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## Chapter 2

### The Pretravel Consultation

#### *Counseling & Advice for Travelers*

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Chapter 2 - Food Poisoning from Marine Toxins

Chapter 2 - Sun Exposure

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## Protection against Mosquitoes, Ticks, & Other Arthropods

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John-Paul Mutebi, William A. Hawley, William G. Brogdon

Vaccines or prophylactic drugs are available to protect against some vectorborne diseases such as yellow fever, Japanese encephalitis, and malaria; however, travel health practitioners should advise travelers to use repellents and other general protective measures against biting arthropods. The effectiveness of malaria prophylaxis is variable, depending on patterns of drug resistance, bioavailability, and compliance with medication, and no similar preventive measures exist for other mosquitoborne diseases such as dengue, chikungunya, Zika, and West Nile encephalitis, or tickborne diseases such as Lyme borreliosis, tickborne encephalitis, and relapsing fever.

The Environmental Protection Agency (EPA) regulates repellent products in the United States. CDC recommends that consumers use repellent products that have been registered by EPA. EPA registration indicates the materials have been reviewed and approved for both 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 website provides updates on regional disease transmission patterns and outbreaks ([www.cdc.gov/travel](http://www.cdc.gov/travel) (<http://www.cdc.gov/travel>)).

**Be aware of peak exposure times and places.** Exposure to arthropod bites may be reduced if travelers modify their patterns or locations of activity. Although mosquitoes may bite at any time of day, peak biting activity for vectors of some diseases (such as dengue, Zika, and chikungunya) is during daylight hours. Vectors of other diseases (such as malaria) are most active in twilight periods (dawn and dusk) or in the evening after dark. Avoiding the outdoors or taking preventive actions (such as using repellent) during peak biting hours may reduce risk. Place also matters; ticks and chiggers are often found in grasses, woodlands, or other vegetated areas. Local health officials or guides may be able to point out areas with increased 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, tucking pants into socks, and wearing closed shoes instead of sandals may reduce risk. Repellents or insecticides, such as permethrin, can be applied to clothing and gear for added protection. (Additional information on clothing is below.)

**Check for ticks.** Travelers should 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. Showering within 2 hours of being in a tick-infested area reduces the risk of some tickborne diseases.

**Bed nets.** When accommodations are not adequately screened or air conditioned, bed nets are essential in providing protection and reducing 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 a pyrethroid insecticide. Pretreated, long-lasting bed nets can be purchased before traveling, or nets can be treated after purchase. Effective, treated nets may also be available in destination countries. Nets treated with a pyrethroid insecticide will be effective for several months if they are not washed. Long-lasting pretreated nets may be effective for much longer.

**Insecticides and spatial repellents.** More spatial repellent products are becoming commercially available. These products, containing active ingredients such as metofluthrin and allethrin, augment aerosol insecticide sprays, vaporizing mats, and mosquito coils that have been available for some time. Such products can help to clear rooms or areas of mosquitoes (spray aerosols) or repel mosquitoes from a circumscribed area (coils, spatial repellents). Although many of these products appear to have repellent or insecticidal activity under particular conditions, they have not yet been adequately evaluated in peer-reviewed studies for their efficacy in preventing vectorborne disease. Travelers should supplement the use of these products with repellent on skin or clothing and using bed nets in areas where vector-borne diseases are a risk or biting arthropods are noted. Since some products available internationally may contain pesticides that are not registered in the United States, it may be preferable for travelers to bring their own. Insecticides and repellent products 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 ([Box 2-04](#)).**

#### **Box 2-04. Maximizing protection from mosquitoes and ticks**

To optimize protection against mosquitoes and ticks and reduce the risk of diseases they transmit:

- Wear a long-sleeved shirt, long pants, and socks.
- Treat clothing with permethrin or purchase pretreated clothing.
  - Permethrin-treated clothing will retain repellent activity through multiple washes.
  - Repellents used on skin can also be applied to clothing but provide shorter duration of protection (same duration as on skin) and must be reapplied after laundering.

- Apply lotion, liquid, or spray repellent to exposed skin.
- For Mosquitoes
  - Ensure adequate protection during times of day when mosquitoes are most active.
  - Dengue, yellow fever, Zika, and chikungunya vector mosquitoes bite mainly from dawn to dusk.
  - Malaria, West Nile, and Japanese encephalitis vector mosquitoes bite mainly from dusk to dawn.
  - Use common sense. Reapply repellents as protection wanes and mosquitoes start to bite.
- For Ticks
  - Check yourself daily (your entire body) and remove attached ticks promptly.

## 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 types of EPA-registered products that provide repellent activity sufficient to help people reduce 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 [Bayrepel] and icaridin outside the US; 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 US).
- **Oil of lemon eucalyptus (OLE)** or **PMD** (chemical name: para-menthane-3,8-diol), the synthesized version of OLE. Products containing OLE and PMD include, but are not limited to, Repel and Off ! Botanicals. This recommendation refers to EPA-registered products containing the active ingredient OLE (or PMD). “Pure” oil of lemon eucalyptus (essential oil not formulated as a repellent) is not recommended; it has not undergone similar, validated testing for safety and efficacy and is not registered with EPA as an insect repellent.
- **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 and SkinSmart.
- **2-undecanone** (chemical name: methyl nonyl ketone). The product BioUD contains 2-undecanone.

EPA characterizes the active ingredients DEET and picaridin as “conventional repellents” and OLE, PMD, IR3535, and 2-undecanone as “biopesticide repellents,” which are either derived from or are synthetic versions of natural materials.

### Repellent Efficacy

Published data indicate that repellent efficacy and duration of protection vary considerably among products and among mosquito and tick species. Product efficacy and duration of protection are also markedly affected by ambient temperature, level of activity, 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 <10% active ingredient may offer only limited protection, often 1–2 hours.

Products that offer sustained-release or controlled-release (microencapsulated) formulations, even with lower active ingredient concentrations, may provide longer protection times. Studies suggest that concentrations of DEET above approximately 50% do not offer a marked increase in protection time against mosquitoes; DEET efficacy tends to plateau at a concentration of approximately 50%. CDC recommends using products with  $\geq 20\%$  DEET on exposed skin to reduce biting by ticks that may spread disease.

Recommendations are based on peer-reviewed journal articles and scientific studies and data submitted to regulatory agencies. People may experience some variation in protection from different products. Regardless of what product is used, if travelers start to get insect bites they should reapply the repellent according to the label instructions, try a different product, or, if possible, leave the area with biting insects.

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

### Repellency Awareness Graphic

The Environmental Protection Agency (EPA) allows companies to apply for permission to include a new repellency awareness graphic on the labels of insect repellents that are applied to the skin ([Figure 2-01](#)). The graphic helps consumers easily identify the time a repellent is effective against mosquitoes and ticks. EPA reviews products that apply to use the graphic to ensure that their data meet current testing protocols and standard evaluation practices. Use of this graphic by manufacturers is voluntary. For more information, visit [www.epa.gov/insect-repellents/repellency-awareness-graphic](http://www.epa.gov/insect-repellents/repellency-awareness-graphic) (<http://www.epa.gov/insect-repellents/repellency-awareness-graphic>).

### Repellents and Sunscreen

Repellents that are applied according to label instructions may be used with sunscreen with no reduction in repellent activity; however, limited data show a one-third decrease in the sun protection factor (SPF) of sunscreens when DEET-containing insect repellents are used after a sunscreen is applied. Products that combine sunscreen and repellent are not recommended, because sunscreen may need to be reapplied more often and in larger amounts than needed for the repellent component to provide protection from biting insects. In general, the recommendation is to use separate products, applying sunscreen first and then applying the repellent. Due to the decrease in SPF when using a DEET-containing insect repellent after applying sunscreen, travelers may need to reapply the sunscreen more frequently.

### Repellents and Insecticides for Use on Clothing

Clothing, hats, shoes, bed nets, jackets, and camping gear can be treated with permethrin for added protection. Products such as Permanone and Sawyer, Permethrin, Repel, and Ultrathon Permethrin Clothing Treatment are registered with EPA specifically for use by consumers to treat clothing and gear. Alternatively, clothing pretreated with permethrin is commercially available, marketed to consumers in the United States as Insect Shield, BugsAway, or Insect Blocker.

Permethrin is a highly effective insecticide, acaricide and repellent. Permethrin-treated clothing repels and kills ticks, chiggers, mosquitoes, and other biting and nuisance arthropods. Clothing and other items must be treated 24–48 hours in advance of travel to allow them to dry. As with all pesticides, follow the label instructions when using permethrin clothing treatments.

Permethrin-treated materials retain repellency or insecticidal activity after repeated laundering but should be retreated, as described on the product label, to provide continued protection. Clothing that is treated before purchase is labeled for efficacy through 70 launderings. Clothing treated with the other repellent products described above (such as DEET) provides protection from biting arthropods but will not last through washing and will require more frequent reapplications.

## Precautions when Using Insect Repellents

Travelers should take the following precautions:

- Apply repellents only to exposed skin or clothing, as directed on the product label. Do not apply repellents under clothing.
- Never use repellents over cuts, wounds, or irritated skin.
- When using sprays, do not spray directly on face—spray on hands first and then apply to face. Do not apply repellents to eyes or mouth, and apply sparingly around ears.
- Wash hands after application to avoid accidental exposure to eyes or ingestion.
- Children should not handle repellents. Instead, adults should apply repellents to their own hands first, and then gently spread on the child's exposed skin. Avoid applying directly to children's hands. After returning indoors, wash your child's treated skin and clothing with soap and water or give the child a bath.
- Use just enough repellent to cover exposed skin 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 repellent-treated skin with soap and water or bathe. Wash treated clothing before wearing it again. This precaution may vary with different repellents—check the product label.

If a traveler experiences a rash or other reaction, such as itching or swelling, from an insect repellent, the repellent should be washed off with mild soap and water and its use discontinued. If a severe reaction has occurred, a local poison-control center should be called for further guidance, if feasible. Travelers seeking health care because of the repellent should 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 and Pregnant Women

Most repellents can be used on children aged >2 months. Protect infants aged <2 months from mosquitoes by using an infant carrier draped with mosquito netting with an elastic edge for a tight fit. Products containing OLE specify that they should not be used on children aged <3 years. 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.

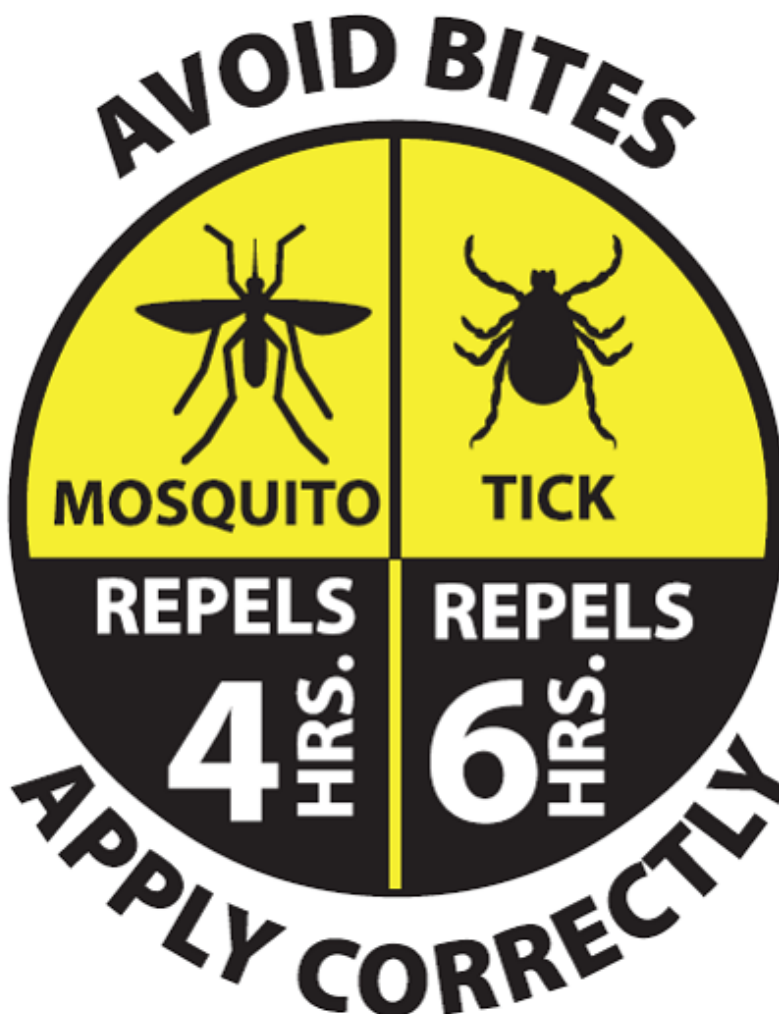
## Useful Links

- Insect Repellents: Use and Effectiveness (EPA): <http://cfpub.epa.gov/oppref/insect/> (<http://cfpub.epa.gov/oppref/insect/>)

- Using Insect Repellents Safely (EPA): [www.epa.gov/insect-repellents/using-insect-repellents-safely-and-effectively](http://www.epa.gov/insect-repellents/using-insect-repellents-safely-and-effectively) (<http://www.epa.gov/insect-repellents/using-insect-repellents-safely-and-effectively>).
- FAQ: Insect Repellent Use and Safety (CDC): [www.cdc.gov/westnile/faq/repellent.html](http://www.cdc.gov/westnile/faq/repellent.html) (<http://www.cdc.gov/westnile/faq/repellent.html>).
- Choosing and Using Insect Repellents (National Pesticide Information Center): <http://npic.orst.edu/ingred/ptype/repel.html> (<http://npic.orst.edu/ingred/ptype/repel.html>).

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**Figure 2-01. Sample repellency awareness graphic for skin-applied insect repellents<sup>1</sup>**



**View Larger Figure** ([http://www.cdc.gov/travel-static/yellowbook/2016/figure\\_2-01.png](http://www.cdc.gov/travel-static/yellowbook/2016/figure_2-01.png)).

<sup>1</sup> Image from: [www.epa.gov/insect-repellents/repellency-awareness-graphic](http://www.epa.gov/insect-repellents/repellency-awareness-graphic) (<http://www.epa.gov/insect-repellents/repellency-awareness-graphic>).

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There has been a recent resurgence in bed bug infestations worldwide, particularly in developed countries. Although bed bugs do not transmit diseases, their bites may be a nuisance. Travelers can take measures to avoid bed bug bites and avoid transporting them in luggage and clothing ([Box 2-05](#)).

### **Box 2-05. Bed bugs and international travel**

A recent resurgence in bed bug infestations worldwide, particularly in developed countries, is thought to be related to the increase in international travel, pest control strategy changes in travel lodgings, and insecticide resistance. Bed bug infestations have been increasingly reported in hotels, theaters, and any locations where people congregate, even in the workplace, dormitories, and schools. Bed bugs may be transported in luggage and on clothing. Transport of personal belongings in contaminated transport vehicles is another means of spread of these insects.

Bed bugs are small, flat insects that are reddish-brown in color, wingless, and range from 1 to 7 mm in length. Although bed bugs have not been shown to transmit disease, their bites can produce strong allergic reactions and considerable emotional stress.

### **PROTECTIVE MEASURES AGAINST BED BUGS**

Travelers should be encouraged to take the following precautions to avoid or reduce their exposure to bed bugs:

- Inspect the premises of hotels or other sleeping locations for bed bugs on mattresses, box springs, bedding, and furniture, particularly built-in furniture with the bed, desk, and closets as a continuous structural unit. Travelers who observe evidence of bed bug activity—whether it be the bugs themselves or physical signs such as blood-spotting on linens—should seek alternative lodging.
- Keep suitcases closed when they are not in use and try to keep them off the floor.
- Remove clothing and personal items (such as toiletry bags and shaving kits) from the suitcase only when they are in use.
- Carefully inspect clothing and personal items before returning them to the suitcase.
- Keep in mind that bed bug eggs and nymphs are very small and can be easily overlooked.

Prevention is by far the most effective and inexpensive way to protect oneself from these pests. The costs of ridding a personal residence of these insects are considerable, and efforts at control are often not immediately successful even when conducted by professionals.

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Chapter 2 - Food Poisoning from Marine Toxins

Chapter 2 - Sun Exposure

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