

Traveler's Handout

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Protection Against Mosquitoes, Ticks, and Other Insects and Arthropods

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Although vaccines or chemoprophylactic drugs are available to protect against some important vector-borne diseases such as yellow fever and malaria, travelers still should be advised to use repellents and other general protective measures against biting arthropods. The effectiveness of malaria chemoprophylaxis is variable, depending on patterns of drug resistance, bio-availability, and compliance with medication, and no similar preventive measures exist for other mosquito-borne diseases such as dengue or chikungunya.

CDC recommends the use of products containing active ingredients that have been registered by the U.S. Environmental Protection Agency (EPA) for use as repellents applied to skin and clothing (see below). EPA registration of active ingredients indicates the materials have been reviewed and approved for efficacy and human safety when applied according to the instructions on the label.

General Protective Measures

- **Avoid outbreaks:** To the extent possible, travelers should avoid known foci of epidemic disease transmission. The CDC Travelers' Health webpage provides alerts and information on regional disease transmission patterns and outbreak alerts (www.cdc.gov/travel).
- **Be aware of peak exposure times and places:** Exposure to arthropod bites may be reduced if travelers modify their patterns of activity or behavior. Although mosquitoes may bite at any time of day, peak biting activity for vectors of some diseases (e.g. yellow fever, zika, dengue, chikungunya) is during daylight hours. Vectors of other diseases (e.g. malaria, West Nile, Japanese Encephalitis) are most active in twilight periods (i.e., dawn and dusk) or in the evening after dark. Avoiding the outdoors or focusing preventive actions during peak hours may reduce risk. Place also matters; ticks are often found in grasses and other vegetated areas. Local health officials or guides may be able to point out areas with greater arthropod activity.
- **Wear appropriate clothing:** Travelers can minimize areas of exposed skin by wearing long-sleeved shirts, long pants, boots, and hats. Tucking in shirts and wearing socks and closed shoes instead of sandals may reduce risk. Repellents or insecticides such as permethrin can be applied to clothing and gear for added protection; this measure is discussed in detail below.
- **Check for ticks:** Travelers should be advised to inspect themselves and their clothing for ticks during outdoor activity and at the end of the day. Prompt removal of attached ticks can prevent some infections.
- **Bed nets:** When accommodations are not adequately screened or air conditioned, bed nets are essential to provide protection and to reduce discomfort caused by biting insects. If bed nets do not reach the floor, they should be tucked under mattresses. Bed nets are most effective when they are treated with an insecticide or repellent such as permethrin. Pretreated, long-lasting bed nets can be purchased prior to traveling, or nets can be treated after purchase. The permethrin will be effective for several months if the bed net is not washed. (Long-lasting pretreated nets may be effective for much longer.)
- **Insecticides:** Aerosol insecticides, vaporizing mats and mosquito coils can help to clear rooms or areas of mosquitoes; however, some products available internationally may contain pesticides that are not registered in the United States. Insecticides should always be used with caution, avoiding direct inhalation of spray or smoke.
- **Optimum protection can be provided by applying the repellents described in the following sections to clothing and to exposed skin.**

Repellents for Use on Skin and Clothing

CDC has evaluated information published in peer-reviewed scientific literature and data available from EPA to identify several EPA-registered products that provide repellent activity sufficient to help people avoid the bites of disease-carrying mosquitoes. Products containing the following active ingredients typically provide reasonably long-lasting protection:

- **DEET** (chemical name: *N,N*-diethyl-*m*-toluamide or *N,N*-diethyl-3-methyl-benzamide). Products containing DEET include but are not limited to Off!, Cutter, Sawyer, and Ultrathon.
- **Picaridin** (KBR 3023, aka Bayrepel, and icaridin outside the United States; chemical name 2-(2-hydroxyethyl)-1-piperidinecarboxylic acid 1-methylpropyl ester). Products containing picaridin include but are not limited to Cutter Advanced, Skin So Soft Bug Guard Plus and Autan (outside the United States).
- **Oil of lemon eucalyptus*** or **PMD** (chemical name: *para*-menthane-3,8-diol) the synthesized version of oil of lemon eucalyptus. Products containing OLE and PMD include but are not limited to Repel.
- **IR3535** (chemical name: 3-[*N*-butyl-*N*-acetyl]-aminopropionic acid, ethyl ester) Products containing IR3535 include but are not limited to Skin so Soft Bug Guard Plus Expedition.

**Note:* This recommendation refers to EPA-registered repellent products containing the active ingredient oil of lemon eucalyptus (or PMD). “Pure” oil of lemon eucalyptus (e.g., essential oil) is not the same product and has not received similar, validated testing for safety and efficacy, is not registered with EPA as an insect repellent, and is not covered by this recommendation.

EPA characterizes the active ingredients DEET and picaridin as “conventional repellents” and oil of lemon eucalyptus, PMD, and IR3535 as “biopesticide repellents,” which are derived from natural materials.

Repellent Efficacy

- Published data indicate that repellent efficacy and duration of protection vary considerably among products and among mosquito species.
- Product efficacy and duration of protection are also markedly affected by ambient temperature, amount of perspiration, exposure to water, abrasive removal, and other factors.
- In general, **higher concentrations of active ingredient provide longer duration of protection**, regardless of the active ingredient. Products with $\leq 10\%$ active ingredient may offer only limited protection, often from 1–2 hours.
- Products that offer **sustained release or controlled release** (i.e., micro-encapsulated) formulations, even with lower active ingredient concentrations, **may provide longer protection times**.
- Studies suggest that concentrations of DEET above $\sim 50\%$ do not offer a marked increase in protection time against mosquitoes (i.e., DEET efficacy tends to plateau at around 50%).
- Regardless of what product is used, if travelers start to get mosquito bites they should reapply the repellent according to the label instructions or leave the area with biting insects if possible.

Repellents should be purchased before traveling and can be found in hardware stores, drug stores and supermarkets. A wider variety of repellents can be found in camping, sporting goods, and military surplus stores. When purchasing repellents overseas, look for the EPA-registered active ingredients on the product labels; some names of products available internationally have been specified above.

Repellents and Sunscreen

Repellents that are applied according to label instructions may be used with sunscreen with no reduction in repellent activity. Products that combine sunscreen and repellent are not recommended, because sunscreen may need to be reapplied with greater frequency and in greater amounts than are needed to provide protection from biting insects. **In general, the recommendation is to apply sunscreen first, before applying the repellent.**

Repellents/Insecticides for Use on Clothing

- Clothing, shoes, bed nets, mesh jackets, and camping gear can be treated with permethrin for added protection.
- Products such as Permanone and Sawyer permethrin are registered with EPA specifically for this use.
- Permethrin is a highly effective insecticide and repellent. Permethrin-treated clothing repels and kills ticks, mosquitoes, and other arthropods. Clothing and other items must be treated several days in advance of travel to allow them to dry. As with all pesticides, follow the label instructions when using permethrin clothing treatments. Alternatively, clothing pretreated with permethrin is commercially available (e.g., products from Buzz Off/Insect Shield).
- Permethrin-treated materials retain repellency/insecticidal activity after repeated laundering but should be retreated as described on the product label to provide continued protection. Clothing treated with the other repellent products described above (e.g., DEET) provides protection from biting arthropods but will not last through washing and will require more frequent reapplications.

Precautions when Using Insect Repellents

- Apply repellents only to exposed skin and/or clothing, as directed on the product label. Do not use repellents under clothing.
- Never use repellents over cuts, wounds or irritated skin.
- Do not apply repellents to eyes or mouth, and apply sparingly around ears. When using sprays, do not spray directly on face—spray on hands first and then apply to face. Wash hands after application to avoid accidental exposure to eyes.
- Do not allow children to handle repellents. When using on children, adults should apply repellents to their hands first, and then put it on the child. It may be advisable to avoid applying to children's hands.
- Use just enough repellent to cover exposed skin and/or clothing. Heavy application and saturation are generally unnecessary for effectiveness. If biting insects do not respond to a thin film of repellent, apply a bit more.
- After returning indoors, wash treated skin with soap and water or bathe. This is particularly important when repellents are used repeatedly in a day or on consecutive days. Also, wash treated clothing before wearing it again. (This precaution may vary with different repellents— check the product label.)
- If anyone experiences a rash or other bad reaction from an insect repellent, the repellent use should be discontinued, the repellent should be washed off with mild soap and water, and a local poison control center should be called for further guidance. If seeking health care because of the repellent, take the repellent to the doctor's office and show the doctor.
- Permethrin should never be applied to skin, but only to clothing, bed nets, or other fabrics as directed on the product label.

Children

- Most repellents can be used on children >2 months of age.
- Protect infants <2 months of age from biting mosquitoes by using an infant carrier draped with mosquito netting with an elastic edge for a tight fit.
- Products containing oil of lemon eucalyptus specify that they should not be used on children <3 years of age.
- Other than the safety tips listed above, EPA does not recommend any additional precautions for using registered repellents on children or on pregnant or lactating women.

Useful Links

- U.S. Environmental Protection Agency. Using Insect Repellents Safely; [updated 2012 July 2; cited 2013 Jun 20]. Available from: <http://epa.gov/pesticides/insect/safe.htm>
- Centers for Disease Control and Prevention. Insect Repellent Use and Safety; [updated 2013 Jun 7; cited 2013 Jun 20]. Available from: www.cdc.gov/westnile/faq/repellent.html
- Health Canada's Pest Management Regulatory Agency. Insect Repellents; [updated 2012 Nov 2; cited 2013 Jun 20]. Available from: <http://www.hc-sc.gc.ca/hl-vs/iyh-vsv/life-vie/insect-eng.php>.

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2. Barnard DR, Bernier UR, Posey KH, et al. Repellency of IR3535, KBR3023, *para*-menthane-3,8- diol, and deet to Black Salt Marsh mosquitoes (Diptera: Culicidae) in the Everglades National Park. *J Med Entomol*. 2002;39(6):895–9.
3. Fradin MS, Day JF. Comparative efficacy of insect repellents against mosquito bites. *N Engl J Med*. 2002;347(1):13–8.
4. Murphy ME, Montemarano AD, Debboun M, et al. The effect of sunscreen on the efficacy of insect repellent: a clinical trial. *J Am Acad Dermatol*. 2000;43(2 Pt 1):219–22.
5. Thavara U, Tawatsin A, Chompoosri J, et al. Laboratory and field evaluations of the insect repellent 3535 (ethyl butylacetylaminopropionate) and deet against mosquito vectors in Thailand. *J Am Mosq Control Assoc*. 2001;17(3):190–5.

From the Yellow Book:

<http://wwwnc.cdc.gov/travel/yellowbook/2010/chapter-2/protection-against-mosquitoes-ticks-insects-arthropods.aspx>

Travelers' Diarrhea

Travelers' diarrhea is the most common travel-related illness. It can occur anywhere, but the highest-risk destinations are in most of Asia (except for Japan) as well as the Middle East, Africa, Mexico, and Central and South America. In otherwise healthy adults, diarrhea is rarely serious or life-threatening, but it can certainly make for an unpleasant trip. Take steps to avoid diarrhea when you travel.

Prevention

Eat & Drink Safely

Choose foods and beverages carefully to lower your risk of diarrhea (see [Food & Water Safety](#)). Eat only food that is cooked and served hot. (Avoid, for example, food that has been sitting on a buffet.) Eat raw fruits and vegetables only if you have washed them in clean water or peeled them. Drink only beverages from factory-sealed containers, and avoid ice (because it may have been made from unclean water).

Keep Your Hands Clean

Wash your hands often with soap and water, especially after using the bathroom and before eating. If soap and water aren't available, use an alcohol-based hand sanitizer. In general, it's a good idea to keep your hands away from your mouth.

Bismuth subsalicylate

Bismuth subsalicylate (Pepto-Bismol, Kaopectate) reduces the incidence of travelers' diarrhea by approximately 50% when taken daily (2 ounces of liquid or 2 chewable tablets, taken 4 times per day).

Treatment

Fluid Replacement

People with diarrhea should drink lots of fluids to stay hydrated. This is especially important for young children or adults with chronic illnesses. In serious cases of travelers' diarrhea, oral rehydration solution—available online or in pharmacies in developing countries—can be used for fluid replacement.

Over-the-Counter Drugs

For many travelers who have only mild or moderate diarrhea, symptom management may be an acceptable way to keep going so you don't miss out on vacation activities or business commitments. Several drugs, such as Lomotil or Imodium, can be bought over-the-counter to treat the symptoms of diarrhea. These drugs decrease the frequency and urgency of needing to use the bathroom, and they may make it easier for a person with diarrhea to ride on a bus or airplane if they are not taking antibiotics or while waiting for an antibiotic to take effect. It is generally better to use Imodium only, for the first 24 hours, since this disease is usually self-limited.

Antibiotics

Many travelers carry antibiotics with them so they can treat diarrhea early if they start to get sick. The choice of antibiotics varies depending on the destination. Due to an increase in multidrug-resistant intestinal pathogens travelers are encouraged to reserve antibiotic self-treatment for severe diarrhea. What constitutes "severe" diarrhea is subjective and will vary by the traveler and specific context, but knowing that antibiotic use contributes to acquiring an infection with a resistant strain may encourage many travelers to adhere to preventive measures and symptom management.

Traveler's Diarrhea cont.

Infants and Children

If the children develop diarrhea, they may become dehydrated. Severe dehydration generally doesn't occur unless there is both diarrhea and vomiting. You can use an oral rehydration solution (ORS). ORS consists of a solution of salts and sugars. The packets need to be mixed with boiled or treated water. Read the instructions carefully. Discard after 12 hours if kept at room temperature, 24 hours if kept refrigerated. They are widely available at stores and pharmacies in most developing countries. Make sure any liquid taken is in a sealed container. If it tastes funny, don't drink it even if it appears to be sealed. Gatorade® or Pedialyte® help prevent dehydration due to diarrhea and/or vomiting. Check with your pediatrician for a recommendation for an over-the-counter anti-diarrhea medication specifically for the children's ages. If the diarrhea becomes persistent or reoccurring and has blood in it, you need to seek medical attention.

Here is an excellent website recommended by the CDC. <http://www.healthychildren.org/English/health-issues/conditions/abdominal/Pages/Treating-Dehydration-with-Electrolyte-Solution.aspx>

The majority of the above information is online: <http://wwwnc.cdc.gov/travel/page/travelers-diarrhea>

Heat Problems

Travelers to tropical countries may develop heat-related illnesses. A few principles may be helpful in preventing and treating heat injury.

Contributing Factors:

- **Age and Illness:**
Elderly people and those of any age who have previously suffered heat stroke are particularly susceptible to heat injury. Excessive heat may not only cause injury itself, but may also aggravate underlying medical illnesses, such as congestive heart failure.
- **Exercise:**
Metabolic heat production increases with exertion; this inner source of heat is the most important in producing heat injury, which can occur even at outdoor temperatures as low as 16 C (about 60 F). The risk of injury rises with increasing temperature, humidity, and solar radiation (direct exposure to the sun). The most important mechanism for losing heat during exercise is evaporation of sweat; when relative humidity increases, less sweat evaporates and thus less heat is dissipated or lost. Too much clothing, particularly heavy, impermeable clothing, also decreases evaporation of sweat.
- **Drugs:**
Patients taking phenothiazines, butyrophenones, antihistamines, anticholinergics, diuretics, beta-blockers, or alcohol may have impaired ability to sweat or regulate body heat. Sympathomimetic amines, particularly cocaine and amphetamine derivatives, may increase metabolic heat production.

Acclimatization:

Only partial tolerance to heat can be acquired by training at lower temperatures. Weeks of pretraining in a hot environment can maximize efficiency in regulating one's temperature during exercise and beneficially produce lower skin and body temperature, increased production of sweat, and a lower sweat sodium concentration. However, a substantial part of the improved tolerance may be lost after as little as six days without continued exposure to heat.

Prevention:

Elderly patients or those with compromised cerebral function may not be thirsty despite fluid depletion and should be encouraged to maintain adequate fluid intake. The dosage of any drug that affects fluid balance or temperature regulation should be adjusted during hot weather to avoid adverse effects.

People engaged in strenuous exercise in hot weather should drink water more frequently than thirst dictates. Runners should drink 100 to 300 ml of water or a hypotonic glucose-electrolyte solution (Gatorade; and others) 10 to 15 minutes before beginning a race, and should drink about 250 ml every three to four kilometers. Medical Letter consultants do not recommend salt tablets; fluid losses during exercise are much greater than electrolyte losses.

Runners should be encouraged to splash themselves with water as often as possible to cool the skin by subsequent evaporation and should be advised that symptoms such as nausea, headache, dizziness, difficulty in speaking, or an altered gait may be early signs of heat injury.

Clinical Signs:

The first symptoms and signs of heat injury include faintness, nausea, vomiting, increased body temperature, headache, piloerection (gooseflesh) on the chest or upper arms, chills, overbreathing, muscle cramps, and an unsteady gait. Abrupt mental disturbances ranging from incoherent speech to deep unconsciousness can occur. "Heat stroke" usually refers to body temperatures higher than 40 to 41 C (104 to 105.8 F) and severe

mental changes, such as delirium or coma. Even though the classic signs of heat stroke include anhidrosis (absence of sweating), some patients with heat injury may sweat freely. True heat stroke produces a variety of serious blood and biochemical changes including lysis of red blood cells, increases in sodium and potassium levels, decrease in glucose levels and abnormalities which reflect muscle damage or clotting problems. The most serious complications of heat injury which may be fatal include convulsions (especially during therapeutic cooling), heart attack and kidney and liver failure.

Treatment:

Heat injury can be treated successfully if cooling measures are begun early. Less severe symptoms ("heat exhaustion") can be treated with oral fluids and by sprinkling water over the patient and fanning to enhance evaporation and heat loss or by applying ice packs to the head, neck, abdomen, axillae, and groin. In patients who have altered consciousness, low blood volume can be corrected by fairly rapid intravenous administration of one liter of a glucose-in- hypotonic saline solution over 30 minutes, or one to two liters over four hours. Expert medical care is required.

For treatment of heat stroke, total immersion in ice and cold water and rigorous ice massage under a fan can be lifesaving. "Cooling units," in which the patient is placed on a net, sprayed with water, and fanned with warm air have also been used; they have the advantage of not causing shivering, but whether they are as effective as ice water immersion remains to be established. Administration of intravenous fluids should be carefully monitored in patients with heat stroke because they may have heart damage from extreme hyperthermia and/or their kidneys may not be able to excrete excess fluid.

Additional Information:

CDC Traveler's Health, Problems with Heat and Cold, <http://wwwnc.cdc.gov/travel/yellowbook/2012/chapter-2-the-pre-travel-consultation/problems-with-heat-and-cold>.

Deep Vein Thrombosis

Deep vein thrombophlebitis (DVT) (local inflammation of a deep vein with a blood clot) mainly occurs in the legs (generally, the calf), causing pain and swelling. However, even if there are no apparent signs of DVT, a thrombus (clot) in the leg can break off and reach the lung (pulmonary embolism). The larger the embolus, the more dangerous, which means that vein thromboses in the thigh, while less common, are more dangerous than clots in the calf. Pulmonary embolism produces chest pain and difficulty breathing, and may be serious or even fatal.

Most but not all studies have indicated a relationship between immobility during long haul flights or drives and DVT. Thromboembolic disease may not necessarily appear during the extended flight or drive but rather in the hours or days afterwards. This is why a physician should be consulted whenever a person experiences any new post-travel breathing difficulty or chest pain or new swelling or pain in the leg.

Risk factors for thromboembolic disease in general:

High:

- Post-thrombosis status (recent DVT, receiving chronic treatment for DVT)
- Recent immobilization (major surgery or accident in the last 6 weeks)
- Serious underlying or chronic illness
- Cancer
- Known predisposition to abnormal blood clotting

Moderate:

- Age >60
- Obesity
- Estrogen therapy
- Cardiac insufficiency (congestive heart failure)
- Pronounced venous insufficiency
- Dehydration (e.g. resulting from diarrhea)
- Pregnancy
- Smoking

Recommendations for preventing thromboembolic disease during travel:

- **Low risk**
If the flight (or bus trip, etc.) is less than 6 hours and none of the risk factors mentioned apply, then no specific preventive measures need to be taken. Travelers should move their feet and legs regularly and drink fluids.
- **Medium risk**
If the flight (or bus trip, etc.) is longer than 6 hours (and especially if > 12 hours) and one of the moderate risk factors applies, then the following preventive measures should be taken: Travelers should wear compression stockings, move their feet and legs, walk around, drink abundant fluids, avoid alcohol, tea and coffee (which favor dehydration).
Treatment with aspirin or even low molecular weight heparin (anticoagulant) might also be considered.
- **High risk**
If the flight (or bus trip, etc.) is longer than 6 hours (and especially if > 12 hours) and one of the high risk factors applies, then travelers should certainly consult their physician about receiving heparin (low molecular weight) and should take the preventive measures indicated above.

What to Pack in Your Travel Health Kit

<http://wwwnc.cdc.gov/travel/content/pack-smart.aspx#travelhealthkit>

Use this list to help you think of things to pack in your travel health kit. Be sure to think about where you are going and whether you will have access to health items and supplies.

Medicines

- **Prescription medicines you usually take**
 - If you have a severe allergy and epinephrine has been prescribed by your doctor, bring your Epinephrine auto-injector (for example, an EpiPen).
- **Special prescriptions for the trip**
 - Medicines to prevent malaria, if needed
 - Antibiotic prescribed by your doctor for self-treatment of moderate to severe diarrhea
- **Special note about prescription medicines**
 - Pack your prescription medications in your carry-on luggage.
 - Pack copies of all prescriptions, including the generic names for medications.
 - Pack a note on letterhead stationery from the prescribing physician for controlled substances and injectable medications.
 - Leave a copy of your prescriptions at home with a friend or relative.
 - Check with the American Embassy or Consulate to make sure that your medicines will be allowed into the country you are visiting. Some countries do not let visitors bring certain medicines into the country.
- **Over-the-counter medicines**
 - Anti-diarrheal medication (for example, bismuth subsalicylate, loperamide)
 - Antihistamine
 - Decongestant, alone or in combination with antihistamine
 - Anti-motion sickness medication
 - Medicine for pain or fever (such as acetaminophen, aspirin, or ibuprofen)
 - Mild laxative
 - Cough suppressant/expectorant
 - Cough drops
 - Antacid
 - Antifungal and antibacterial ointments/creams.
 - 1% hydrocortisone cream

Other important items

- **Supplies to prevent illness or injury**
 - Insect repellent containing DEET (30%-50%) or picaridin (up to 15%)
 - Sunscreen (preferably SPF 15 or greater) that has both UVA and UVB protection
 - Antibacterial hand wipes or alcohol-based hand sanitizer containing at least 60% alcohol
 - Lubricating eye drops

- **First-aid supplies**
 - First aid quick reference card
 - Basic first-aid items (bandages, gauze, ace bandage, antiseptic, tweezers, scissors, cotton-tipped applicators)
 - Moleskin for blisters
 - Aloe gel for sunburns
 - Digital thermometer
 - Oral rehydration solution packets
- **Health insurance card (either your regular plan or supplemental travel health insurance plan) and copies of claim forms**

Other items that may be useful in certain circumstances

- Mild sedative or other sleep aid from primary care provider
- Medicine to prevent altitude sickness
- Water purification tablets
- Commercial suture/syringe kits to be used by local health-care provider. (These items will also require a letter on letterhead stationery from your primary care physician.)
- Latex condoms
- Child safety seats
- Bicycle helmet