

# Good night, sleep tight, don't let the bedbugs bite

By Lynne Dees, PhD, NREMT-P



*Bedbug photo from iStockphoto.*

## Scenario

For the last couple of shifts, a paramedic at Station 5 noticed a few tiny blood spots on his bed linens as he left his bunk at the end of duty. He innocently assumed that he had cut himself shaving or had acquired a small scratch while making runs that day. However, when he awoke on the third shift with his arms covered with hundreds of small, red, itchy bumps, he suspected something more sinister. At the end of his shift he discussed the situation with the incoming crew and discovered that a coworker who slept in the same bunk also experienced similar signs and symptoms. Skillful deduction indicated the infestation of some type of insect, and further investigation revealed that the fire station bedroom was the home of bedbugs.

## History and habits

Although myriad hazards face EMS providers while on duty, one of the more unconventional and inconceivable includes bedbug infestations. Fortunately, bedbug

bites are not known to transmit disease (Goddard & deShazo, 2009), and although only slightly more than a nuisance for most bite victims, infestations can cost employees and employers thousands of dollars in medical bills, preventive measures and professional extermination.

The bedbug problem is not a recent one. These bloodsuckers originally lived exclusively in caves and fed on bats (Panagiotakopulu & Buckland, 1999), later besieging other mammals such as rodents and birds. Bedbug remains discovered in ancient Egyptian archaeological sites indicate an association with man for at least 3500 years (Panagiotakopulu & Buckland). Classical Greek historians Aristophanes, Pliny, Aristotle and Dioscorides chronicled the nuisance of bedbugs (Anderson & Leffler, 2008; Panagiotakopulu & Buckland). Bedbugs persisted in the eighteenth century British Isles, and interestingly, the wealthy suffered more from bedbug infestations than the poor because they could afford to

heat their homes with coal rather than peat. The fuel difference resulted in warmer homes that were more conducive to bug breeding (Panagiotakopulu & Buckland). Even today, people who can afford to travel are at higher risk of acquiring and moving bedbugs from location to location. This pest knows no socioeconomic boundaries and is not related to a lack of hygiene.

The bedbug population was at its height in the 1920s and 1930s in the United States (Berg, 2010), with an estimated 30 percent of American homes infested during pre-World War II times (Gangloff-Kaufmann & Pichler, 2008). During the mid-twentieth century, America's bedbug population waned to its lowest number. However, in the last three decades, a formidable resurgence has occurred (Goddard & deShazo, 2009). Several factors have led to the recrudescence of the tiny bloodsuckers, especially in urban settings.

The banishment of dichlorodiphenyltrichloroethane (DDT) in the United States on December 31, 1972 (U.S. Environmental Protection Agency [EPA], 2009) removed a pesticide that had been used with success to control cockroaches with a secondary benefit of controlling bedbugs. However, bedbug resistance to DDT had already been seen as early as 1948 (Gangloff-Kauffman & Shultz, 2003). More recently, pyrethrin, an extract from daisies that is also used in pet flea treatments, has shown promise, but bedbugs are similarly beginning to display resistance (Romero, Potter, & Haynes, 2007; 2009). Insect sprays and foggers have been shunned by consumers who maintained concerns related to danger to pets, children and the environment. Entomologists and

exterminators are currently working in earnest to develop another form of control.

An increase in travel, particularly international travel, moved bedbugs quickly from place to place, even across continents from countries with a more pronounced bug population. Immigrants also have transported bugs from one geographical setting to another in luggage, furniture, and other belongings.

Because infestations in the United States were in decline for decades, public awareness about bedbugs was essentially nonexistent until recently. As a result, when the public finally realized that a problem existed, it was already of epidemic proportions.

Finally, shipping and transport of cargo has entrapped bugs and their eggs in boxes and crates, sending them perhaps thousands of miles from their origin. In 2010, a number of New York clothing stores including Abercrombie & Fitch, Victoria's Secret, Juicy Couture, and Nike temporarily closed for extermination. Trained bedbug-sniffing dogs are now being utilized to detect infestations.

## Physiology

*Cimex lectularius* L. (*Cimex* derived from the Roman designation for bug and *lectularius* from the Latin name for couch or bed) (Goddard & deShazo, 2009) is a wingless blood-sucking ectoparasite (external parasite) that is similar to head lice. Its size can range from one to seven millimeters in length, or approximately the size of Lincoln's head on a penny. Relatively flat, the unfed brownish bedbug looks like crinkled paper, and is covered with short, golden hairs. It becomes longer, more cylindrical, and reddish after a blood meal. Bedbugs seek warmth and carbon dioxide, which attracts them to sleeping humans and animals, usually



in the early hours of the morning. The creature injects into the skin an anesthetic and anticoagulant with one tube while extracting blood from the victim with a sucking tube. Although it can travel more than 100 feet nightly, the bedbug usually congregates within one to two meters of its sleeping victims (Goddard & deShazo; U.S. Centers for Disease Control and Prevention [CDC] & U.S. Environmental Protection Agency [EPA], 2010) and hides during the daytime. Its small size and flat shape allow it to hide along the creases



*Bedbug bites. Photo from iStockphoto.*

and seams in mattresses and box springs in addition to the backside of headboards and behind electrical outlet plates and baseboards. Since the bugs cannot jump or fly, they must rely upon crawling to reach their victim.

A bedbug's life span is approximately one year, and it can breed all year in a warm environment. Females can lay 200 to 400 eggs annually; hatch time for the eggs is 6 to 17 days (Texas A&M University, 2008), and blood meals are required at several stages of life (Gangloff-Kaufmann & Shultz, 2003). *C. lectularius* can survive up to 18 months without a blood meal (Anderson & Leffler, 2008; Berg, 2010; Goddard & deShazo, 2009), making short-term human evacuation from a residence ineffective.

Environmental evidence of the presence of bedbugs includes excrement in the form of brown stains along the seams

of mattresses and box springs in addition to eggs, shed skins, and bugs behind baseboards, headboards, electrical outlets, hanging pictures and clutter stacked against walls. Luggage and backpacks may house bedbugs in cracks and crevices. Tiny blood spots may occur on bedding as the victim rolls over in his or her sleep, consequently squashing the bedbug. In heavily infested rooms, a sweet smell of rotten raspberries may prevail. Live bugs may also be viewed crawling around on surfaces, especially at night.

### **Preventing bedbug transport**

Prevention includes employing awareness and care when responding to EMS runs as well as using caution in personal affairs. Firefighters and EMS providers should avoid sitting or leaning upon upholstered furniture, beds and carpeting, including upholstery in vehicles while responding to EMS calls. Although the likelihood of transporting live bugs on clothing is slim, the sticky eggs could adhere to bunker gear, uniforms or footwear. In addition, rescuers should avoid placing medical bags on suspect surfaces. Some fire departments now mandate that rescuers wear disposable shoe covers when responding to residences and assign designated personnel to hold all medical bags rather than leaving them on the floor or furniture. Bunker gear and equipment should not be taken into station living quarters. When contamination is suspected, gear can be placed in a closed automobile and left in the sun in a hot climate for 24 hours or run through a clothes dryer. Uniforms should be laundered in hot water and left at the station or workplace. Apparel should not be taken home, where family and private domiciles could be exposed. Even if infestation at the workplace is not evident,

zippered mattress and box springs covers should be used to eliminate the bugs' hiding places, and beds should be moved away from walls.

Bedbugs have been known to infest not only residences, but also department stores, hotels, offices, jails, schools, college dormitories, public transportation vehicles and even movie theaters. Caution is advised when responding to any type of scene. In a Denver, Colorado, attic fire, bedbugs fled from the blaze and sought refuge on firefighters' equipment and turnout gear (Nicholson, 2010). Fire stations in numerous American cities have been infested, including Cincinnati, Albuquerque, San Diego and Phoenix.

In one's personal life, care should be taken especially while traveling. Hotel rooms and quarters on cruise ships or train compartments should be surveyed for evidence of bedbugs before unpacking belongings. Signs of bedbugs should immediately be reported to management. Suitcases, clothing and shoes should not be stored on the floor, and care should be taken to not allow bed linens to come in contact with floor surfaces. Bedbugs cannot easily navigate smooth surfaces (Gangloff-Kaufmann & Shultz, 2003), so some travelers profess storing luggage and shoes on tile bathroom floors. One EMT stated that whenever they return from a vacation, his family unpacked suitcases, duffel bags and backpacks in the garage and then immediately cycles all clothing through the laundry before it is allowed in the house. Dryer heat kills bedbugs in all life stages, as will laundering with hot water. Care should also be taken when purchasing items from garage sales or resale shops, especially upholstered items, and all items should be inspected and laundered if possible before introduction into the home.

## **Eliminating bedbug infestations**

A concerted effort to eliminate hiding places for bedbugs will lessen their prevalence. For example, clutter should be reduced in the home as well as the work quarters, cracks and crevices in the walls should be painted and/or caulked, loose paneling or wallpaper should be inspected and repaired. Floors and carpets should be vacuumed often and the vacuum cleaner bag contents disposed of frequently.

Professional treatment of an infestation includes the use of steam heat and/or extreme cold with carbon dioxide along with specialized applications of pesticides to kill bedbugs in all life stages. Unfortunately, do-it-yourself pesticides generally drive the pests deeper into crevices and walls, failing to eliminate the problem and increasing the difficulty for professional exterminators to reach the bug populations. The Centers for Disease Control and Prevention (CDC) and the Environmental Protection Agency (EPA) recommend integrated pest management (IPM), which is an effective and environmentally sensitive approach used by exterminators that is most effective in conjunction with participation by residents (CDC & EPA, 2010).

## **Responding to bedbug-related calls**

EMTs and paramedics may be called to assess and identify cutaneous symptoms of bedbug bites. Part of the EMS profession's evolving responsibilities includes public health education, and EMS providers should be accordingly educated and aware so they can advise patients of suspected bedbug bites and resources to contact for help. EMS also may play a role in alleviating fear and rumors regarding the pest and the ramifications of an infestation.

Because of the increased attention

given to the problem by the news media, EMS may be increasingly summoned by patients who feel that they have been infested with the parasites, complete with real or imagined itching or crawling skin sensations. Rescuers should remember that such symptoms, including any visual sign of bites could be attributed to other insects, mites, allergies, medical conditions or psychiatric problems. Because bedbug infestations are difficult to control, rescuers may also respond to individuals who have accidentally poisoned themselves while attempting to eradicate bedbugs by using aerosol foggers or even illegal pesticide products.

Signs and symptoms of bites include small, pink, pruritic bumps that may resemble mosquito bites or pustules similar to those seen in fire ant bites. If the victim's scratching infects the site, a secondary infection may develop, which can include folliculitis, cellulitis and eczematoid dermatitis (Goddard & deShazo). At times, multiple bites in straight lines or clusters may be visible (Buchanan & Cleary, 2006). Uninfected bites usually resolve in 3 to 10 days; however, hives (urticaria) may be seen and/or anaphylaxis can occur due to an inflammatory response. Proteins present in the bedbug's saliva can instigate mild to severe allergic reactions in up to 30 percent of all victims (Goddard & DeShazo), sometimes requiring antipruritic lotions, antihistamines and even prescribed corticosteroids. Anemia has been reported in those patients with age extremes within heavily infested residences, and asthma has been linked to the presence of bedbugs, as with the presence of cockroaches (Gangloff-Kaufmann & Pichler, 2008).

Finally, firefighters may be called to respond to fires or explosions caused by residents who may have attempted

to eradicate their bedbugs by methods of heating rooms with propane grills, fogging near an open flame, or by applying pesticides to mattresses or personal belongings. As a result, EMS providers may be required to treat burns, explosion injuries, or poisonings.

Federal and state public health entities have attacked this problem with zeal. In fact, the Second National Bedbug Summit was convened on February 1 and 2, 2011, in Washington, D.C., and several states have published guidelines related to controlling the pest. Numerous resources available on the Internet include information helpful for EMTs and paramedics in their personal as well as professional lives. Cornell University sponsors an online comprehensive guide for prevention and management of the pest (Gangloff-Kaufmann & Pichler, 2008), and Texas A&M maintains an informational webpage with numerous illustrations (Texas A&M, 2008). Bedbugs are difficult to eradicate, and with no demonstrated effectiveness in repellents (Goddard & deShazo, 2009) or pesticide residuals (Romero, Potter, & Haynes, 2009), prevention promises to provide the most advantageous action in controlling the pest in the workplace as well as in the home.

### **Scenario solution**

Quick recognition and a comprehensive treatment plan eliminated the bedbug problem at Station 5. The paramedic's immune response to his bedbug bites was remedied with antipruritic lotion, diphenhydramine, and a course of corticosteroids. To allow for professional extermination, the rescuers were moved out of their quarters for two weeks. Interestingly, the exterminators found evidence of bedbugs in the presence of shed bedbug skins; however, only two live

bugs were found. Although no conclusive source for the pests was identified, the paramedic has reevaluated and modified his behavior when traveling and also while responding to EMS calls, and a continuing education module increased the EMS professionals' awareness and dispelled rumors regarding the pest.

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Contact: [nancy.rosas@dshs.state.tx.us](mailto:nancy.rosas@dshs.state.tx.us)