



## Medical Force Protection: Mexico

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Mexico has been assessed as an **INTERMEDIATE-RISK** country, with an overall disease risk that will adversely impact mission effectiveness unless force health protection measures are implemented.

### Major Threats

Diarrhea, respiratory diseases, injuries, hepatitis A, dengue fever, leptospirosis, rabies, Brucellosis, malaria, other arthropod-borne infections, sexually transmitted diseases, heat injury, and Chaga's disease. Raw sewage, industrial wastes, agrochemicals, and salt-water intrusion may contaminate water.

### Requirements before Deployment

1. **Before Deploying report to Medical to:**
  - a. Ensure your Immunizations are up to date, specific immunizations needed for area: **Hepatitis A, MMR, Polio, Typhoid, Yellow fever, Tetanus (Td), and Influenza.**
  - b. If you have not been immunized against Hepatitis A (two dose series over 6 months) get an injection of Immunoglobulin with the initial Hepatitis A dose.
2. **Malaria Chemoprophylaxis:**

**Must include Primaquine terminal prophylaxis** (see "Requirements after deployment")

  - a. **Chloroquine 500 mg/week 2 weeks prior to entering Mexico, and until 4 weeks after departure.**
  - b. **Mefloquine 250 mg/week 2 weeks prior to entering Mexico, until 4 weeks after departure**
  - c. **Doxycycline 100 mg/day 2 days prior to the entering Mexico, until 4 weeks after departure.**
3. **Get HIV testing if not done in the past 12 months.**
4. **Make sure you have or are issued from unit supply: DEET, permethrin, bednets/poles, sunscreen and lip balm. Treat utility uniform and bednet with permethrin.**

### Requirements during Deployment

1. Consume food, water, and ice only from US-approved sources; "**Boil it, cook it, peel it, or forget it**".
2. Involve preventive medicine personnel with troop campsite selection.
3. Practice good personal hygiene, hand-washing, and waste disposal.
4. Avoid sexual contact. If sexually active, use condoms.
5. Use DEET and other personal protective measures against insects and other arthropod-borne diseases. Personal protective measures include but are not limited to proper wear of uniform, use of bed nets, and daily "buddy checks" in tick and mite infested areas.
6. Minimize non-battle injuries by ensuring safety measures are followed. Precautions include hearing and eye protection, enough water consumption, suitable work/rest cycles, acclimatization to environment and stress management.
7. Eliminate food/waste sources that attract pests in living areas.
8. Avoid contact with animals and hazardous plants.
9. Conduct DNBI surveillance per NEHC TM 6490.00-1 (<http://www-nehc.med.navy.mil/downloads/prevmed/weeklydnbi.pdf>)

### Requirements after Deployment

1. Receive preventive medicine debriefing after deployment.
2. Seek medical care immediately if ill, especially with fever.
3. Get HIV and PPD testing as required by your medical department or Task Force Surgeon.
4. Malaria terminal prophylaxis: Primaquine 15 mg/day beginning on day of departure for 14 days unless G-6 PD deficient.
5. **Complete post-deployment health assessment (DD Form 2796)\*** per NEHC TM 6490.00-1 (<http://www-nehc.med.navy.mil/prevmed/epi/depsurv.htm>). The form can be downloaded from the website: [http://amsa.army.mil/deploy\\_surv/DD2796\\_Post\\_Deploy.pdf](http://amsa.army.mil/deploy_surv/DD2796_Post_Deploy.pdf)

\* Mail completed original copy of DD 2795 and 2796 to: Army Medical Surveillance Activity, Building T-20, Room 213 (Attn: Deployment Surveillance), 6900 Georgia Ave, N.W., Washington D.C. 20307-5001



## Vector Risk Assessment Profile (VECTRAP): Mexico

Prepared by: Navy Disease Vector Ecology and Control Center  
Naval Air Station, Jacksonville, FL 32212-0043  
MSG ADDRESS: NAVDISVECTECOLCONCEN JACKSONVILLE FL//MEI//  
PH: (904) 542-2424; DSN: 942-2424  
FAX: (904) 542-4324; DSN FAX: 942-4324  
E-mail: [mei@dveccjax.med.navy.mil](mailto:mei@dveccjax.med.navy.mil)  
<http://dvecc-jax.med.navy.mil/>

1. **GEOGRAPHY:** Mexico is 1,978,000 sq. km (764,000 sq. mi.), about three times the size of Texas. Because of its large size, Mexico has a variety of different terrain and climate. Generally, the northern part of the country ranges from desert to semi-arid and is mountainous. Daytime temperatures can climb above 110° F in the summer, and nights are often cool, with freezing weather in the winter. The East Coast and Yucatan Peninsula are forested lowlands. In the central and southern parts of Mexico, climate changes to semi-tropical and tropical, depending on the elevation. Mountains peak at 18,000 ft above sea level. The population is 100,294,036 (1999), making Mexico the largest Spanish-speaking nation on earth.

### 2. VECTOR-BORNE DISEASES:

a. **MALARIA:** Almost exclusively the benign form (Plasmodium vivax) exists throughout the year in some rural areas that are not often frequented by tourists. The states most affected (in decreasing order) are: Oaxaca, Chiapas, Sinaloa, Campeche, Quintana Roo, Nayarit, Tabasco, Michoacan, Chihuahua, and Hidalgo. In 1986, the states of Chiapas and Oaxaca produced 50 percent of all malaria cases in the country. Plasmodium falciparum has accounted for less than 1% of all the cases in Mexico and occurs only in the rain forest areas near the border with Belize and Guatemala. The state of Chiapas produces most the P. falciparum cases. Plasmodium vivax is common in suburbs of Vera Cruz, Mazatlan, Puerto Vallarta, and Acapulco. The situation is improving; malaria incidence nationwide decreased from 110,000 cases in 1989 to 27,000 cases in 1991 to 16,000 cases in 1992. Malaria is chloroquine sensitive in some rural areas of the country. This disease can severely affect combat readiness.

b. **DENGUE FEVER (DF) AND DENGUE HEMORRHAGIC FEVER (DHF):** DF is endemic in 23 states, being a problem primarily in urban areas. Outbreaks occur at irregular intervals. The degree of risk in Central Mexico is low. Risk on the Pacific Coast is low to moderate while risk along the Gulf Coast is high, particularly from July to September. DHF, while still rare, has occurred sporadically since 1984. During an epidemic of DEN-4 in Merida, Mexico, in 1984, over 5,390 cases were reported, including 9 cases of DHF, 4 of which were fatal. In 1986, outbreaks occurred at high altitudes (1,500 m) in Oaxaca and Puebla. In 1986, reported cases of DF increased to 21,975, with northern Mexico contributing nearly half of the country total. An outbreak occurred during late 1993 in suburban Monterrey in Nuevo Leon State, northern Mexico. In 1994, an outbreak in Yucatan resulted in 134 cases. Another outbreak occurred in early 1995 in Morelos, south of Mexico City. Dengue serotypes 1, 2, and 4 were present in this last outbreak. This disease can severely impair combat effectiveness.

c. **MOSQUITO-BORNE ENCEPHALITIS:** The three types of primary vector borne encephalitides existing in Mexico are: Western Equine Encephalitis (WEE), Venezuelan Equine Encephalitis (VEE), and St. Louis Encephalitis (SLE). The risk of contracting any of them is low, yet the potential for an outbreak exists. A zoonotic outbreak of VEE occurred in 1993 in Chiapas State with 97 equine cases (43 fatal). These diseases can severely impair combat readiness.

d. **CUTANEOUS AND MUCOCUTANEOUS LEISHMANIASIS:** These diseases occur in the northern two-thirds of the Pacific Coastal Region (including Baja California) and the southeastern tip of Mexico; increased incidence follows the rainy season in forested areas. The risk of contracting leishmaniasis in Mexico is low. If acquired, the affect on combat readiness is minimal.

\*Note: only nine cases of visceral leishmaniasis has occurred in Mexico between 1951 - 1989, therefore, it is not considered a disease threat, though it may be present in extremely small amounts. Eight of the nine cases occurred in the Balsas river basin located in the southern states of Guerrero and Puebla.

e. **TICK-BORNE RELAPSING FEVER:** Although endemic to the central portion of Mexico, the incidence appears low. Occurrences of this disease are sporadic and vary with the seasonal activity of the ticks. The risk is low; this disease can severely affect combat readiness.

f. **FLEA-BORNE TYPHUS (MURINE TYPHUS):** This rickettsial infection is considered endemic, yet the incidence is not known. Even though it is a milder disease than louse-borne epidemic typhus, if acquired, it can severely impair combat readiness.

g. **AMERICAN TRYPANOSOMIASIS (CHAGAS' DISEASE):** Chagas' disease is endemic throughout southern and coastal Mexico. The majority of cases originate in rural and semi-urban areas because of poor socioeconomic conditions that provide ample harborage for the domestic vectors. Risk is greatest in rural areas below 1,500 m in: Sonora, Sinaloa, Nayarit, Jalisco, Colima,



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Michoacan, Guerrero, Oaxaca, Chiapas, Vera Cruz, Tabasco, Campeche, Yucatan, Quintana Roo, Durango, Zacatecas, San Luis, Potosi, Mexico, Morelos, and Puebla. Prevalence is considered greatest in the Pacific Coast states from Chiapas to Nayarit, in the Yucatan Peninsula, and in certain places in the Altiplano. Human transmission is accomplished through contact with the infectious feces of these insects. Once acquired, this disease in the acute phase could severely affect combat readiness.

h. ONCHOCERCIASIS: Onchocerca volvulus is a serious health problem in highland areas of southwestern Mexico. It is found between 600 and 1,200 m elevation. The states most affected are Oaxaca, Chiapas, and Guerrero on the highland slopes where coffee is grown. Transmission is most intense during the rainy season, which lasts from May to October. Risk of infection is low when proper preventive measures are taken. If acquired, this disease will have minimal impact on combat effectiveness during short-term operations.

- i. ANIMAL ASSOCIATED DISEASES: Rabies is endemic to Mexico. Consult DISRAP Mexico (NEPMU-5 Box 143 San Diego, CA 92136-5143).
- j. West Nile virus: In 2003 WNV was isolated from birds in Mexico and human infections are predicted to follow.

### 3. DISEASE VECTOR INFORMATION:

a. MALARIA: Anopheles albimanus, Anopheles pseudopunctipennis, Anopheles aztecus, and Anopheles darlingi are the principal vectors of malaria in Mexico. These anophelines bite at night.

Anopheles albimanus is the primary malaria vector in Mexico. It can fly considerable distances in search of blood. Anopheles albimanus larvae are found in sunlit collections of water, such as pools, lakes and lagoons where the water surface is broken by plants or floating algal mats. Algal mats along the edges of slow moving streams provide good breeding habitats. Adults are often found resting outdoors and will readily enter houses to feed. Peak biting hours are from dusk to midnight. This species has shown significant resistance to all four major classes of insecticides.

Secondary vectors include: Anopheles pseudopunctipennis, Anopheles darlingi, and Anopheles aztecus.

Anopheles pseudopunctipennis is a highland mosquito with a wide variety of breeding sites. These include shallow pools, seepages, drying streambeds, and other similar water impoundment's. This species rests outdoors but will readily enter dwellings to feed on humans and dogs. In some areas, An. pseudopunctipennis is resistant to all 4 major insecticide categories. This mosquito is the primary malaria vector in nearly two-thirds of the country's malaria endemic areas.

Anopheles darlingi prefers shaded habitats, which include fresh water marshes, lagoons, swamps, lakes, ponds and edges of streams, especially those with vegetation. It feeds mainly on man indoors and will remain indoors after feeding.

Anopheles aztecus is commonly found at altitudes of 1,500-2,200 m. A variety of breeding sites are used, from pools, ponds and lakes, to canals containing polluted water. This species will bite man indoor and outdoors.

b. DENGUE FEVER (DF) AND DENGUE HEMORRHAGIC FEVER (DHF): The principal vector of DF and DHF in Mexico is Aedes aegypti. This highly domestic mosquito will feed on a number of hosts, though human blood is preferred. Aedes aegypti has a propensity for biting on the lower part of the legs and ankles. This species prefers to breed in artificial containers near human dwellings. Some man-made habitats include discarded tires, cans, bottles, cisterns, roof gutters, and any item, which holds fresh water. Additionally, this species will breed in natural containers such as tree holes, bamboo stumps, coconut shells, and even large snail shells. Adult females readily enter houses and other buildings. They usually rest in dark corners, under tables, chairs or beds, in mosquito nets and among clothing. They can be found resting at any time of the day or evening. Aedes albopictus, a secondary vector of dengue fever, is found in at least 13 Mexican states. It has similar biting and breeding habits as A. aegypti, except that it tends to be found more often in rural areas in natural settings such as leaf axils, stagnate pools of water and tree holes as well as artificial containers. Aedes albopictus has recently been discovered in Coahuila, which has a common border with Texas.

c. MOSQUITO-BORNE ENCEPHALITIS: SLE is vectored by Culex quinquefasciatus and Culex tarsalis. WEE is vectored by Culex tarsalis. A wide variety of mosquito genera have been found naturally infected with VEE but their precise role in the epidemiology of the disease is not clearly understood.

Culex tarsalis is most often associated with agricultural usage of water, principally rice fields, in both coastal and valley areas. This species will readily bite man and birds at night. Various birds function as the natural reservoir for both SLE and WEE viruses.



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Culex quinquefasciatus is found near human habitations and can be a severe nuisance. It characteristically breeds in foul water, cesspools, shallow wells and similar impoundment's. It generally feeds at night with a peak biting period in the early evening hours.

d. FLEA-BORNE TYPHUS (MURINE TYPHUS): Commensal rodents (Rattus rattus, and R. norvegicus) are considered the primary reservoirs. The Oriental rat flea, Xenopsylla cheopis, is the principle vector, but other fleas and reservoir species may be involved. Fleas live in close association with their respective hosts. The larval stages are usually found in the rodent nest.

e. TICK-BORNE RELAPSING FEVER: Ornithodoros species are the vectors. These Argasid (soft) ticks are "nest" parasites and normally live in sheltered places such as crevices and similar locations in dwellings and caves. They will feed frequently but only at night. Feral rodents are the natural reservoirs for this disease.

f. AMERICAN TRYPANOSOMIASIS (CHAGAS DISEASE): Reduviid bugs (kissing bugs) transmit this disease. Rhodnius prolixus is the principle vector of Chagas' Disease and Triatoma dimidata is considered an important secondary vector.

Rhodnius prolixus is well adapted to houses and is essentially a domestic species. It can be found from 20 to 2,600 m above sea level and has the ability to occupy a number of different habitats outside of human dwellings. This species has a strong preference for man and can be found in large numbers and all life stages inside houses. It generally prefers thatched roofs of palm where it can easily conceal itself. Triatoma dimidata is peridomestic and moderately well adapted to domestic conditions as well as having wild populations. These vectors are generally associated with dirt floors, poor sanitary conditions of dwellings, and piles of firewood. It has a longer life cycle and is a less aggressive feeder than R. prolixus.

g. ONCHOCERCIASIS: This filarial infection (River Blindness) is transmitted by several species of black flies. Simulium ochraceum is the principle vector. This species usually breeds in small streams in highly wooded, coffee growing areas. These small flies bite only in the daytime. Only adult female flies feed on blood. The larvae and pupae are normally attached to aquatic plants or rocks and require well-oxygenated water to develop. They show a strong preference for humans and can be, at times, vicious biters. Black flies have flight ranges of 10 miles or more.

h. CUTANEOUS AND MUCOCUTANEOUS LEISHMANIASIS: Sand flies of the genus Lutzomyia are the vectors of leishmaniasis. These insects are generally night-biters, but will bite during the day if disturbed. A relatively weak flier, the sand fly is active when there is little or no wind and travels in characteristic "short hops" close to the ground.

### 4. DISEASE VECTOR CONTROL PROGRAMS:

a. Prevention and Control: The conscientious use of personal protective measures will help to reduce the risk of many vector-borne diseases. Protection from mosquitoes and other biting flies can be accomplished by the use of screened eating and sleeping quarters (insect bar NSN 7210-00-266-9736) and by limiting the amount of outside activity during the evening/night hours whenever possible. If necessary, space spray with d-Phenothrin (NSN 6840-01-412-4634) within quarters.

Personal protective measures should be initiated at sundown in the prevention of malaria, JE and filariasis. Keeping the body covered, such as rolling shirtsleeves down, will deter mosquito biting. The use of DEET 33% lotion (2 oz. tubes: NSN 6840-01-284-3982) or DEET 75% repellent (2 oz. bottles: NSN 6840-00-753-4963) during daylight and evening/night hours is recommended for protection against mosquitoes, sand flies, other biting flies and also against mites and fleas. Additional protection can be achieved through the use of DEET jackets (NSN 8415-01-035-0846 =Sm. 0847 =Med. 0848 =Lrg) and through the use of 0.5% Permethrin aerosol clothing repellent (NSN 6840-01-278-1336). Chemical control of vectors may be necessary in areas where avoidance is impractical.

Avoid tick-infested areas when feasible. Using a buddy system, search total body area every 3-4 hours for attached ticks. Prompt removal of ticks may prevent potential disease transmission. DEET or Permethrin aerosol spray may be used as a tick and mite repellent when applied to clothing. The blousing of trouser legs will deter tick biting.

The most important element of a vector control program involving Aedes aegypti and A. albopictus is SOURCE REDUCTION. The number of mosquitoes will be greatly reduced by the elimination of all water holding containers in areas close to human habitation. Tin cans, tires, broken pottery, plant vases and similar items must be emptied weekly, be eliminated or stored as to prevent further mosquito breeding. Sand or mortar can be used to fill tree holes and rock holes found near encampments. In areas where it is necessary to store water for drinking, ensure the container has a tight fitting lid or apply Temephos (Abate) larvicide at 1 ppm.

Rodent control should be implemented only after satisfactory flea or mite control has been accomplished.



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Filth fly control should be considered a priority to prevent outbreaks of enteric infections such as Shigellosis. Flytek® and/or Apache® fly baits (NSN 6840-01-183-7244) may be considered for use.

Recommended pesticides, by vector group, can be found in Technical Information Memorandum # 24, Contingency Pest Management Pocket Guide, Armed Forces Pest Management Board, Walter Reed Army Medical Center, Washington, D.C. 20307-5-001.

Units should contact NEPMU-6, Box 112, Pearl Harbor, HI 96860-5040 (PLAD: NAVENPVNTMEDU SIX, PEARL HARBOR HI) for current chemoprophylactic and additional preventive measures.

### Important References:

Contingency Pest Management Pocket Guide-Fourth Edition. Technical Information Memorandum(TIM)24. Available from the Defense Pest Management Information Analysis Center (DPMIAC) (DSN: 295-7479 COMM: (301) 295-7479). Best source for information on vector control equipment, supplies, and use in contingency situations.

Control of Communicable Diseases Manual-Edited by A. S. Benenson. Sixteenth Ed. 1995. Available to government agencies through the Government Printing Office. Published by the American Public Health Association. Excellent source of information on communicable diseases.

Medical Environmental Disease Intelligence and Countermeasures-MEDIC. September 1997. Available on CD-ROM from Armed Forces Medical Intelligence Center, Fort Detrick, Frederick, MD 21702-5004. A comprehensive medical intelligence product that includes portions of the references listed above and a wealth of additional preventive medicine information.

Internet Sites- Additional information regarding the current status of vector-borne diseases in this and other countries may be found by subscribing to various medical information sites on the internet. At the Centers of Disease Control and Prevention home page subscriptions can be made to the Morbidity and Mortality Weekly Report(MMWR)and the Journal of Emerging Infectious Diseases. The address is [www.cdc.gov](http://www.cdc.gov). The World Health Organization Weekly Epidemiology Report (WHO-WER) can be subscribed to at [www.who.int/wer](http://www.who.int/wer). The web site for PROMED is [www.promedmail.org:8080/promed/promed.folder.home](http://www.promedmail.org:8080/promed/promed.folder.home). Although PROMED is not peer reviewed, it is timely and contains potentially useful information. The CDC and WHO reports are peer reviewed. Information on venomous arthropods such as scorpions and spiders as well as snakes, fish and other land animals can be found at the International Venom and Toxin Database website at [www.uq.edu.au/~ddbfr/](http://www.uq.edu.au/~ddbfr/). Information on anti-venom sources can also be found at that site. Information on Poisonings, Bites and Envenomization as well as poison control resources can be found at [www.invivo.net/bg/poison2.html](http://www.invivo.net/bg/poison2.html).

**USERS OF THIS VECTRAP:** Please notify NDVECC Bangor, or the appropriate NEPMU, if you acquire any medical entomology information that can be used to update this VECTRAP.

**CUSTOMER SURVEY:** In order to improve our VECTRAPs we would like your opinions on the quality and quantity of information contained in them. Please take time to fill out the survey which is contained as an attachment and Fax or e-mail your response back to us. Thank you for your cooperation.

ADDITIONAL INFORMATION ON DISEASE VECTOR SURVEYS, CONTROL AND SPECIMEN ID's WILL BE PROVIDED UPON REQUEST.