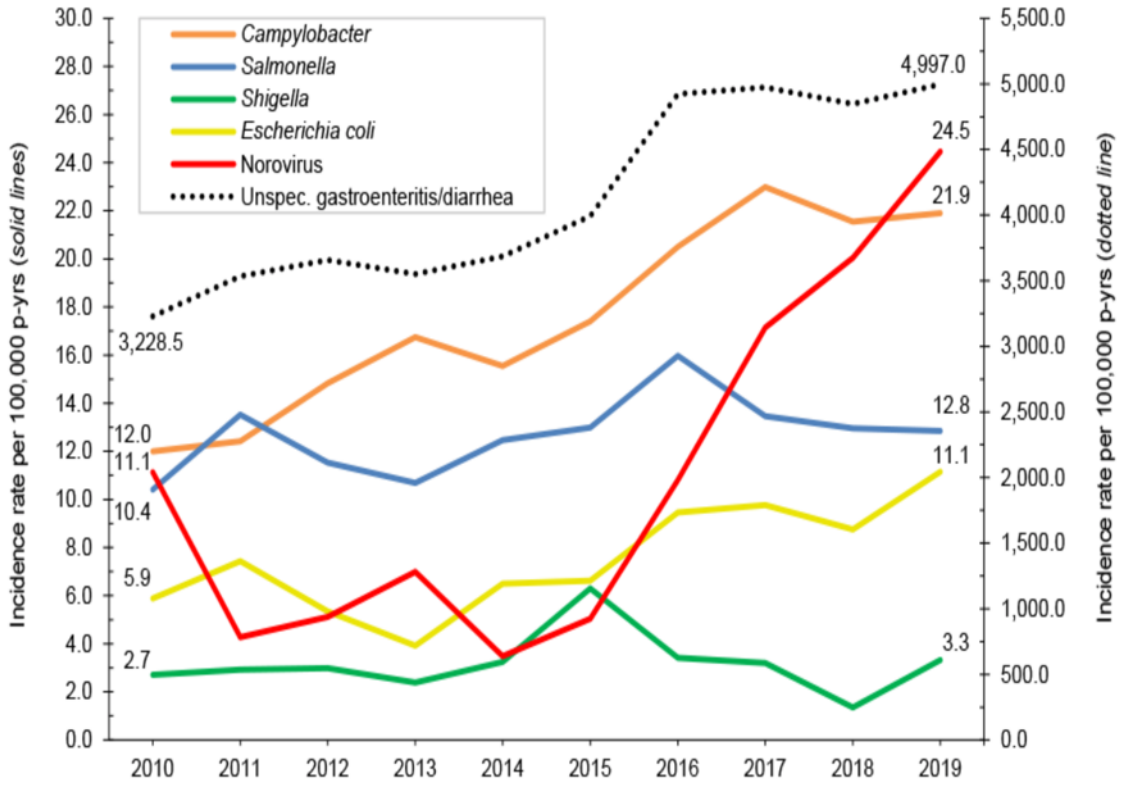
HIV, human immunodeficiency virus.

Specific Threats to the Force – Enterics

U.S. Army 1st Lt. Robert Wolfe, security force platoon leader for Provincial Reconstruction Team Farah, provides rooftop security during a key leader engagement in Farah City, Afghanistan. (Lt. j.g. Matthew Stroup/U.S. Navy)

Update: Incidence of Acute Gastrointestinal Infections and Diarrhea, Active Component, U.S. Armed Forces, 2010–2019

FIGURE 1. Crude annual incidence rates of GI infections, by type of infection, active component, U.S. Armed Forces, 2010–2019



Case Counts

2,241: Campylobacter
1,616: Salmonella
406: Shigella
952: E. coli
1,379: norovirus
527,357: unspecified

A Multisite Network Assessment of the Epidemiology and Etiology of Acquired Diarrhea among U.S. Military and Western Travelers (Global Travelers' Diarrhea Study): A Principal Role of *Norovirus* among Travelers with Gastrointestinal Illness

Pathogen results by country and geographic region and country

Pathogen	Asia-Pacific, *n* (%)		South/Central America, *n* (%)		Middle East, *n* (%)	Total by pathogen, *n* (%)
	Nepal	Thailand	Honduras	Peru	Egypt	
Norovirus						
Positive	53 (32)	7 (44)	9 (20)	28 (16)	1 (7)	98 (24)
Genogroup I	18 (34)	2 (29)	2 (22)	3 (11)	0 (0)	–
Genogroup II	28 (53)	5 (71)	7 (78)	25 (89)	1 (100)	–
Genogroups I and II	7 (13)	0 (0)	0 (0)	0 (0)	0 (0)	–
Negative	112 (68)	9 (56)	35 (80)	143 (84)	13 (93)	312 (76)
Campylobacter jejuni						
Positive	30 (18)	5 (31)	5 (11)	16 (9)	1 (7)	57 (14)
Negative	135 (82)	11 (69)	39 (89)	155 (91)	13 (93)	353 (86)
Shigella–enteroinvasive *E. coli*						
Positive	16 (10)	0 (0)	4 (9)	16 (9)	4 (29)	40 (10)
Negative	149 (90)	16 (100)	40 (91)	155 (91)	10 (71)	370 (90)
Salmonella						
Positive	3 (2)	3 (19)	0 (0)	0 (0)	0 (0)	6 (1)
Negative	162 (98)	13 (81)	44 (100)	171 (100)	14 (100)	404 (99)
Enteropathogenic *E. coli*						
Positive	16 (10)	5 (31)	0 (0)	10 (6)	1 (7)	32 (8)
Negative	149 (90)	11 (69)	44 (100)	161 (94)	13 (93)	378 (92)
Shiga toxin–producing *E. coli*						
Positive	2 (1)	0 (0)	0 (0)	1 (1)	0 (0)	3 (1)
Negative	163 (99)	16 (100)	44 (100)	170 (99)	14 (100)	407 (99)
Enteroaggregative *E. coli*						
Positive	18 (11)	1 (6)	2 (5)	5 (3)	1 (7)	27 (7)
Negative	147 (89)	15 (94)	42 (95)	166 (97)	13 (93)	383 (93)
Enterotoxigenic *E. coli*						
Positive	35 (21)	1 (6)	6 (14)	16 (9)	6 (43)	64 (16)
Negative	130 (79)	15 (94)	38 (86)	155 (91)	8 (57)	346 (84)
Pathogen combinations						
Single pathogen	74 (45)	10 (63)	17 (39)	69 (40)	7 (50)	177 (43)
Multiple pathogen	42 (25)	5 (31)	4 (9)	10 (6)	3 (21)	64 (16)
None detected*	49 (30)	1 (6)	23 (52)	92 (54)	4 (29)	169 (41)

E. coli = *Escherichia coli*.
* Limited to observations with all pathogen reports of "0"; "missing," or "pending" observations were excluded.

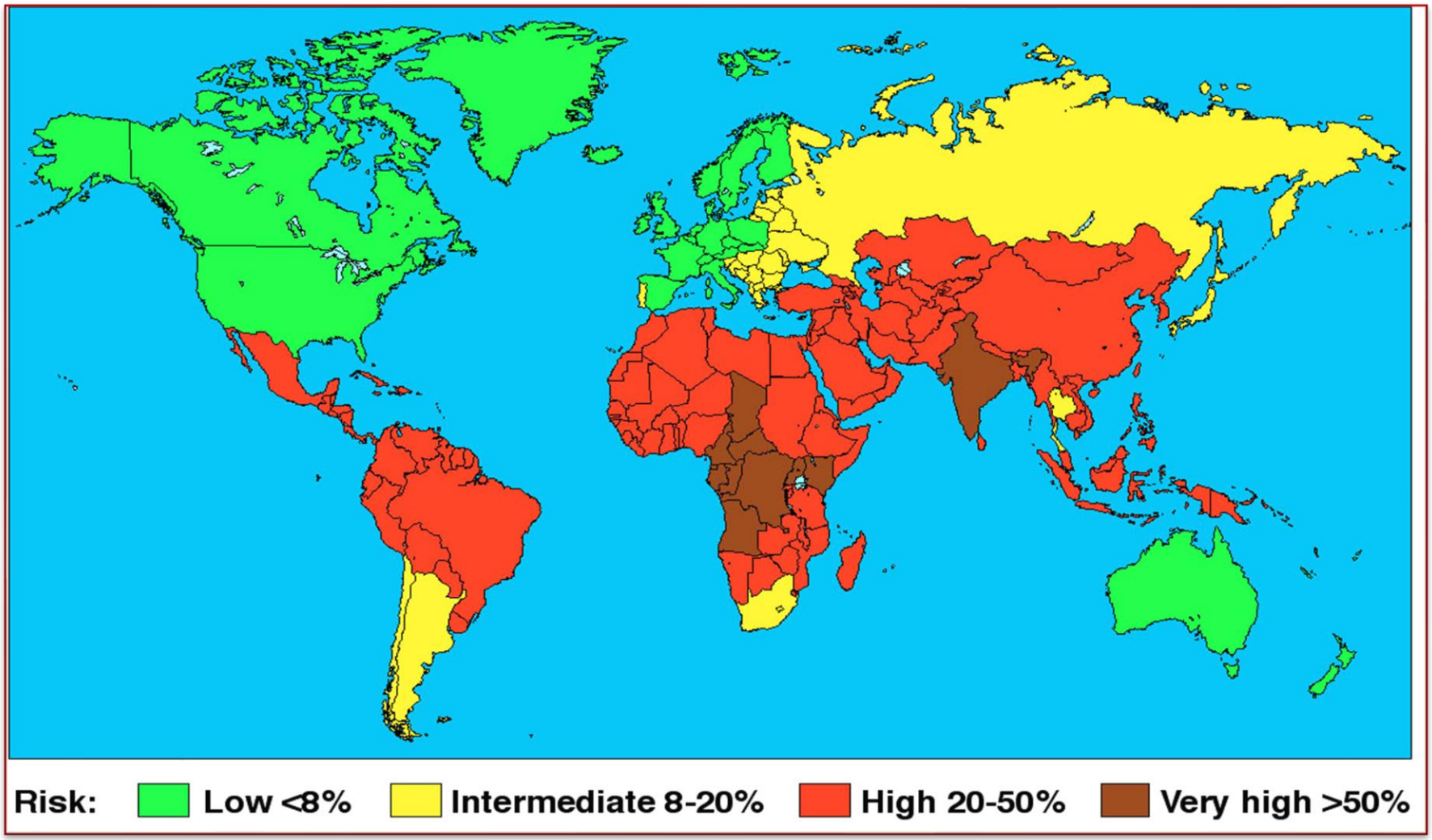
Am. J. Trop. Med. Hyg., 103(5), 2020, pp. 1855–1863
doi:10.4269/ajtmh.20-0053
Copyright © 2020 by The American Society of Tropical Medicine and Hygiene

Surveillance Snapshot: Norovirus Outbreaks in Military Forces, 2015–2019

TABLE. Reported NoV outbreaks in military forces, 2015–2019

Month and year of outbreak onset	Setting	Estimated attack rate (%) [no. of NoV cases out of total personnel]	Description
April 2015	Army base, Portugal	4.9% [46 cases out of 938]	7 specimens positive for NoV GI.9
August 2015	Military camp, Singapore	3.0% [150 out of 5,000]	New emerging strains of caliciviruses [sapovirus (GII.3) and NoV(GI.7 and GII.17)] identified as causative agents
October 2015	Army base, Portugal	40.0% [36 cases out of 90]	1 specimen tested positive for NoV GII.17; 22 cases hospitalized
January 2016	Army base, Azores (Portugal)	40.0% [20 cases out of 50]	5 specimens positive for NoV GII.Pe-GII.4 Sydney; likely spread by food worker
January 2016	Deployed French armed forces, Central African Republic	22.2% [200 cases out of 900]	6 specimens positive for NoV GII; foodborne outbreak likely due to local food handlers
February 2016	Military unit, France	34.3% [103 cases out of 300]	1 specimen positive for NoV GII.17; likely spread by food worker
November 2016	Army base, Portugal	7.4% [29 cases out of 394]	11 specimens positive for NoV GII.P2-GII.2
January 2017	Army military exercise, Portugal	20.0% [17 cases out of 84]	3 specimens positive for NoV GII.P16-GII.2
December 2017	Multiple Army units, Lisbon, Portugal	3.5% [31 out of 874 in 3 Army units]	11 samples positive for NoV GII.P16-GII.4 Sydney
May 2018	U.S. military, Camp Arifjan, Kuwait	No attack rate reported; 91 cases (8 confirmed, 83 suspected)	8 specimens positive via BioFire FilmArray; genotype unspecified

Geographic Risk of Traveler's Diarrhea



Journal of Travel Medicine
International Society of Travel Medicine
Established 1991
Promoting healthy travel worldwide
Journal of Travel Medicine, 2017, Vol 24, Suppl 1, S63–S80
doi: 10.1093/jtm/tax026
Original Article

Original Article

Guidelines for the prevention and treatment of travelers' diarrhea: a graded expert panel report

Prophylaxis

1. Antimicrobial prophylaxis should not be used routinely in travelers (Strong recommendation, low/very low level of evidence).
2. Antimicrobial prophylaxis should be considered for travelers at high risk of health-related complications of travelers' diarrhea (Strong recommendation, low/very low level of evidence).
3. Bismuth subsalicylate (BSS) may be considered for any traveler to prevent travelers' diarrhea (Strong recommendation, high level of evidence).
4. When antibiotic prophylaxis is indicated, rifaximin is recommended (Strong recommendation, moderate level of evidence).
5. Fluoroquinolones are not recommended for prophylaxis of travelers' diarrhea (Strong recommendation, low/very low level of evidence).

Journal of Travel Medicine, 2017, Vol. 24, Suppl 1

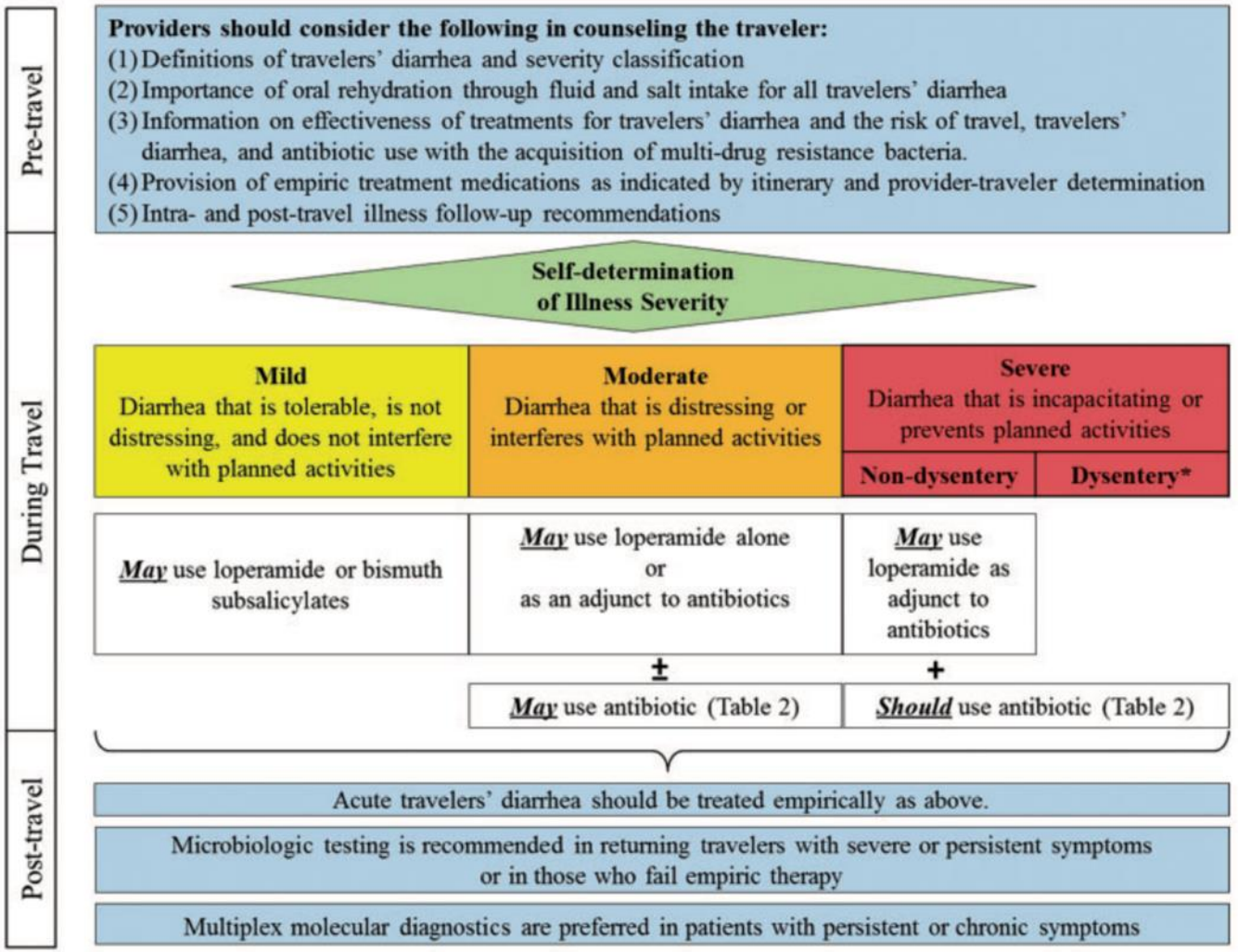


Figure 1. Travelers' diarrhea management algorithm
Footnote: *All Dysentery is considered severe

Traveler's Diarrhea Treatment

Table 2. Acute diarrhea antibiotic treatment recommendations

Antibiotic[a]	Dose	Treatment duration
Azithromycin[c, d]	1000 mg by mouth or	Single or 1-day divided[b]
	500 mg by mouth	3 day course
Levofloxacin	500 mg by mouth	Single dose[b] or 3 day course
Ciprofloxacin	750 mg by mouth or	Single dose[b]
	500 mg by mouth	3 day course
Ofloxacin	400 mg by mouth	Single dose[b] or 3 day course
Rifaximin[e]	200 mg by mouth three times daily	3 days

[a]Antibiotic regimens may be combined with loperamide, 4 mg first dose, then 2 mg dose after each loose stool, not to exceed 16 mg in a 24 hour period.

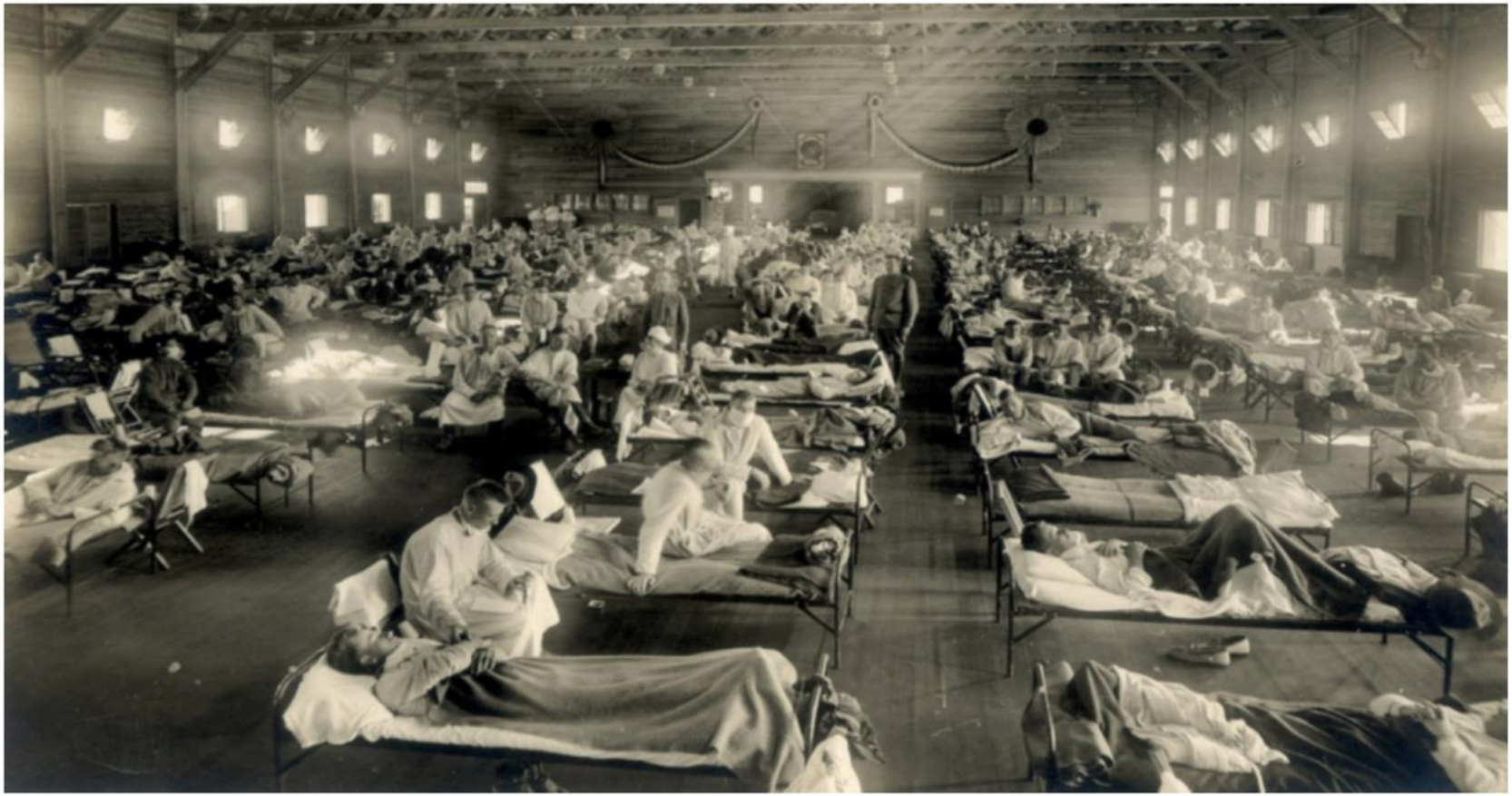
[b]If symptoms are not resolved after 24 hours, continue daily dosing for up to 3 days.

[c]Use empirically as first line in Southeast Asia and India to cover fluoroquinolone resistant *Campylobacter* or in other geographical areas if *Campylobacter* or resistant ETEC are suspected.

[d]Preferred regimen for dysentery or febrile diarrhea.

[e]Do not use if clinical suspicion for *Campylobacter, Salmonella, Shigella* or other causes of invasive diarrhea.

Specific Threats to the Force - Influenza



Soldiers at Camp Funston, Kansas, are quarantined while recovering from the Spanish flu in 1918

Photo by National Guard Bureau

Summary of the 2018–2019 Influenza Season Among Department of Defense Service Members and Other Beneficiaries

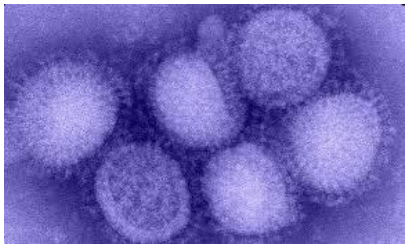
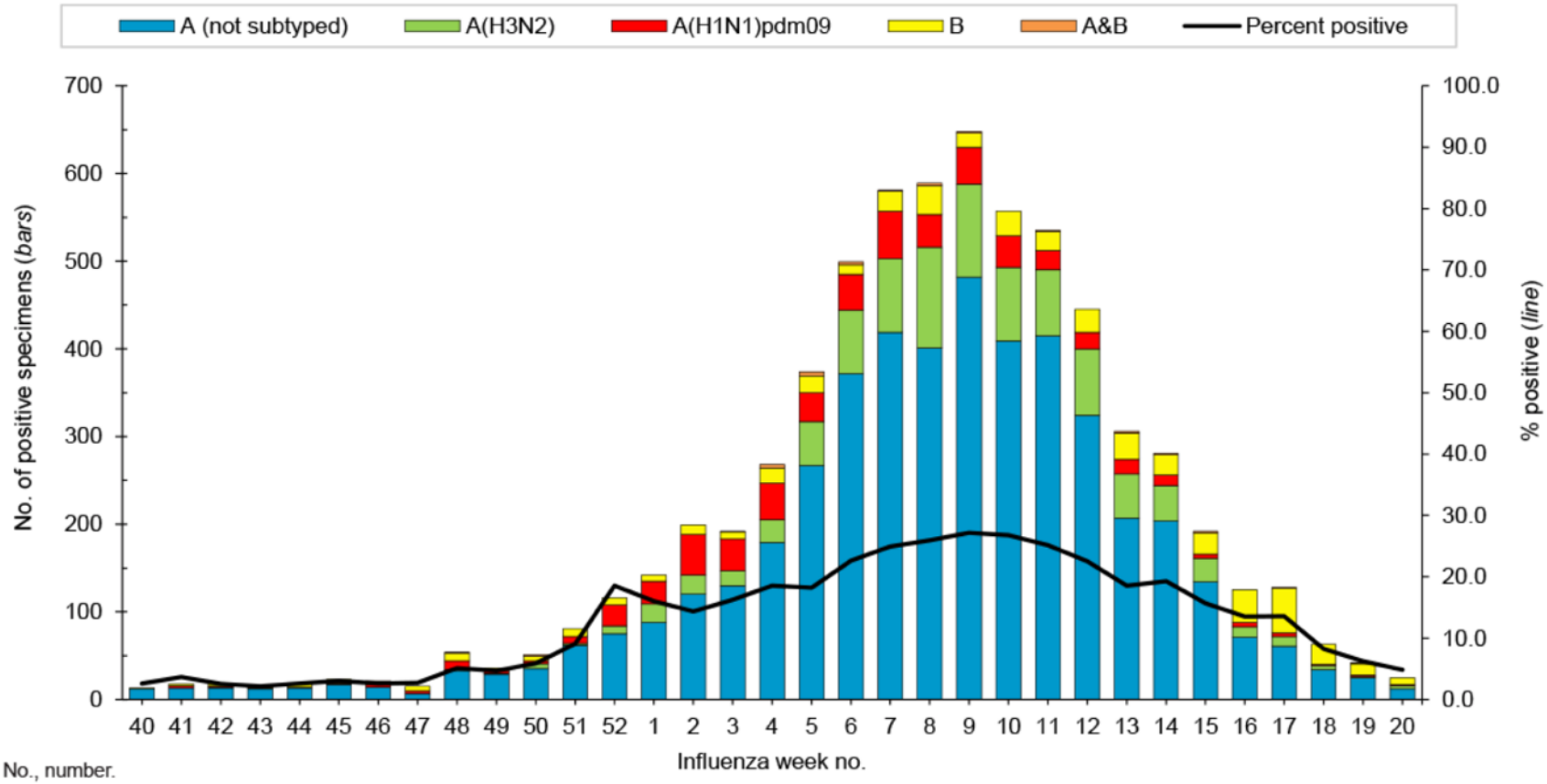
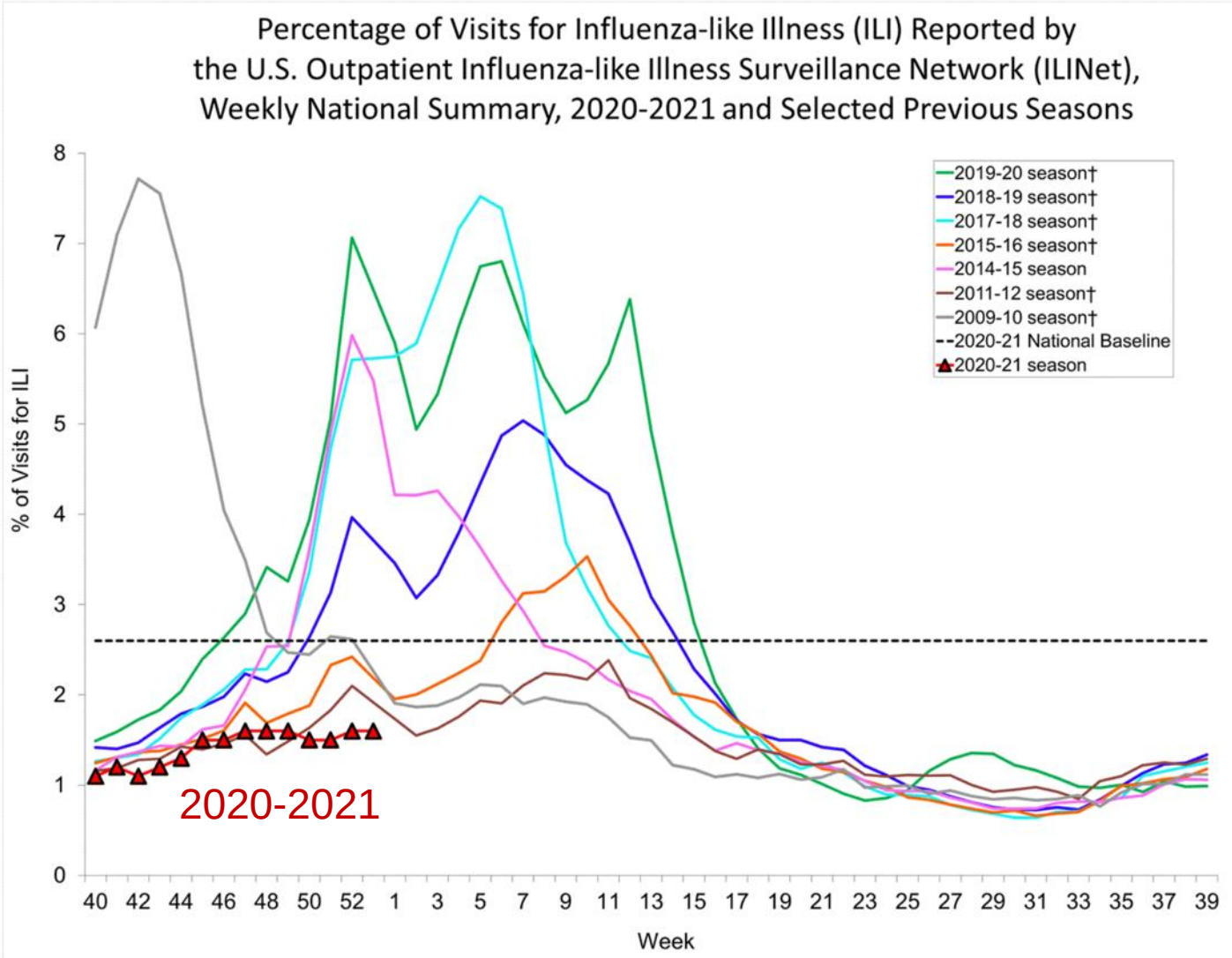


FIGURE 1a. Numbers of laboratory-confirmed influenza specimens by serotype and percentages of respiratory specimens positive for influenza by surveillance week, service members, U.S. Armed Forces, 2018–2019 influenza season



No., number.

US Influenza Activity (2019-2020)



RESEARCH ARTICLE

Influenza Seasonality in the Tropics and Subtropics – When to Vaccinate?

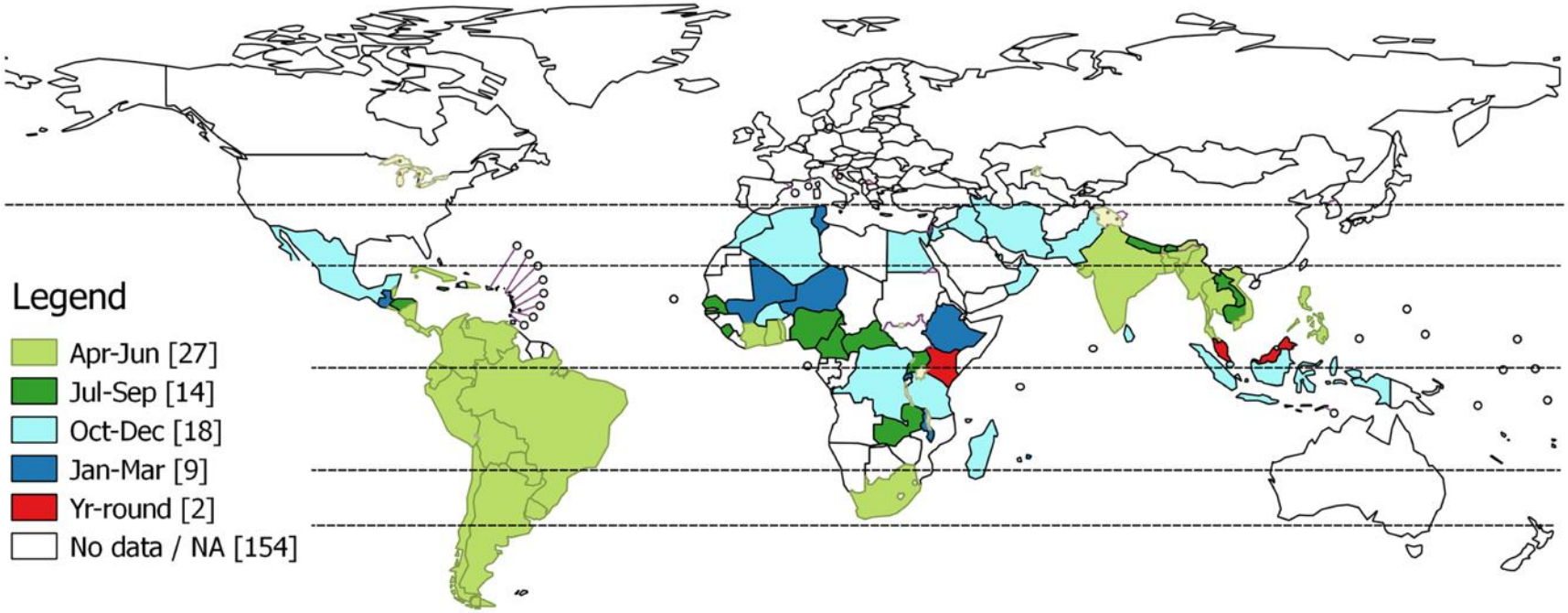
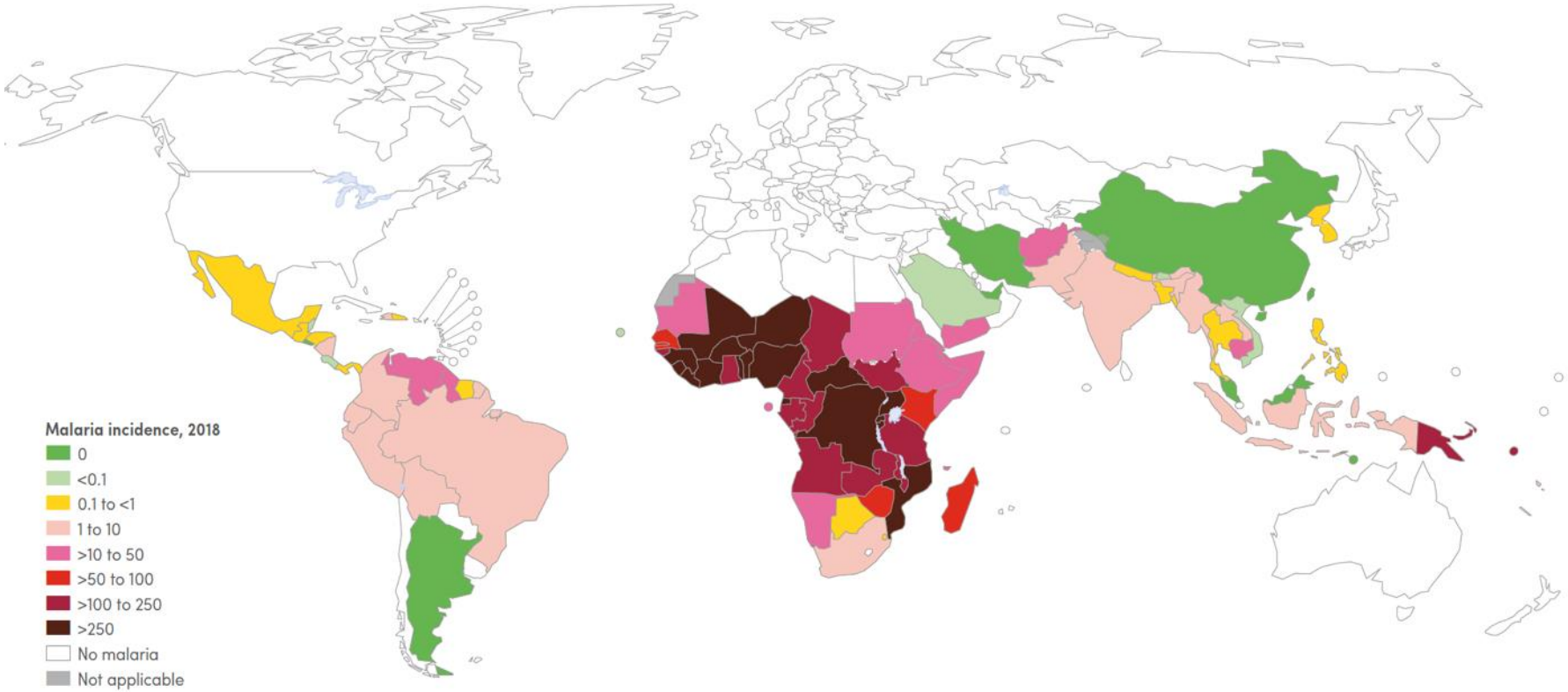


Fig 3. Start of the primary main influenza season. The number in parenthesis in legend indicate number of countries.

doi:10.1371/journal.pone.0153003.g003

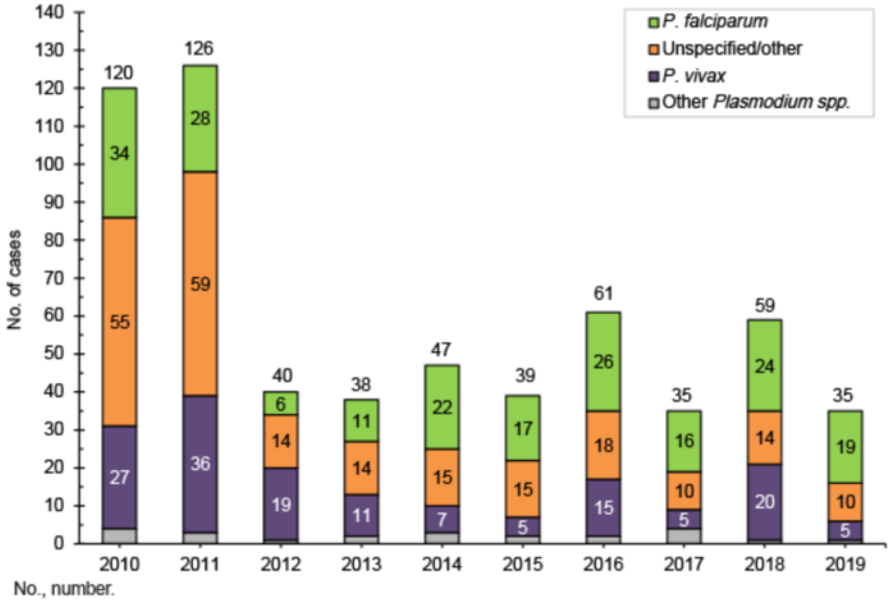
Specific Threats to the Force - Malaria

World Health Organization



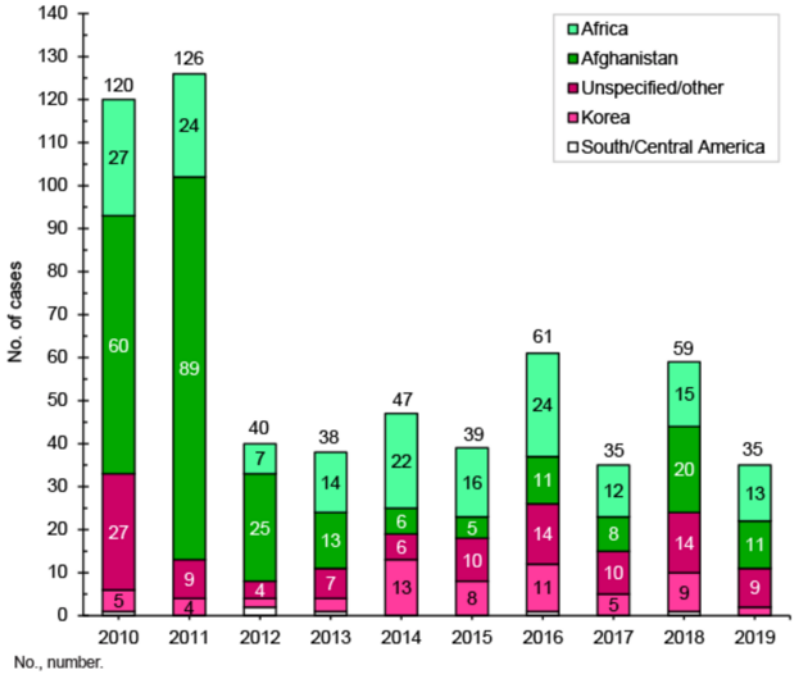
Update: Malaria, U.S. Armed Forces, 2019

FIGURE 1. Numbers of malaria cases, by *Plasmodium* species and calendar year of diagnosis or report, active and reserve components, U.S. Armed Forces, 2010–2019



No., number.

FIGURE 2. Annual numbers of malaria cases, by location of acquisition, U.S. Armed Forces, 2010–2019



No., number.

Clinical Suspicion = Prompt Diagnosis

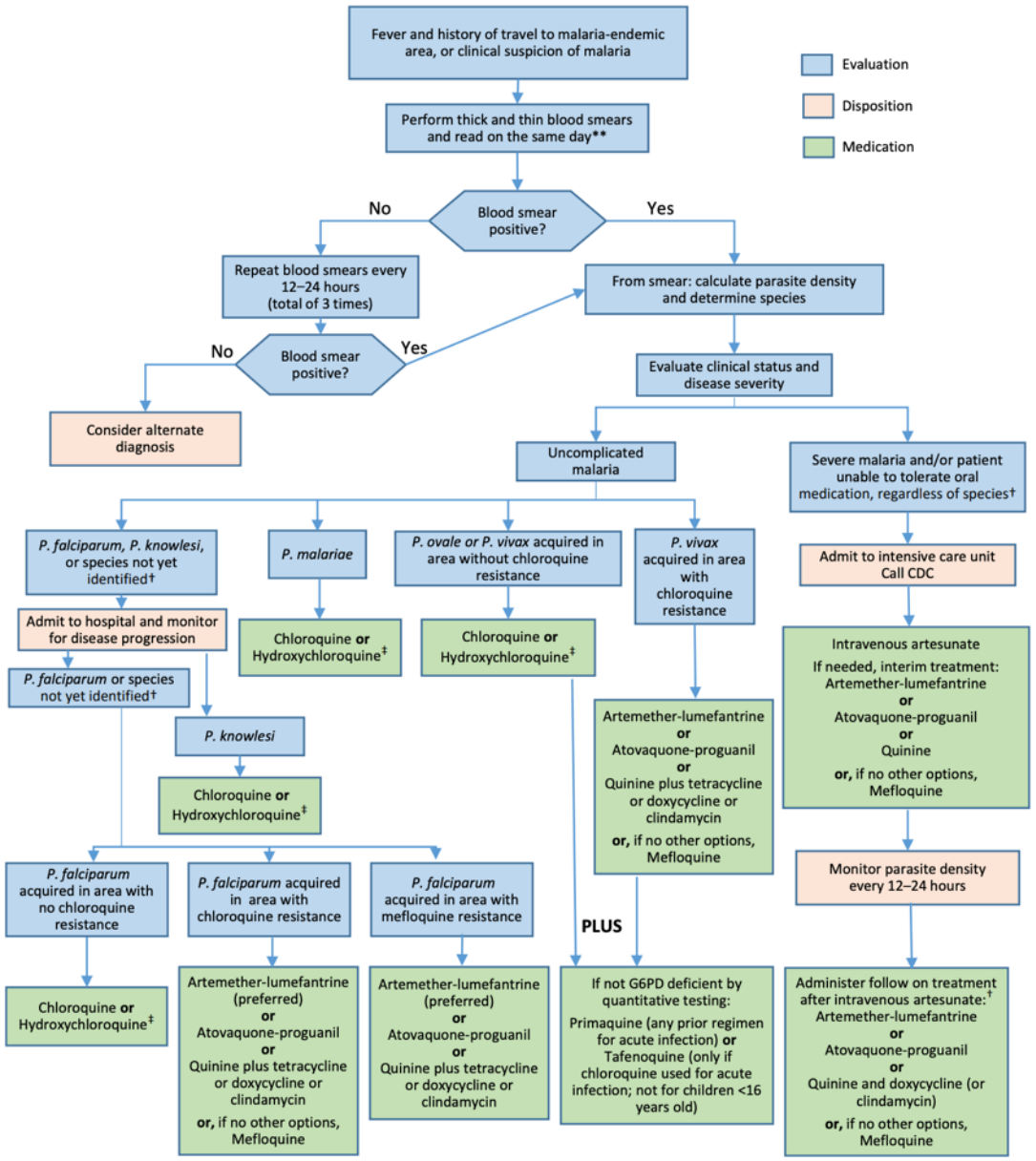
- Travel to area with malaria and any symptom
  - Malaria until proven otherwise
- Within 1 month of return be highly concerned
- >1 month since return, *p. falciparum* less likely

Malaria Symptoms

- Fever, Chills, Sweats
- Headaches, Nausea and vomiting
- Body aches, General malaise

TABLE 276-1 Diagnostic Features of Severe Malaria

Cerebral malaria (diminished consciousness, seizures)
Respiratory distress
Prostration
Hyperparasitemia
Severe anemia
Hypoglycemia
Jaundice/icterus
Renal insufficiency
Hemoglobinuria
Shock
Cessation of eating and drinking
Repetitive vomiting
Hyperpyrexia



- Malaria Treatment
  - Be suspicious
  - Make the diagnosis
  - Assess clinical severity
  - Choose therapy

FDA NEWS RELEASE

FDA Approves Only Drug in U.S. to Treat Severe Malaria

Share Tweet Linkedin Email Print

For Immediate Release: May 26, 2020

Today, the U.S. Food and Drug Administration approved artesunate for injection to treat severe malaria in adult and pediatric patients. Treatment of severe malaria with intravenous (IV) artesunate should always be followed by a complete treatment course of an appropriate oral antimalarial regimen.

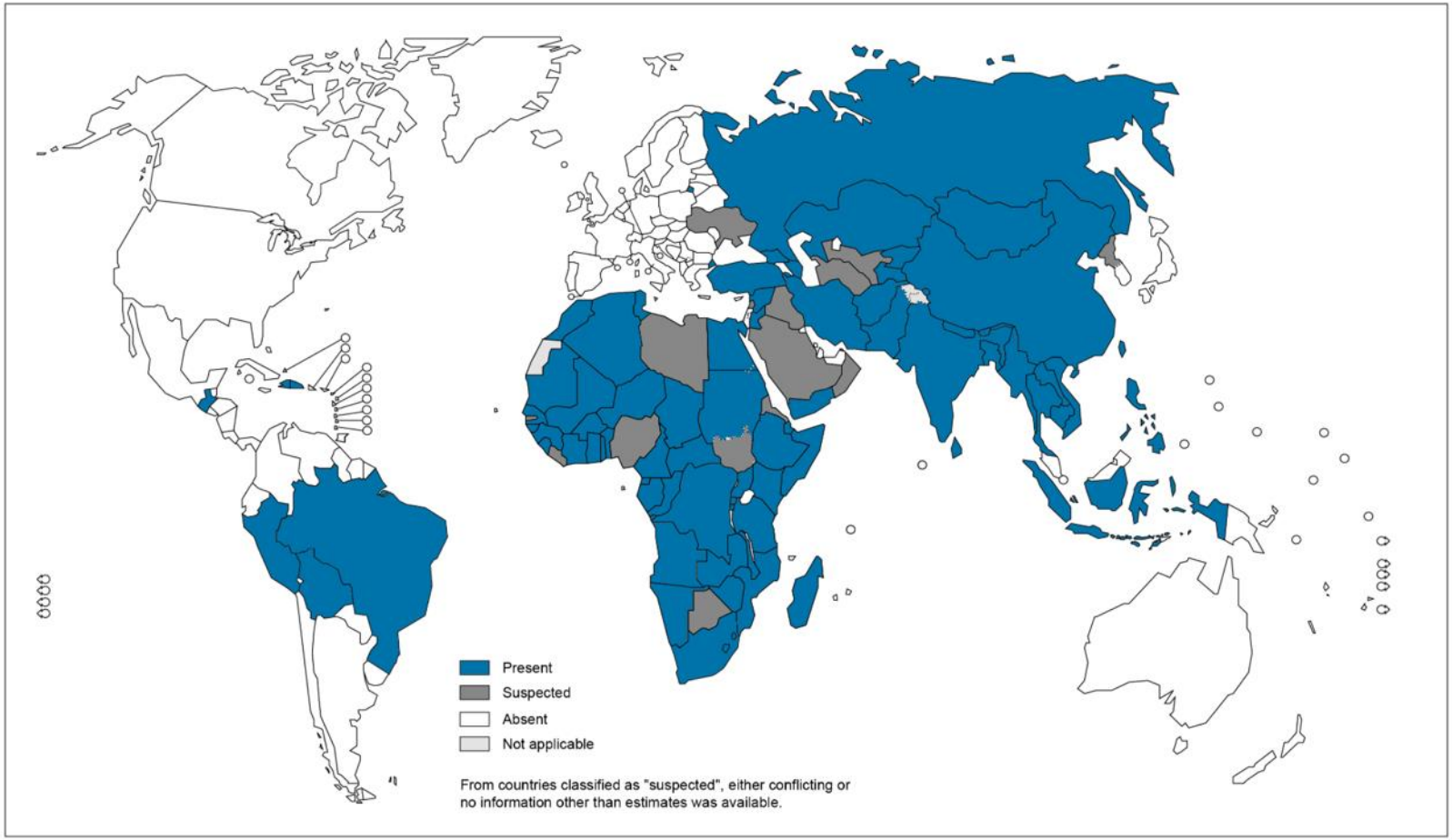
CDC Malaria Hotline: (770) 488-7788 or (855) 856-4713 (toll free) Monday to Friday 9am-5pm EST – (770) 488-7100 after hours, weekends, and holidays.

Specific Threats to the Force - Rabies

A woodcut from the Middle Ages showing a rabid dog / Scanned from Dobson, Mary J. (2008) *Disease*, Englewood Cliffs, N.J: Quercus, p. 157, Wikimedia Commons

Global Rabies Distribution

Presence of dog-transmitted human rabies based on most recent data points from different sources, 2010-2014



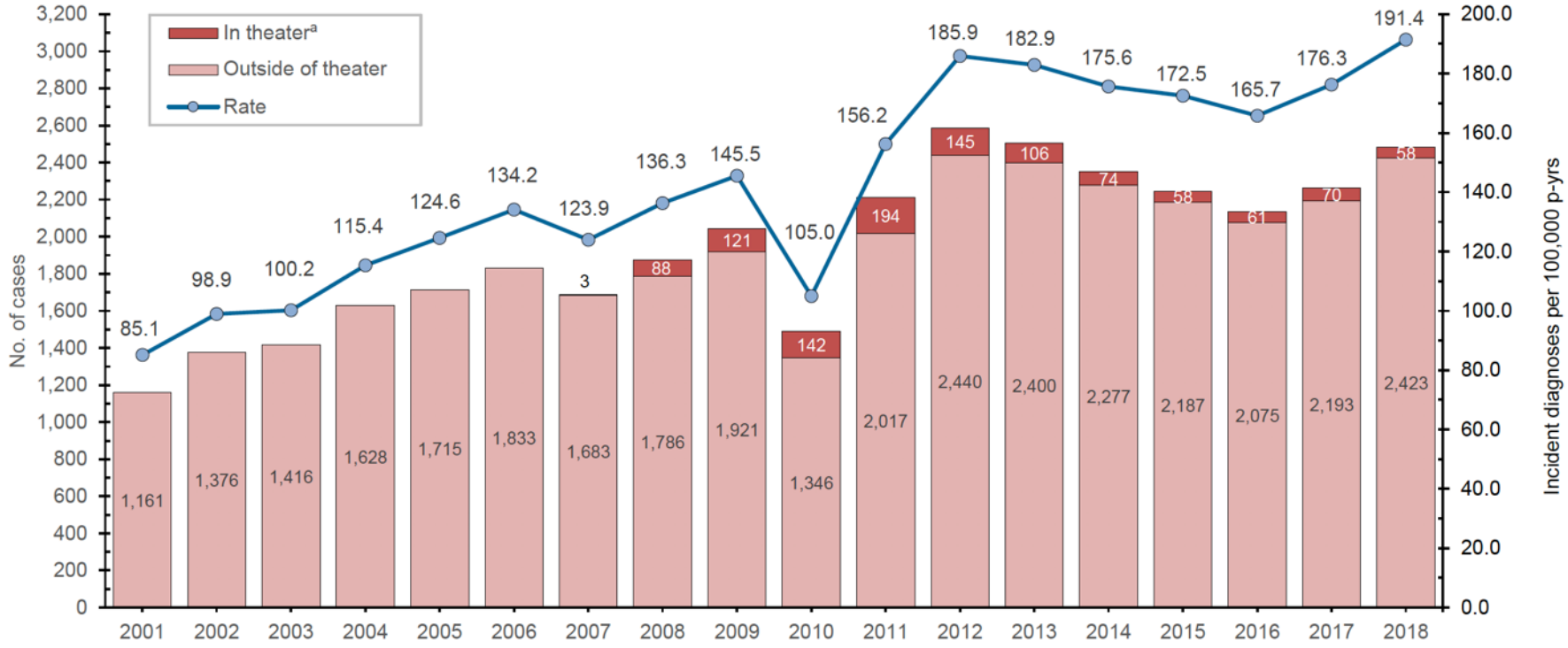
The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement. © WHO 2015. All rights reserved

Data Source: World Health Organization
Map Production: Control of Neglected Tropical Diseases (NTD)
World Health Organization

World Health Organization

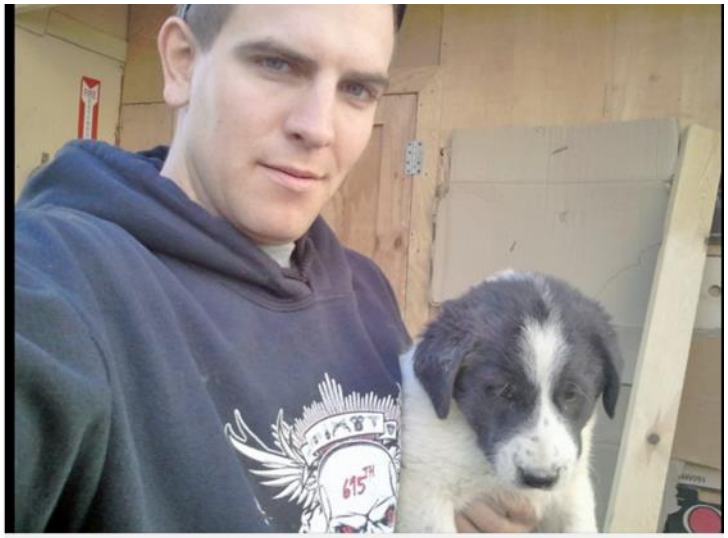
Animal Bites and Rabies Post-exposure Prophylaxis, Active and Reserve Components, U.S. Armed Forces, 2011–2018

FIGURE 1. Numbers and rates of animal bite diagnoses per year, active component, U.S. Armed Forces, 2001–2018



[a]Records of medical encounters in theater were not completely reported in TMDS before 2007.

No., number; p-yrs, person-years; TMDS, Theater Medical Data Store.



SPC Kevin Shumaker with a "base" puppy. Shumaker loved dogs, his mother said, and according to the investigation into his death from rabies, he fed and otherwise interacted with dogs on Combat Outpost Base Chamkani, a violation of a longstanding CENTCOM general order. But the order was also ignored by the base command, the investigation showed. Keeping dogs as pets has been common on U.S. bases in Afghanistan because they improve morale, troops say, and sometimes improve security.
COURTESY ELAINE TAYLOR

CDC Home
Centers for Disease Control and Prevention
CDC 24/7: Saving Lives. Protecting People.™
A-Z Index A B C D E F G H I J K L M N O P Q R S T U V W X Y Z #
Morbidity and Mortality Weekly Report (*MMWR*)

Imported Human Rabies in a U.S. Army Soldier — New York, 2011

Weekly
May 4, 2012 / 61(17);302-305

On August 19, 2011, a male U.S. Army soldier with progressive right arm and shoulder pain, nausea, vomiting, ataxia, anxiety, and dysphagia was admitted to an emergency department (ED) in New York for suspected rabies. Rabies virus antigens were detected in a nuchal skin biopsy, rabies virus antibodies in serum and cerebrospinal fluid (CSF), and rabies viral RNA in saliva and CSF specimens by state and CDC rabies laboratories. An Afghanistan canine rabies virus variant was identified. The patient underwent an experimental treatment protocol (*1*) but died on August 31. The patient had described a dog bite while in Afghanistan. However, he had not received effective rabies postexposure prophylaxis (PEP). In total, 29 close contacts and health-care personnel (HCP) received PEP after contact with the patient. This case highlights the continued risks for rabies virus exposure during travel or deployment to rabies-enzootic countries, the need for global canine rabies elimination through vaccination, and the importance of following effective PEP protocols and ensuring global PEP availability.

Rabies - Post Exposure Prophylaxis

MMWR
Morbidity and Mortality Weekly Report
www.cdc.gov/mmwr
Recommendations and Reports March 19, 2010 / Vol. 59 / No. RR-2

WASH THE WOUND!

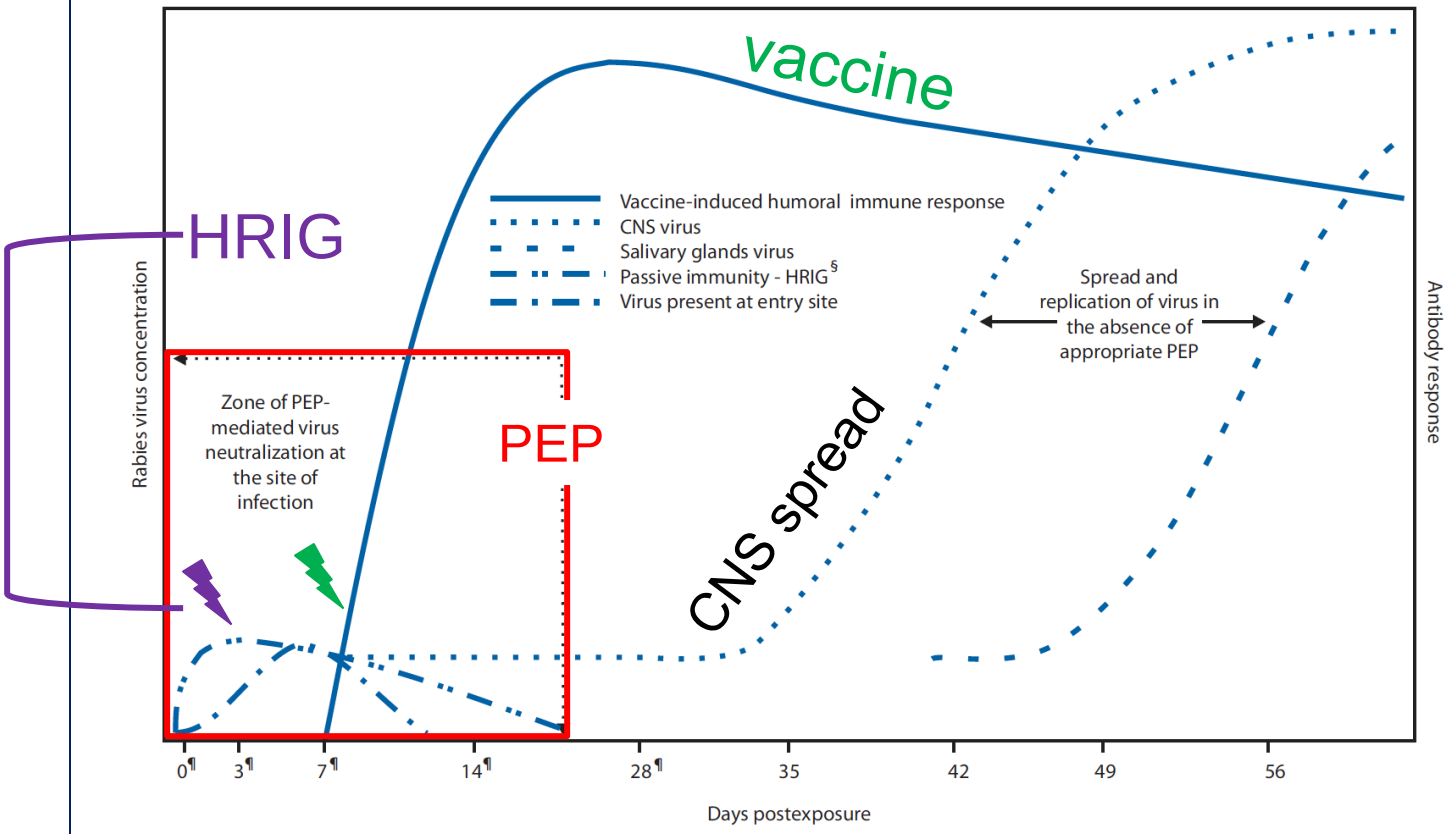
TABLE 3. Rabies postexposure prophylaxis (PEP) schedule — United States, 2010

Vaccination status	Intervention	Regimen*
Not previously vaccinated	Wound cleansing	All PEP should begin with immediate thorough cleansing of all wounds with soap and water. If available, a virucidal agent (e.g., povidine-iodine solution) should be used to irrigate the wounds.
	Human rabies immune globulin (HRIG)	Administer 20 IU/kg body weight. If anatomically feasible, the full dose should be infiltrated around and into the wound(s), and any remaining volume should be administered at an anatomical site (intramuscular [IM]) distant from vaccine administration. Also, HRIG should not be administered in the same syringe as vaccine. Because RIG might partially suppress active production of rabies virus antibody, no more than the recommended dose should be administered.
	Vaccine	Human diploid cell vaccine (HDCV) or purified chick embryo cell vaccine (PCECV) 1.0 mL, IM (deltoid area†), 1 each on days 0,§ 3, 7 and 14.¶
Previously vaccinated**	Wound cleansing	All PEP should begin with immediate thorough cleansing of all wounds with soap and water. If available, a virucidal agent such as povidine-iodine solution should be used to irrigate the wounds.
	HRIG	HRIG should not be administered.
	Vaccine	HDCV or PCECV 1.0 mL, IM (deltoid area†), 1 each on days 0§ and 3.

* These regimens are applicable for persons in all age groups, including children.
† The deltoid area is the only acceptable site of vaccination for adults and older children. For younger children, the outer aspect of the thigh may be used. Vaccine should never be administered in the gluteal area.
§ Day 0 is the day dose 1 of vaccine is administered.
¶ For persons with immunosuppression, rabies PEP should be administered using all 5 doses of vaccine on days 0, 3, 7, 14, and 28.
** Any person with a history of pre-exposure vaccination with HDCV, PCECV, or rabies vaccine adsorbed (RVA); prior PEP with HDCV, PCECV or RVA; or previous vaccination with any other type of rabies vaccine and a documented history of antibody response to the prior vaccination.

Rabies - Why PEP?

FIGURE 1. Schematic of dynamics of rabies virus pathogenesis* in the presence and absence of postexposure prophylaxis (PEP)–mediated immune responses†



* Rabies can progress through five stages: incubation period (5 days to >2 years: U.S. median ~35 days), prodrome state (0–10 days), acute neurologic period (2–7 days), coma (5–14 days), and death.

† Once in tissues at the entry site, rabies virus can be neutralized by passively administered rabies immune globulin (RIG). Active immunization (vaccine) stimulates the host immune system, and, as a result, virus-neutralizing antibodies (VNA) are produced approximately 7–10 days after initiation of vaccination. By approximately day 14–28 (after administration of 4 vaccine doses), VNAs peak. In the absence of early and adequate PEP, virus enters host neurons, spreads to the central nervous system (CNS), and causes disease, with inevitably fatal consequence.

§ Human rabies immune globulin.

¶ Day vaccine administered.

Animal Bites and Rabies Post-exposure Prophylaxis, Active and Reserve Components, U.S. Armed Forces, 2011–2018

TABLE 4. Frequency of reports of "exposure to rabies" and rabies PEP associated with animal bite diagnoses, reserve and active components, U.S. Armed Forces, 2011–2018

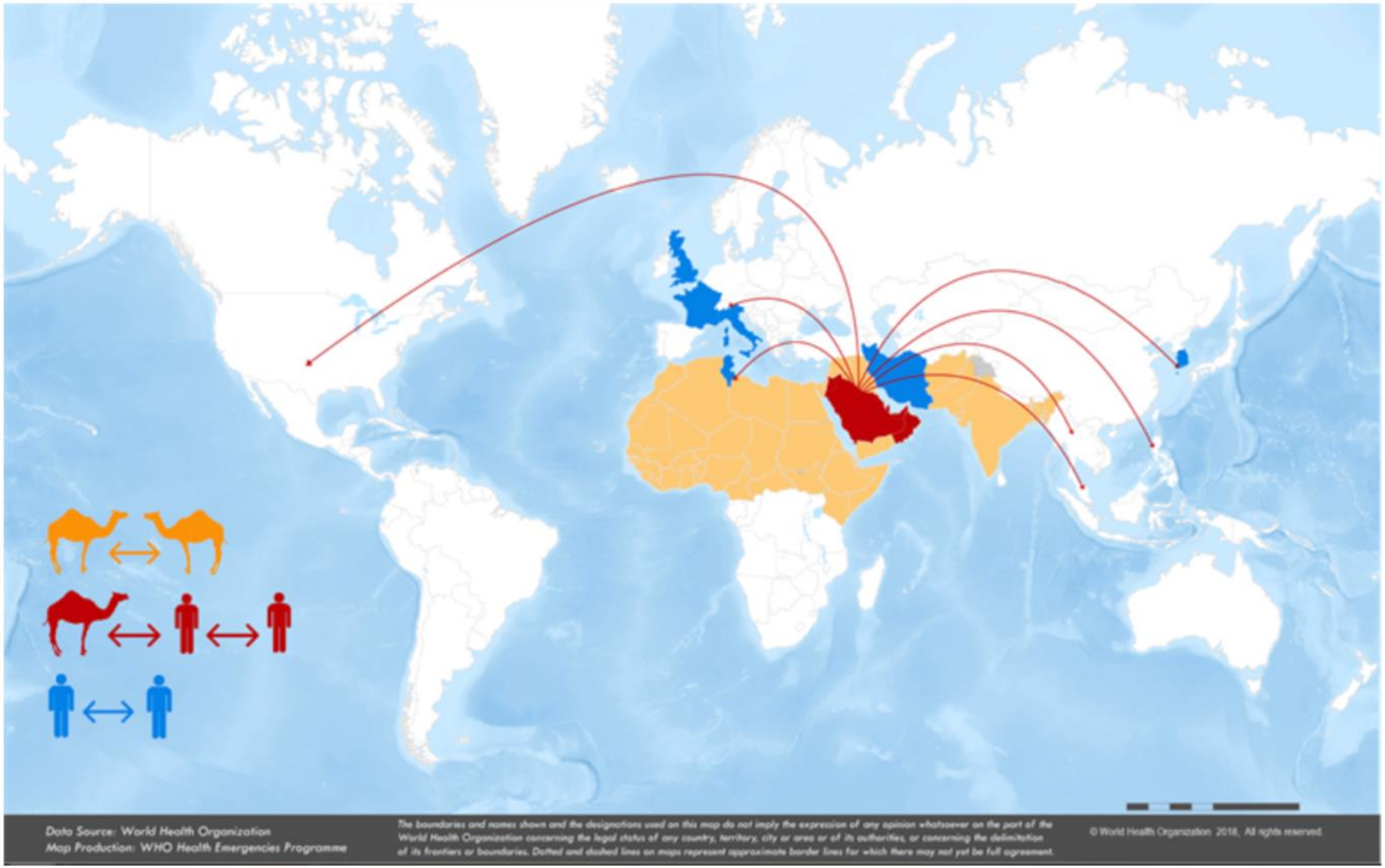
	Outside of theater[a] (n=21,830)							In theater[a] (n=899)						
Follow-up time after animal bite diagnosis		0–7 days		8–30 days		31–90 days			0–7 days		8–30 days		31–90 days	
	Total	No.	%	No.	%	No.	%	Total	No.	%	No.	%	No.	%
Exposure to rabies diagnosis	658	490	74.5	109	16.6	59	9.0	28	11	39.3	10	35.7	7	25.0
Received rabies vaccine	2,745	2,392	87.1	239	8.7	114	4.2	316	291	92.1	15	4.7	10	3.2
Received HRIG	830	740	89.2	73	8.8	17	2.0	139	127	91.4	9	6.5	3	2.2
Received rabies vaccine and HRIG	793	707	89.2	71	9.0	15	1.9	132	120	90.9	9	6.8	3	2.3
Received rabies vaccine but no HRIG	1,952	1,684	86.3	171	8.8	97	5.0	184	165	89.7	11	6.0	8	4.3
Received unspecified immune globulin	8	8	100.0	.	.	.	.	.	.	.	.	.	.	.

[a]Source of animal bite diagnosis only; follow-up can be from either source.
PEP, post-exposure prophylaxis; No., number; HRIG, human rabies immune globulin.

Specific Threats to the Force – MERS-CoV

Military police wearing masks take a visitors's temperature as a precaution against MERS, Middle East Respiratory Syndrome, virus, at the Defense Ministry in Seoul, South Korea, Tuesday, June 9, 2015. South Korea believes cases of a MERS virus outbreak may have peaked, and experts say the next several days will be critical to determining whether the governments belated efforts have successfully stymied a disease that has killed seven and infected nearly 100. (AP Photo/Lee Jin-man) | Photo Credit: **Lee Jin-man**

MERS-CoV transmission and geographic range - 19 January 2019



World Health Organization
REGIONAL OFFICE FOR THE Eastern Mediterranean

MERS SITUATION UPDATE
DECEMBER 2019

SUMMARY

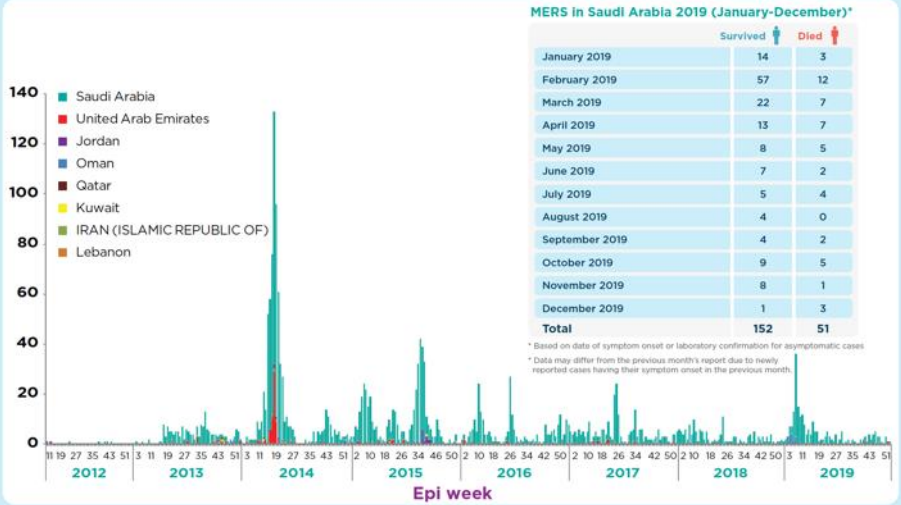
2502 Laboratory-confirmed cases reported since April 2012

861 deaths reported since April 2012

27 countries reported cases globally

12 countries reported cases since April 2012 in the Eastern Mediterranean Region

Laboratory-confirmed cases of MERS reported in the Eastern Mediterranean Region, July 2012–December 2019

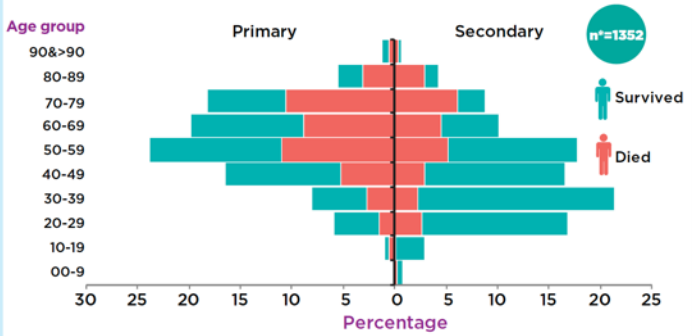


MERS in Saudi Arabia 2019 (January-December)*

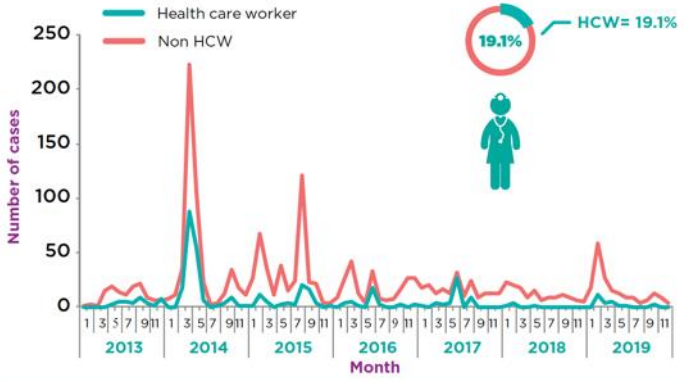
	Survived	Died
January 2019	14	3
February 2019	57	12
March 2019	22	7
April 2019	13	7
May 2019	8	5
June 2019	7	2
July 2019	5	4
August 2019	4	0
September 2019	4	2
October 2019	9	5
November 2019	8	1
December 2019	1	3
Total	152	51

* Based on date of symptom onset or laboratory confirmation for asymptomatic cases
* Data may differ from the previous month's report due to newly reported cases having their symptom onset in the previous month.

Age and fatality distribution of primary and secondary cases of MERS reported from Saudi Arabia, 2012–December 2019

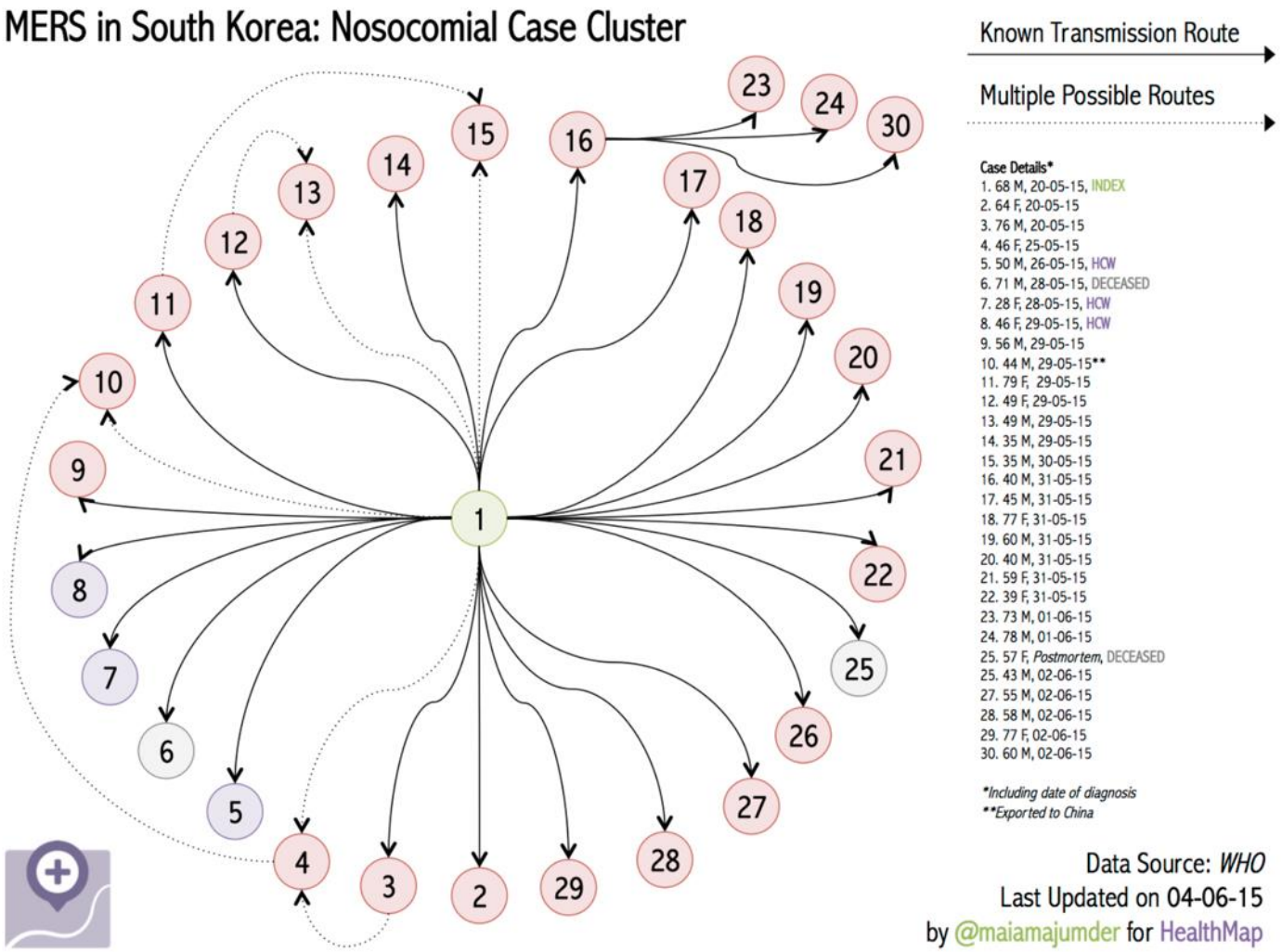


Cases of MERS in healthcare workers reported from Saudi Arabia, Jan 2013–Dec 2019



Superspreader

Mens et Manus on WordPress.com



Specific Threats to the Force - Zika

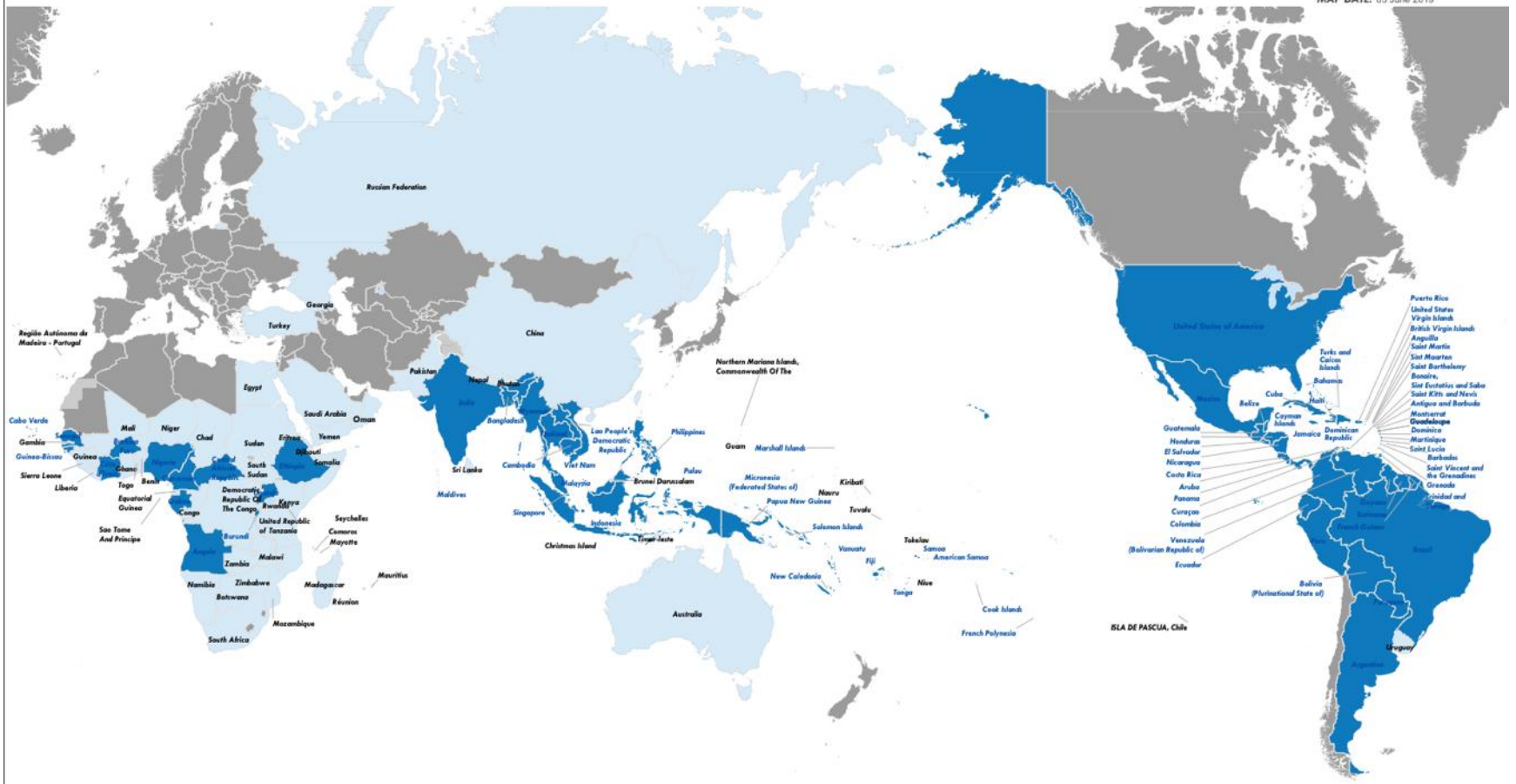
Staff Sgt. Derrick Jones and Airman 1st Class Stephen Nicer get ready to examine the contents of a mosquito trap at Eglin Air Force Base, Florida. (U.S. Air Force Photo/Susan Lawson)

Countries and territories with current or previous Zika virus transmission

World Health Organization

© WHO 2018. All rights reserved.

MAP DATE: 05 June 2019



Countries and territories with current or previous Zika virus transmission

Countries and territories with established competent vector, but no known cases of Zika virus infection

Countries and territories with no known cases of Zika virus infection and no established competent vector

Not Applicable

Areas are classified according to country, territory, or subnational area.
Data as of November 16,2017.
Zika virus country classification tables available at:
http://www.who.int/emergencies/zika-virus/classification-tables/en/
Zika virus country classification scheme available at:
http://apps.who.int/iris/bitstream/10665/254619/1/WHO-ZIKV-SUR-17.1-eng.pdf

The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

The expanding spectrum of modes of transmission of Zika virus: a global concern

Rodriguez-Morales *et al.*
Ann Clin Microbiol Antimicrob (2016) 15:13

Alfonso J. Rodriguez-Morales[1,2*], Antonio Carlos Bandeira[3] and Carlos Franco-Paredes[4,5]

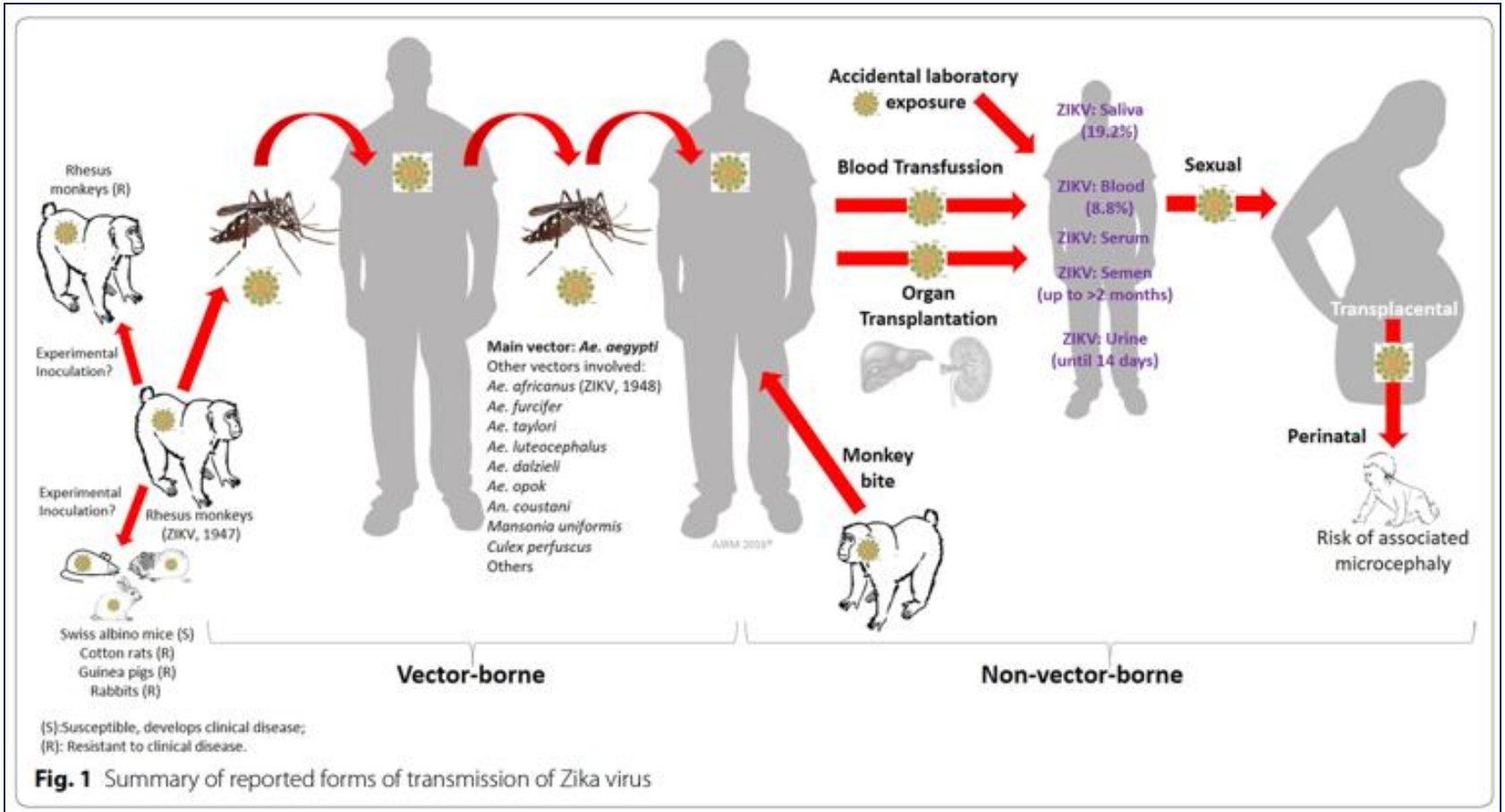


Fig. 1 Summary of reported forms of transmission of Zika virus

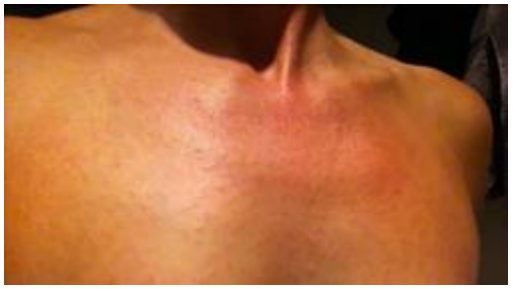
Travel-Associated Zika Virus Disease Cases Among U.S. Residents — United States, January 2015–February 2016

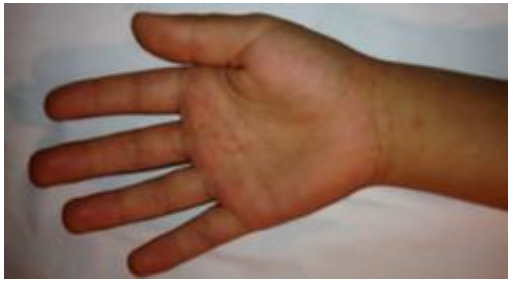
MMWR / March 25, 2016 / Vol. 65 / No. 11

TABLE 2. Clinical signs and symptoms reported by 115 residents of U.S. states and the District of Columbia with laboratory evidence of Zika virus disease — January 1, 2015–February 26, 2016*

Sign/symptom	Yes† No. (%)	No No. (%)	Unknown No. (%)
✓ Rash	113 (98)	1 (1)	1 (1)
✓ Fever	94 (82)	20 (17)	1 (1)
✓ Arthralgia	76 (66)	33 (29)	6 (5)
Headache	65 (57)	37 (32)	13 (11)
Myalgia	63 (55)	38 (33)	14 (12)
Conjunctivitis	43 (37)	53 (46)	19 (17)
✓ Diarrhea	22 (19)	63 (55)	30 (26)
✓ Vomiting	6 (5)	79 (69)	30 (26)

* Testing performed at CDC's Arboviral Diseases Branch laboratory.
† Some patients had more than one sign and/or symptom.





Clinical Microbiology Reviews July 2016 Volume 29 Number 3

Zika Virus Surveillance in Active Duty U.S. Military and Dependents Through the Naval Infectious Diseases Diagnostic Laboratory

TABLE 3. Laboratory results

Trioplex RT-PCR	n=1,299	%
ZIKV positive	11	0.8
DENV positive	8	0.6
CHIKV positive	0	.
Multiple	0	.
Zika MAC-ELISA	**n=1,409**	
Presumptive+ (≥3.0)	56	4.0
Equivocal (≤2.0–<3.0 and background ≥2.0)	44	3.1
Negative (<2.0)	1,278	90.7
Inconclusive (≥2.0 and background <2.0)	31	2.2
Zika PRNT	**n=131**	
Positive	32	24.4
Negative	99	75.6

RT-PCR, reverse transcription polymerase chain reaction; ZIKV, Zika virus; DENV, dengue virus; CHIKV, chikungunya virus; MAC-ELISA, immunoglobulin M antibody enzyme-linked immunosorbent assay; PRNT, plaque reduction neutralization test.

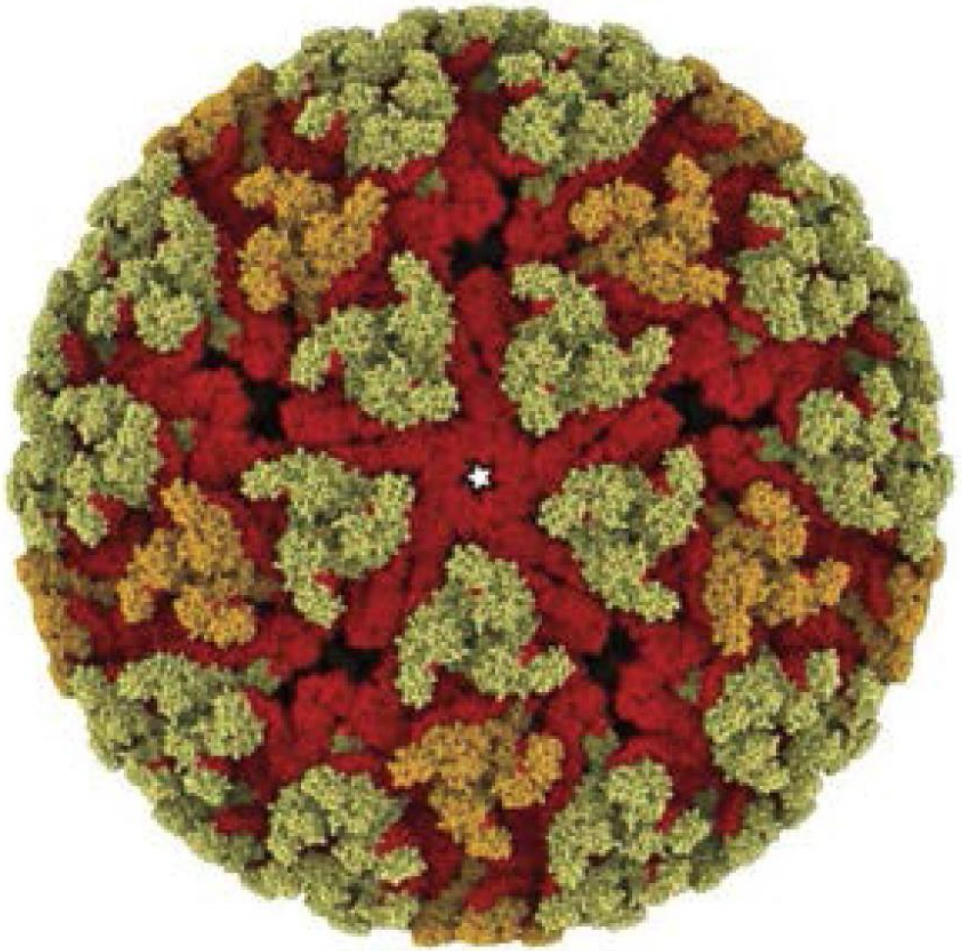
TABLE 4. ZIKV RT-PCR-positive individuals

Sex	Symptomatic?	Treatment location	Country of travel
M	Unknown	NMC San Diego, CA	Unknown
F	Yes	Fort Belvoir, VA	Puerto Rico
M	Unknown	NHC Annapolis, MD	Unknown
F	Yes	NMC San Diego, CA	Unknown
M	Unknown	NBHC Groton, CT	Unknown
F	Yes	NMC San Diego, CA	Puerto Rico
F	Yes	NH Lemoore, CA	Unknown
F	Yes	NMC San Diego, CA	Mexico
M	Yes	Fort Belvoir, VA	Puerto Rico
M	Yes	Walter Reed NMMC, MD	Bonaire
M	Yes	NH Okinawa, Japan	Phillippines

ZIKV, Zika virus; RT-PCR, reverse transcription polymerase chain reaction; NMC, Naval Medical Center; NHC, Naval Health Clinic; NBHC, Naval Branch Health Clinic; NH, Naval Hospital; NMMC, National Military Medical Center.

In 2016–2017, 1,420 tested with 11 confirmed Zika cases and 26 flavivirus infections (possibly ZIKV) by serology.

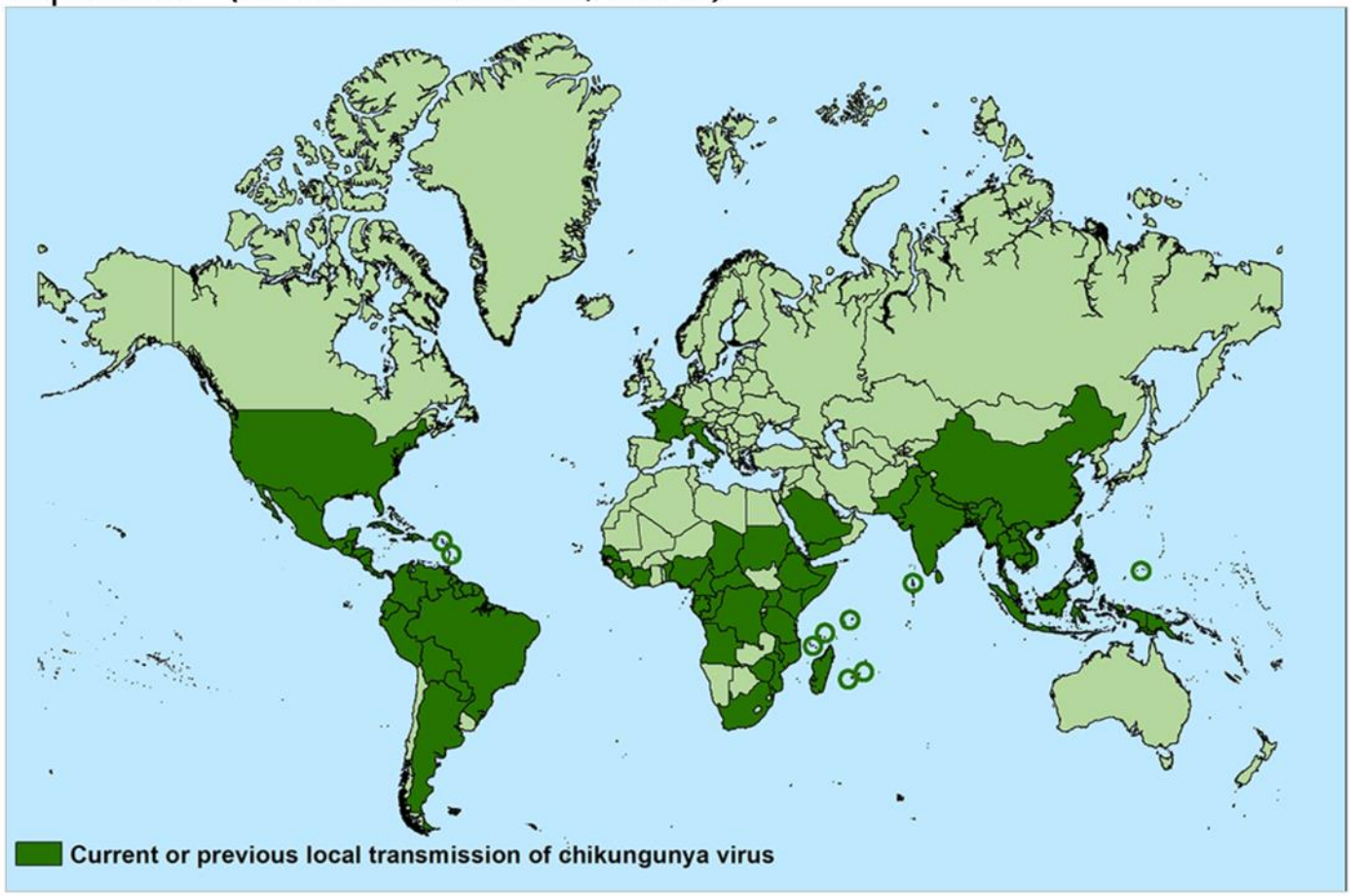
Specific Threats to the Force - Chikungunya



Felix Rey, Institut Pasteur,

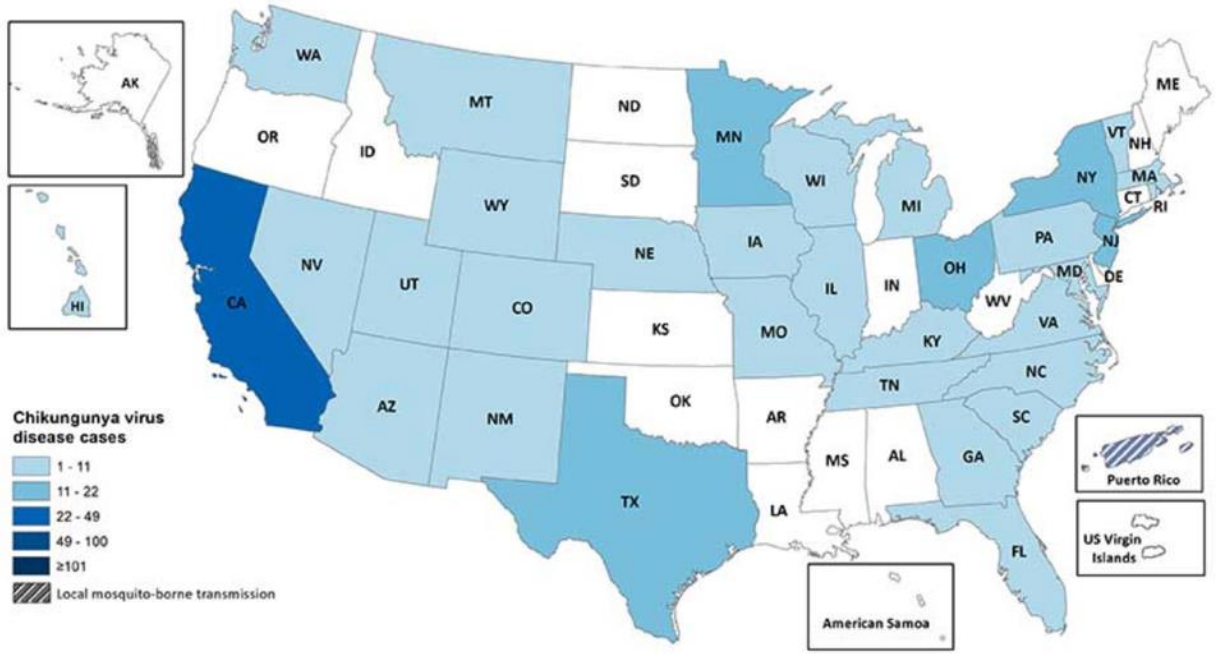
Chikungunya Clinical Epidemiology

Countries and territories where chikungunya cases have been reported* *(as of October 30, 2020)*



*Does not include countries or territories where only imported cases have been documented.

Chikungunya virus disease cases* reported to ArboNET by states and territories – United States, 2019



Chikungunya virus disease cases* reported to ArboNET—United States, 2019

	Travel-associated cases No. (%)	Locally-transmitted cases No. (%)
States	(N=192)	(N=0)

Chikungunya Infection in DoD Healthcare Beneficiaries Following the 2013 Introduction of the Virus into the Western Hemisphere, 1 January 2014 to 28 February 2015

TABLE 2. Age and sex distribution of all DoD chikungunya cases among service members and other Department of Defense beneficiaries identified between 1 January 2014 and 28 February 2015

	Service members			
	Active component	Reserve component	Other beneficiaries	Total
Age				
0–20	0	0	7	7
21–25	5	2	3	10
26–30	12	11	1	24
31–35	14	12	7	33
36–40	10	14	3	27
41–45	8	11	3	22
46–50	1	7	4	12
51+	0	11	11	22
Sex				
Female	5	18	20	43
Male	45	50	19	114

The table depicts the age and sex distribution of all DoD chikungunya cases identified among Service Members and other DoD beneficiaries for the period 1 January 2014 — 28 February 2015. Within the Service Member category, the numbers of cases in the active and reserve components are displayed separately.

Chikungunya Infection in DoD Healthcare Beneficiaries Following the 2013 Introduction of the Virus into the Western Hemisphere, 1 January 2014 to 28 February 2015

TABLE 4. Reported exposure location of all DoD chikungunya cases among service members and other DoD beneficiaries identified between 1 January 2014 and 28 February 2015

		Service members[a]	Other beneficiaries[b]	Total
Caribbean exposure	Location			
	Barbados[c]	0	3	3
	Caribbean NOS	1	0	1
	Curaçao	5	0	5
	Dominica[c]	1	0	1
	Dominican Republic	1	3	4
	El Salvador	2	1	3
	Guatemala	0	1	1
	Guyana	1	0	1
	Haiti	1	0	1
	Jamaica	2	6	8
	Puerto Rico	76	9	85
	Total	90	23	113
Other exposure	Location			
	American Samoa	1	0	1
	Guam	0	1	1
	Samoa	0	1	1
	West Africa	1	0	1
	Total	2	2	4

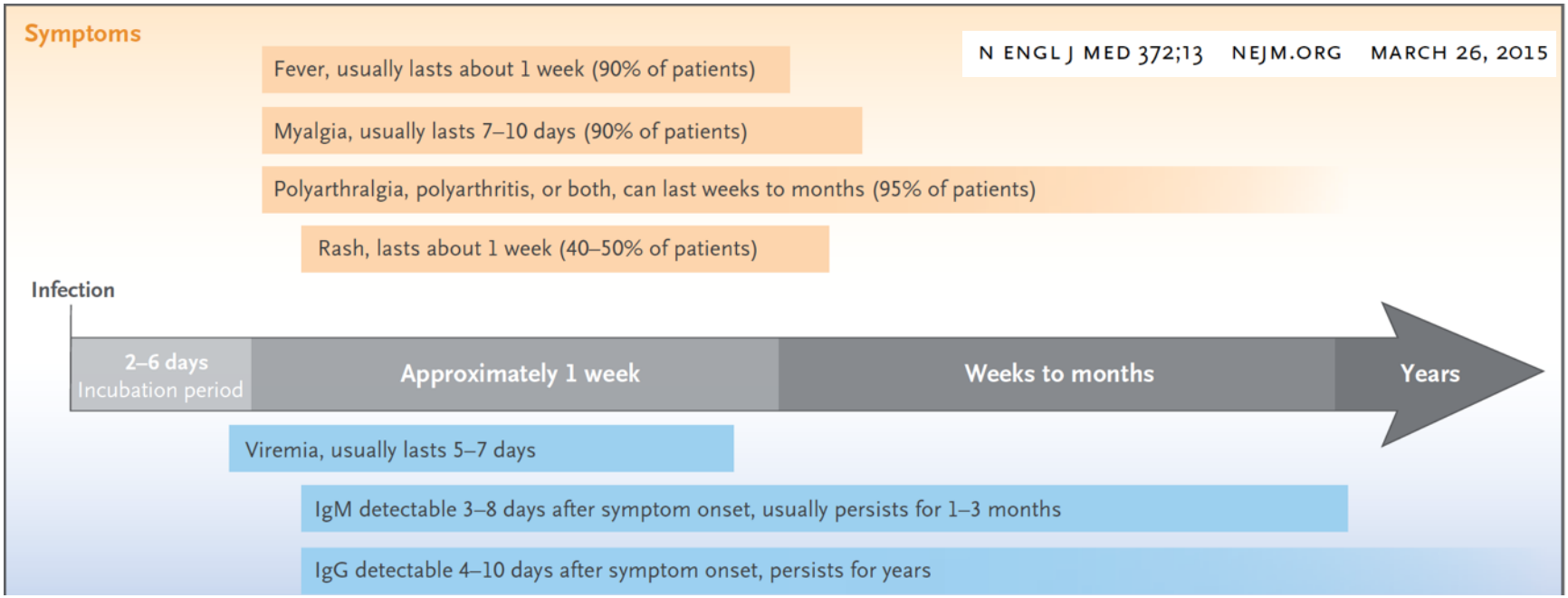
[a]Active and reserve components

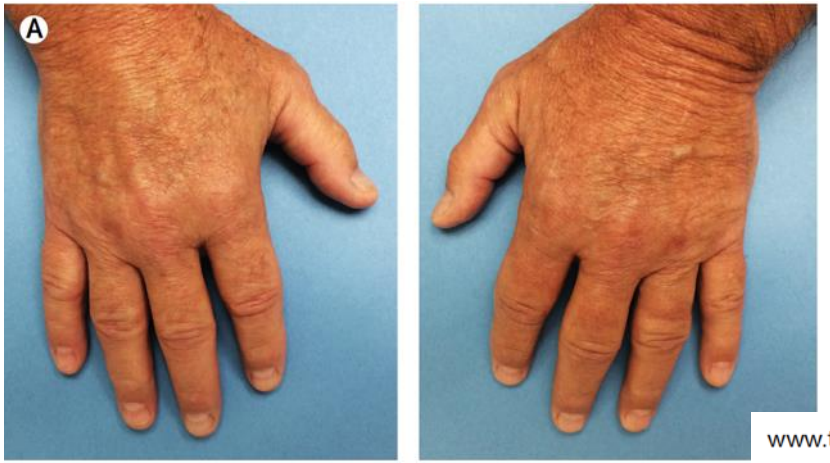
[b]Dependents, retirees, other, and unknown

[c]One case reported recent travel to both Barbados and Dominica.

The table displays the reported exposure locations of 117 DoD chikungunya cases among Service Members and other DoD beneficiaries identified for the period 1 January 2014 — 28 February 2015. Most (113) were exposed to the virus in the Caribbean Basin and 1 each was exposed in West Africa, Samoa, Guam, and American Samoa. The three locations in the Caribbean most associated with cases were Puerto Rico (85 cases), Jamaica (8), and Curaçao (5).

Chikungunya Clinical Manifestations



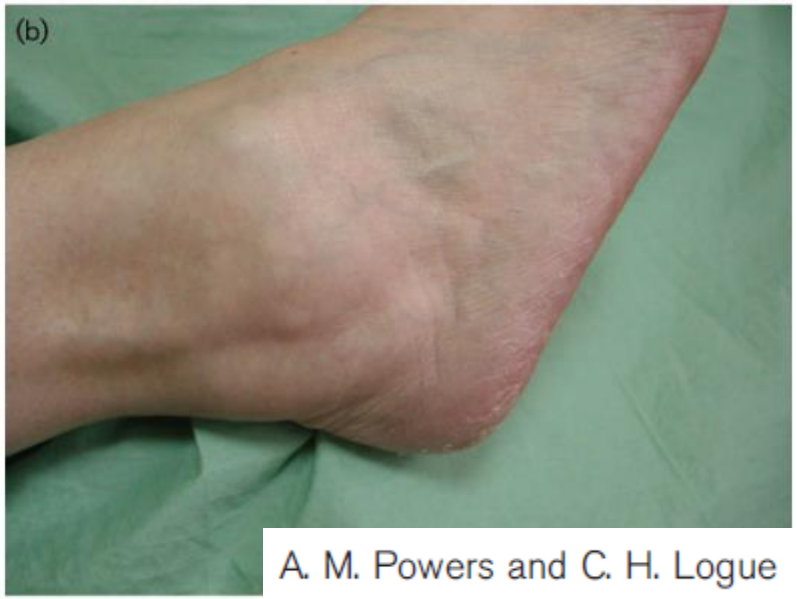


www.thelancet.com/infection **Vol 17 April 2017**

Table 1. Typical and atypical manifestations of CHIKV disease in patients

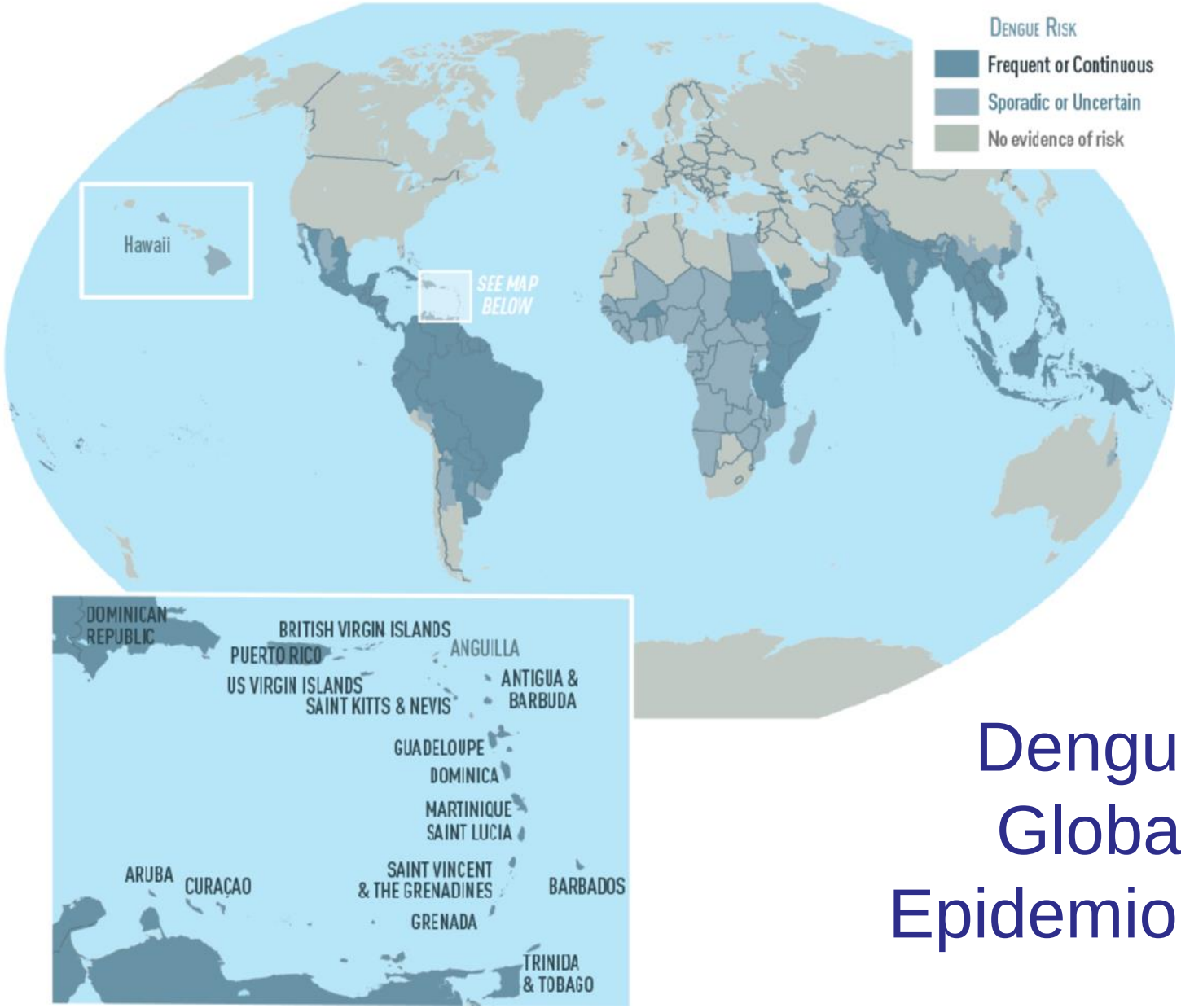
Organ/System	Typical	Atypical
Systemic	Fever; asthenia	Lymphadenopathy
Musculoskeletal	Arthralgia; arthritis; myalgia; joint edema; tenosynovitis; backache; persistent or relapsing-remitting polyarthralgias	Chronic inflammatory rheumatism; articular destruction
Dermatological	Rash; erythema	Bullous dermatosis; hyperpigmentation; stomatitis; xerosis
Neurological	Headache	Meningoencephalitis; encephalopathy; seizures; sensorineural abnormalities; Guillain-Barré syndrome; paresis; palsies; neuropathy
Gastrointestinal		Nausea; vomiting; abdominal pain; anorexia; diarrhea
Hematological	Lymphopenia; thrombocytopenia	Hemorrhage
Ocular	Retro-orbital pain; photosensitivity	Optic neuritis; retinitis; uveitis
Cardiovascular		Myocarditis; pericarditis; heart failure; arrhythmias; cardiomyopathy
Hepatic		Fulminate hepatitis
Pulmonary		Respiratory failure; pneumonia
Renal		Nephritis; acute renal failure

jci.org Volume 127 Number 3 March 2017



Specific Threats to the Force - Dengue

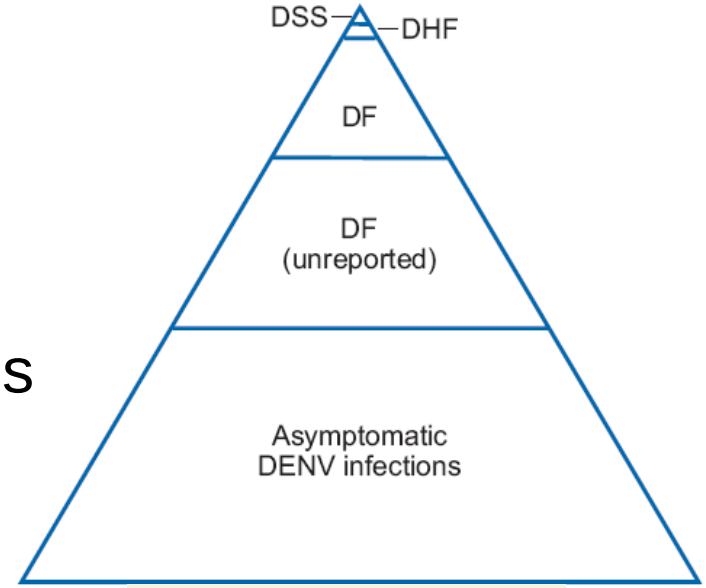
Albert Sabin performing assays for Japanese encephalitis antibody in a tent in Okinawa. From WRAIR Archives.



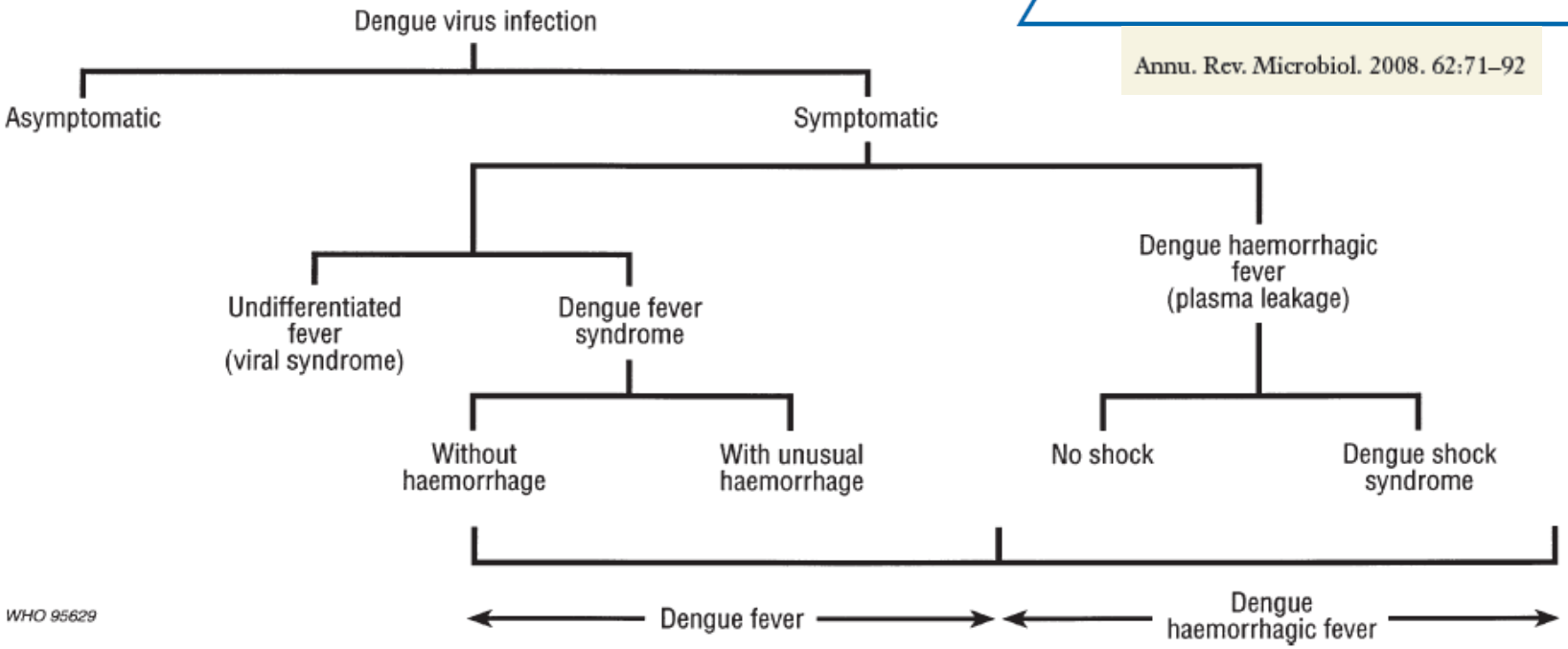
Dengue Global Epidemiology

Dengue Clinical Picture

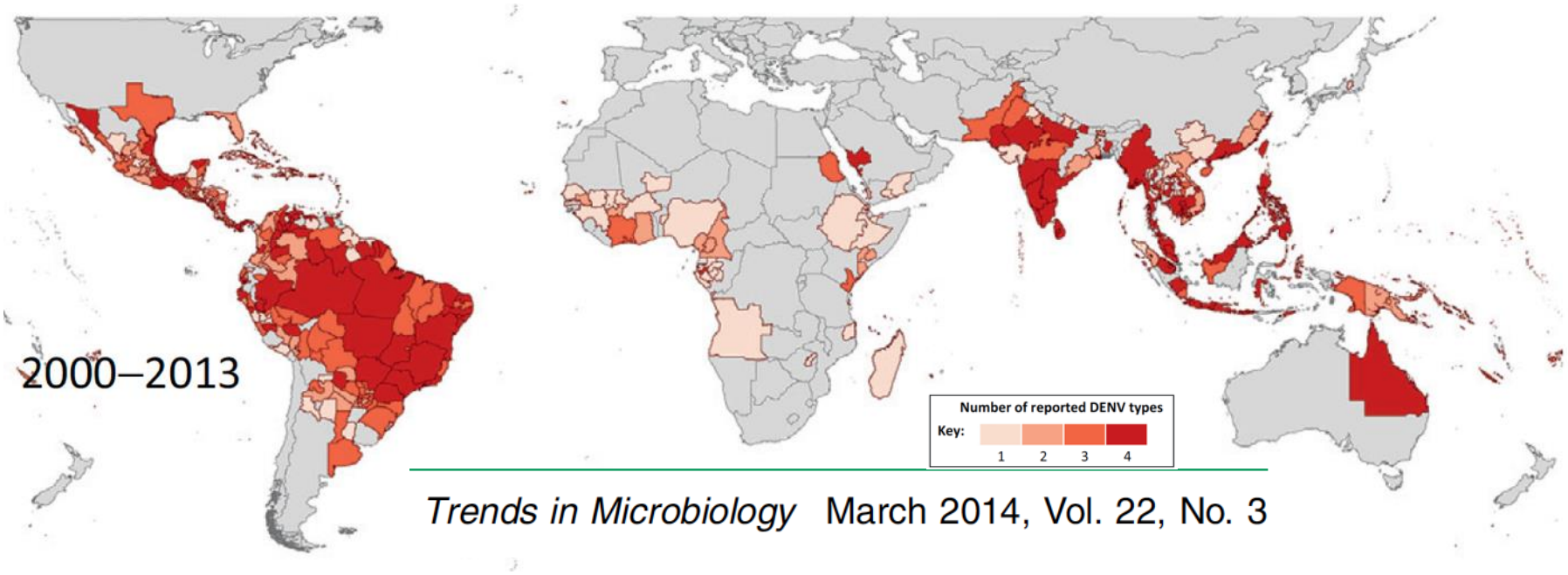
- First infection less severe
- Second infection high risk
  - Two infections, Two DENV types



Annu. Rev. Microbiol. 2008. 62:71–92



Dengue Virus Co-circulation

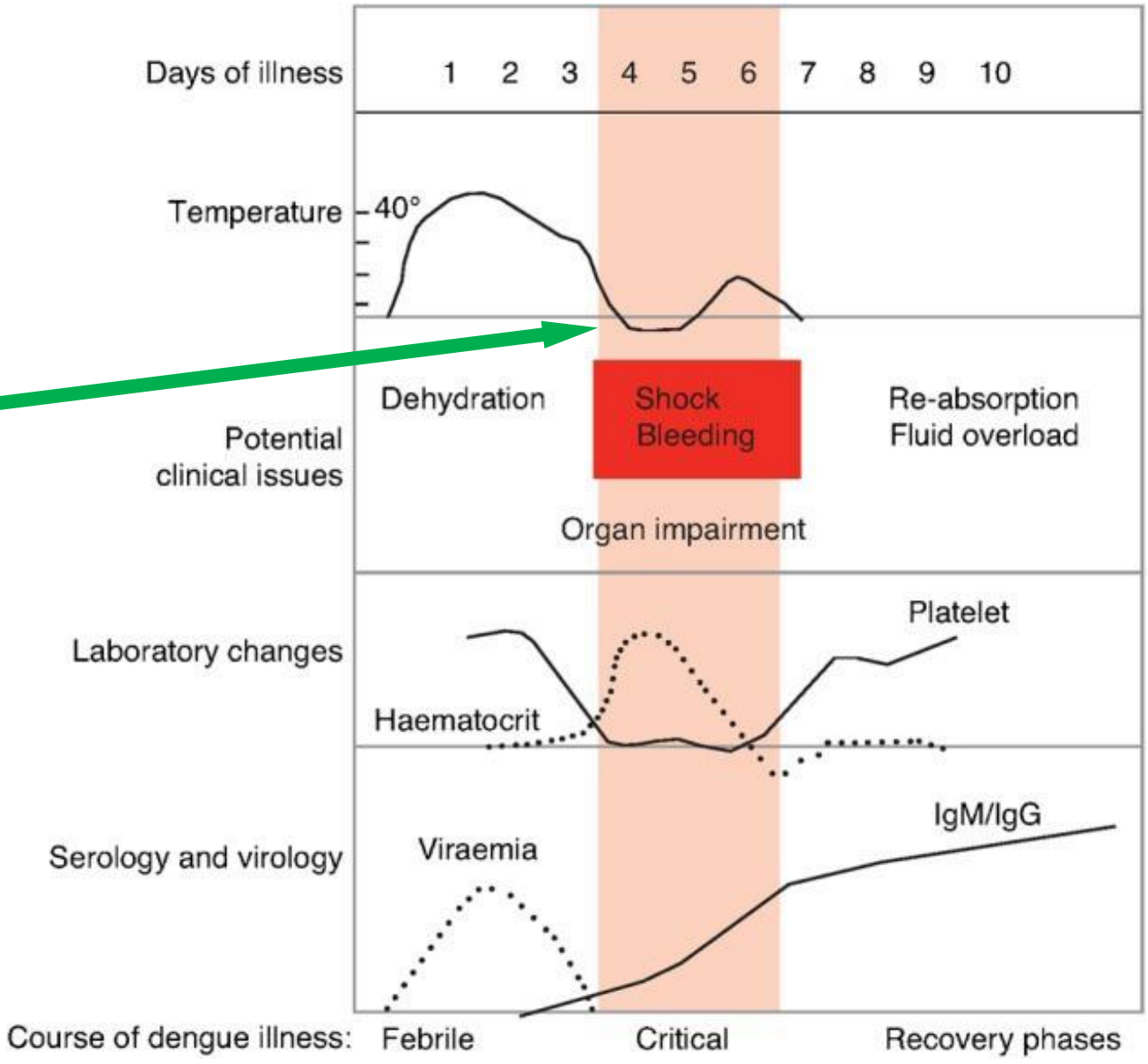


Trends in Microbiology March 2014, Vol. 22, No. 3

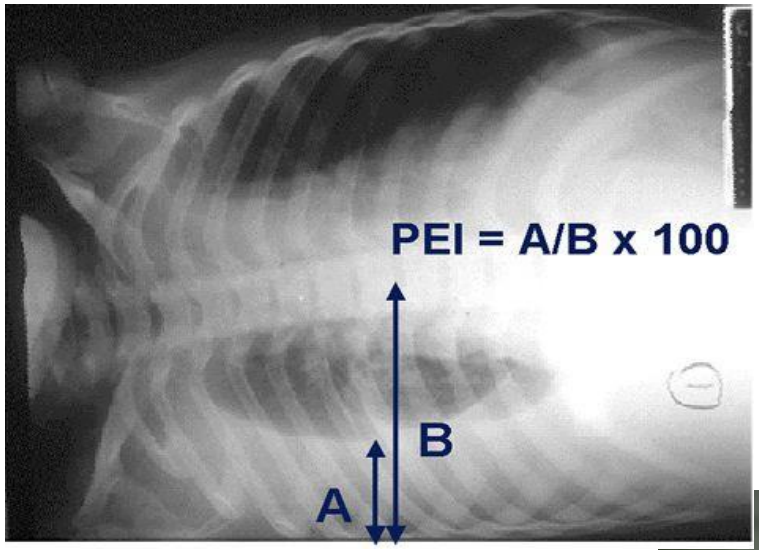
Numerous DENV types co-circulating in a specific geographic region increases the risk for secondary infection and more severe disease.

Dengue Clinical Phases

24-48 hr period around defervescence = danger period for plasma leakage and severe disease



Dengue's Clinical Picture



N ENGL J MED 366;15 NEJM.ORG APRIL 12, 2012

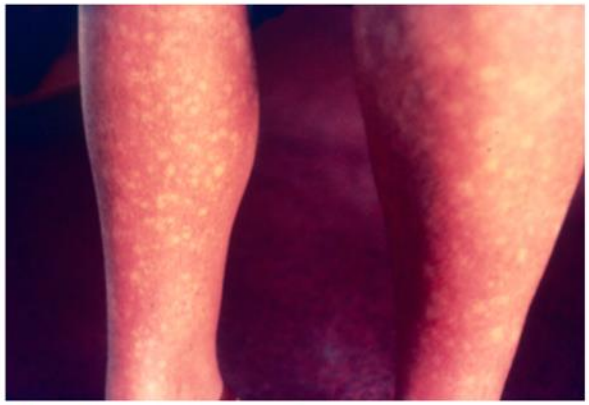
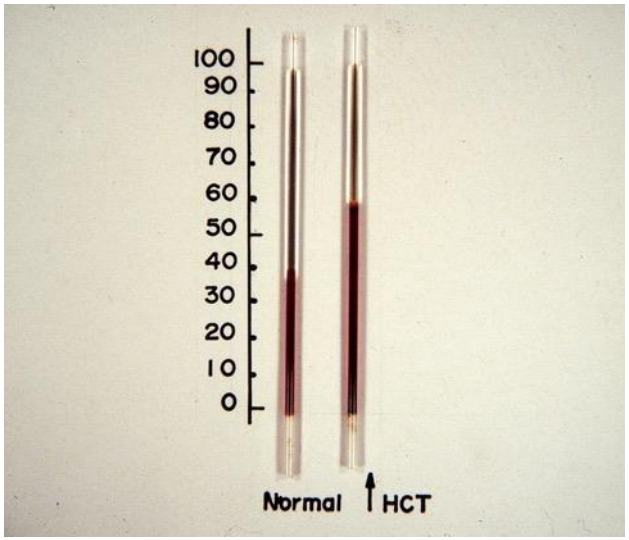


Figure 1: Picture of rash on legs due to dengue fever

http://www.emedicinehealth.com/dengue_fever/article_em.htm

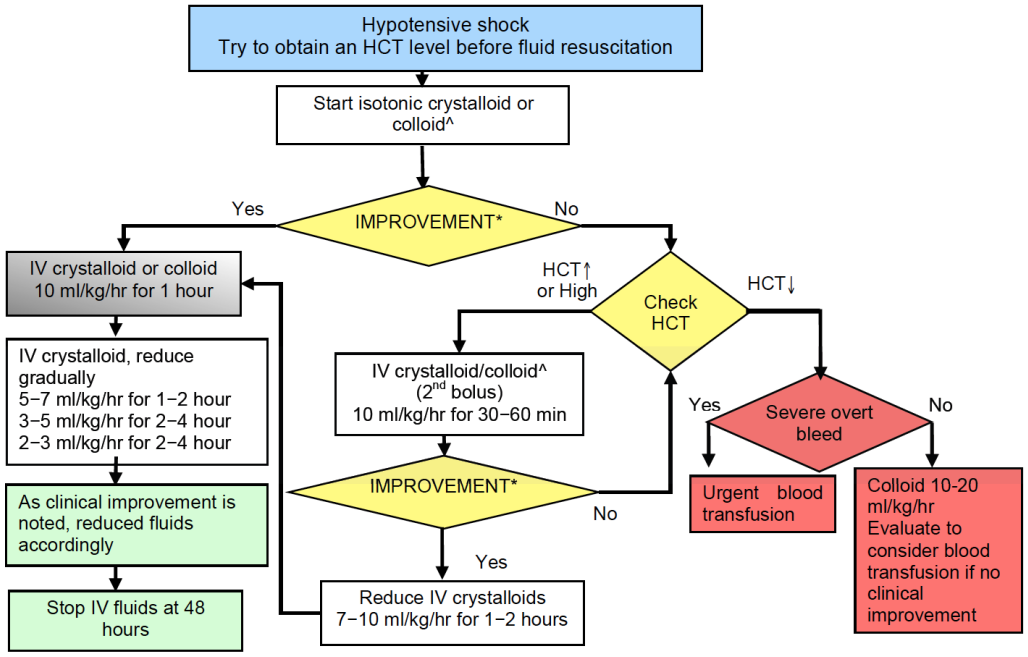


http://www.nytimes.com/slideshow/2008/11/03/health/110408-Dengue_index-4.html

Treating Dengue

© World Health Organization 2012

Fig. 7. Algorithm for fluid management in hypotensive shock – infants, children and adults



^Colloid is preferable if the patient has already received previous boluses of crystalloid
*Reassess the patient's clinical condition, vital signs, pulse volume, capillary refill time and temperature of extremities.
IV = intravenous; HCT = haematocrit; ↑ = increased; ↓ = decreased

WHO Library Cataloguing-in-Publication Data

Handbook for clinical management of dengue.

1.Dengue – therapy. 2.Dengue – diagnosis. 3.Clinical medicine. 4.Handbooks. I.World Health Organization.

ISBN 978 92 4 150471 3 (NLM classification: WC 528)

- Process

  Assess →

  Intervene →

  Reassess →

  Adjust

- Judicious intravascular volume replacement

Entities NOT Covered

- Skin and Soft Tissue Infections
- Multi-Drug Resistant Organisms
- Sexually Transmitted Infections
- Tick Borne Diseases
- Hemorrhagic Fever

Summary

- Infectious Diseases have not been conquered
- A highly expeditionary force is at risk of exposure
- A highly mobile global population transports pathogens
- Biosurveillance, Research & Development, Personal Protective Measures, Collaboration = Risk Mitigation
- Comprehensive and sustained commitment to developing medical countermeasures ensures Force Readiness

UPSTATE
MEDICAL UNIVERSITY
State University of New York

Thank you.

Questions?

The Continued Threat of Infectious Diseases to the U.S. Military

PRESENTED BY:

Stephen Thomas, M.D.

Chief of Infectious Disease, SUNY Upstate Medical

MODERATED BY:

Steve Redifer

2021-01-15

Homeland Defense & Security Information Analysis Center

HDIAC is sponsored by the Defense Technical Information Center (DTIC). Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the Defense Technical Information Center. DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

info@hdiac.org
https://www.hdiac.org