

Guidelines for Prevention and Management of Bed Bugs in Shelters and Group Living Facilities

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State IPM Program, Cornell University
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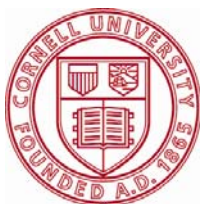
Produced for the New York City Department of Homeless Services, in cooperation with the New York City Department of Health and Mental Hygiene and the New York State Integrated Pest Management (IPM) Program, Cornell University.

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Summary

This publication covers bed bug prevention, management and control, education and awareness, and is specifically geared toward public agencies and private or public housing administrators and their facilities management teams. It is applicable to other types of living situations, though techniques and recommendations may need to be adapted. Fact sheets listed at the end are intended to be used as stand-alone educational document for residents, housekeepers, medical and social service providers, and others as needed. Detailed information about the use of pesticides for managing bed bugs is not covered in this book, but can be found in *The Bed Bug Handbook* (Pinto, Cooper and Kraft 2008).

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Introduction

What are bed bugs?

Bed bugs are insects of the Order Hemiptera and Family Cimicidae, which has over 90 species around the world and 15 in North America. Bed bugs and their relatives are wingless, blood-feeding parasites of animals. The common bed bug (*Cimex lectularius*) is a pest of humans this species has recently become a problem in the United States and countries all over the world.



Bed bug adult and egg. Photo by J. Gangloff-Kaufmann.

Bed bugs have three basic life stages; egg, nymph, and adult. They begin as a very small but visible egg, hatch to become a first instar nymph or juvenile, which is 1 millimeter long or about the size of a poppy seed. There are five juvenile stages, which feed on blood, molt and grow over time. The adult is about the size of an apple seed.

Bed bugs tend to gather together in hidden and undisturbed places where a person sleeps, or sits for an extended period of time. They are usually found in the bed, along the seams and sides of the mattress and box spring, the headboard, and bed frame, creating clusters of live bed bugs, shed skins, dark-colored fecal spots, and eggs. In heavily infested locations bed bugs can be found anywhere in the room. As bed bugs grow they shed their amber-colored, transparent skins, leaving behind what look like hollow bed bugs.

A fecal spot, the result of bed bug digestion, may look like a brownish-black bump on a hard surface, or a dark stain (like a magic marker dot) on fabric. Eggs are cemented to fabric, wood, paper, and most other surfaces as the female hides or wanders in search of a host.

Bed bugs, cast skins, eggs and fecal matter on the wood under a bed. Photo by P. Stravino.



Where did bed bugs come from?

It is unclear exactly why and from where bed bugs re-emerged as a pest in our homes, dormitories, hotels, and shelters, but the resurgence was noticed throughout the world in the late 1990's. During pre-World War II times, it was estimated that nearly 30% of American

homes had bed bugs. After World War II, many long-lasting pesticides were commonly used indoors. Bed bugs were nearly absent for 50 years in America. However, stories and reports indicate that bed bugs may never have truly disappeared in America but they were very uncommon, until recently.

What is the risk of having bed bugs?

Bed bugs must bite to feed on blood. They have pointed mouth parts, like mosquitoes, and feed for just a few minutes at a time. They must feed to grow and although they primarily feed at night, bed bugs will bite during the day if necessary. Bed bugs have never been shown to transmit disease to humans. The most common symptom of bed bug bites are itchy welts on the skin of most but not all sufferers. Reactions vary widely from person to person and bites alone cannot be used to confirm bed bugs. Bites may develop secondary infections through scratching. Anemia has been reported in the elderly and very young in cases where homes are heavily infested. Asthma has also been linked to the presence of bed bugs in homes, though not yet in the United States.



Bed bug bites. Photo by L. Sorkin.

More risks can arise with the use of insecticides to treat bed bug problems in the home, particularly when individuals attempt to eradicate bed bugs without the help or advice of a professional pest manager. People with no pesticide application experience are using total release aerosol foggers (“bug bombs”), professional products, and sometimes illegal products to attempt to control bed bugs in their homes. The impact on public health from overexposure to pesticides used to control bed bugs is unknown. The New York City Department of Health and Mental Hygiene strongly discourages the use of “bug bombs” and foggers because of the potential of human exposure to insecticides and the risk of device explosions.

Bed bugs can be transferred among people, and that places a great deal of social, emotional and financial stress on sufferers. Control is challenging and costly, and there is still a certain amount of social stigma attached to living with bed bugs. Having bed bugs may restrict the social lives of people. Sufferers avoid visiting friends and family and often throw away belongings, at great cost, and minimal benefit. Tenant-landlord disputes over who is responsible continue to take place and these battles can be damaging to both parties.

How can we get rid of them?

Pesticides alone, or the use of any single method, will not eliminate bed bugs. A strategy that includes a number of methods is absolutely necessary, especially in multiple unit facilities like apartments, shelters, dormitories, group homes, and hotels. The following are needed for effective bed bug control:

- Cooperation of landlord, management, and resident to focus on the problem
- Accurate identification to be sure it is a bed bug and not another pest
- Identification of the source (especially if bed bugs are moving from an adjacent room or apartment unit)
- Thorough inspection of the facility and identification of all possible hiding spots

- Cleaning and organization of the living area
- Reducing clutter in the home
- Bagging and removal of bedding and clothing from the affected area
- Washing sheets and blankets and drying on HOT setting
- Encasing the mattress and box spring in a zippered encasement
- Washing or treating the headboard and bed frame
- Cleaning and removing bed bugs from other items
- Isolating the cleaned (bed bug free) items until bed bugs are gone
- Careful and targeted use of insecticides, following label instructions
- Inspection and treatment of all surrounding adjacent units
- Follow up inspections and all other procedures as needed (there should be at least one follow up inspection 3 weeks after initial treatment)

Management of bed bugs should begin at the first sign of a problem. The longer an infestation is allowed to exist, the more difficult and expensive it will be to control. It may take several months to get rid of bed bugs if there is a large infestation.

There must be cooperation among tenants and the management staff in multiple dwelling facilities. A bed bug management program must be coordinated for the entire building as well as the individual room or person, because bed bugs can go undetected for long periods of time and can spread very easily through walls, on electrical and plumbing conduits. Cooperation from the tenant includes following the pest reporting procedures, cleaning and preparation of the room for treatment, and taking measures to avoid reintroduction of bed bugs.

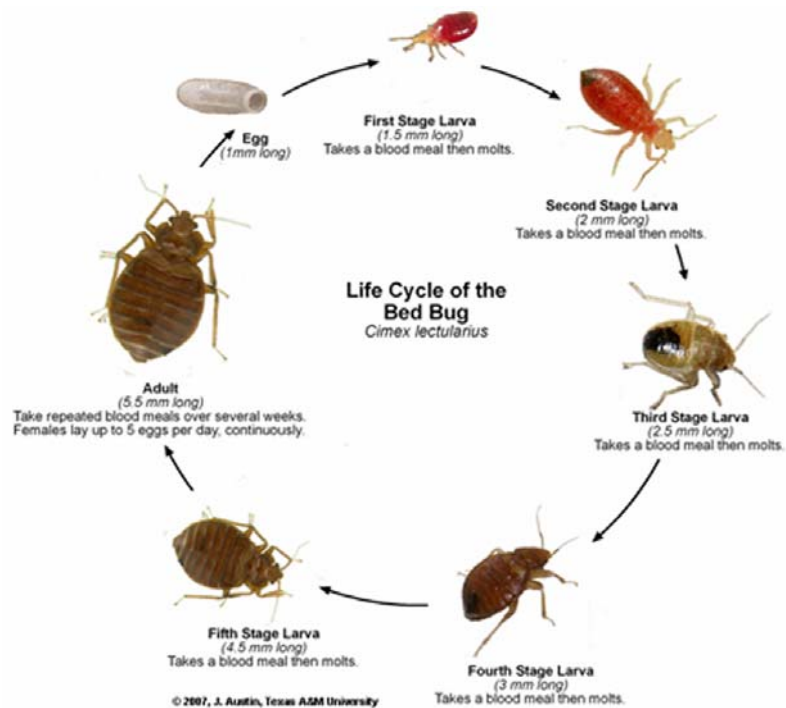
Building management must ensure that tenants are aware of these procedures and are provided with the necessary contact information they need to report a complaint. Complaints must be addressed in a timely manner. Most building managers cannot deal with a bed bug infestation without the help of a pest management professional (PMP). The PMP should be involved at an early stage. Professionals know how and where to look for bed bugs, and can thoroughly assess an infestation to ensure the right measures are taken.



The life stages of bed bugs, from egg to adult (left to right). Photo by A. Taisey.

Identification of Bed Bugs

Bed bugs are small but visible insects. There are three main life stages: the whitish egg (about 1 mm in length), five pale juvenile (nymph) stages that range from 1mm to 4.5 mm (1/4 inch), and the adult which can be as long as 7 or 8 mm (3/8 inch) when fed. The newly hatched nymph is very pale until it feeds. Then it looks like a tiny droplet of blood. Each nymph stage will feed and become filled with red blood. The adult is about the size and shape of an apple seed, and dark red to brown in color and as flat as a credit card before feeding.



The first sign of a bed bug infestation is usually the appearance of bites on the arms, neck, torso, or legs. Read on for more information about bed bug bites. One may also find live or dead bugs. Collect a sample for positive identification. Clusters of small stains or droplets of dried blood on furniture and bedding may also be found. These stains are the bed bugs' fecal droppings. They may be accompanied by shed skins, because bed bugs shed their outer skin, or molt, as they grow. Shed skins are amber in color and resemble the shape of a bed bug. There may also be live bugs and eggs where droppings are found.



Bed bugs, cast skins, fecal stains and eggs in the wood structure of a box spring. Photo by P. Stravino.

DON'T mistake bed bug droppings for cockroach droppings. Cockroaches leave behind tiny rectangular pellets, not round droplets or stains. There may also be rectangular egg cases or dead cockroaches nearby.

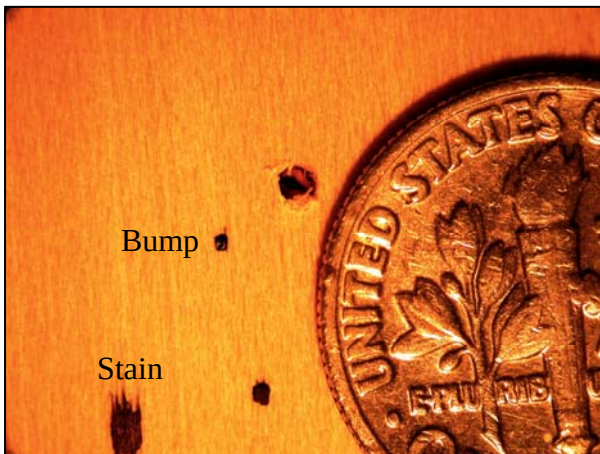
When searching for bed bugs it is important not to overlook the nymphs, which can be difficult to spot. Look for nymphs where droppings and stains appear, especially in crevices on fabric and wood surfaces.

Actual sizes of bed bug life stages:

⁰	⁰	⁰	⁰	⁰	⁰	⁰
Egg	1 st	2 nd	3 rd	4 th	5 th	adult



A newly hatched bed bug is smaller than a poppy seed (left) and the color of a sesame seed (right). Photo by J. Gangloff-Kaufmann.



The stains from bed bug fecal droppings can appear as rounded bumps or blackish, soaked-in stains. Photo by J. Gangloff-Kaufmann.



This adult bed bug is waiting to feed on blood. Adult bed bugs are very flat and fit into crevices as thin as a credit card before they feed. Nymphs are even thinner. Once fed, they are longer and plump until they begin to digest the blood meal. Photo by J. Gangloff-Kaufmann.

Bed Bug Bites and the Bites of Other Arthropods

Bites are usually the early warning sign of a bed bug infestation. Bed bugs feed only on blood. Each life stage feeds, except the egg. They insert the fine stylets from their beak directly into the skin in search of a tiny blood vessel, and may move and bite repeatedly until they find the right spot. At each point the beak releases saliva into the skin. The saliva contains proteins and enzymes that will cause an allergic reaction in many people. Allergic reactions vary widely from practically no reaction, to small itchy red or white bumps, to blisters or pustules. Not every person in a household will react the same way and many times only one person will show signs of bites, leading others to believe it cannot be bed bugs.



Bed bug bites on a woman's leg. Photo from www.bedbugger.com.

It is difficult, if not impossible, to distinguish bed bug bites from those of other biting pests without other circumstantial evidence that will link to a specific pest. It is critical to confirm bed bugs in the sleeping or living area through inspection to be sure that bites are caused by bed bugs. Bed bug bites can resemble mosquito and flea bites.

If you or someone you know has bites, consider the following:

- Bed bugs tend to feed on exposed skin, but can feed under loose clothing.
- Bed bugs primarily feed at night in the dark, in a typical situation.
- Under stressed conditions bed bugs may feed during the day. Stressed conditions include:
 - *Bed bugs have no access to hosts because people are not sleeping nearby*
 - *When bed bugs are disturbed by cleaning or pesticides they may move to other areas*
 - *As the numbers increase, bed bugs may spread due to overcrowding*
- Bed bug bite reactions can take a few minutes or as many as 14 days to appear.
- If bed bugs cannot be located in sleeping areas after multiple inspections, other biting pests must be considered.
- If local temperatures are over 60° F and the individual is outdoors or has unscreened windows open, mosquito bites must be considered. Mosquitoes can also breed in standing indoor water in basements or unused sinks, toilets, drains, refrigerator pans, pet water dishes, plants, or dirty fish or reptile tanks. A quick inspection will help identify these conditions.
- Pets or wildlife, including raccoons, squirrels, rabbits, and rodents may carry fleas that bite humans, especially in warmer months.

There are other causes of bites and lesions aside from bed bugs. While bites can vary, the activities of the person bitten may help determine the cause.



- **Mosquitoes** – Generally, mosquitoes feed at dawn and dusk, but at least one species bites during the day. In most people, a wheal and flare reaction is common and occurs quickly. Mosquito bites are usually associated with warm weather and being outdoors. A torn or missing window screen allows mosquitoes into the living area.



- **Head, body, and pubic lice** – Lice live on the human body, feeding by penetrating the skin. Head lice live on the scalp among hairs, body lice live in clothing and feed on adjacent skin, and pubic lice feed among the hairs of the pubic region. Look for signs of lice and their eggs (nits) in the hair and clothes.



- **Ticks** – Most often associated with natural areas, such as grassy shorelines and wooded areas, ticks are rarely encountered indoors unless pets bring them inside. Ticks insert their mouth parts into the skin and remain attached to feed on blood. They usually remain attached for a long period of time (1 to 3 days), become greatly engorged with blood and are much more noticeable for these reasons.



- **Fleas** – Flea bites are usually associated with the presence of animals serving as flea hosts, such as pets and occasionally wildlife. Fleas tend to leave multiple bites on the arms and legs.



- **Bird and rodent mites** – Associated with birds, rats and mice nesting in or on the building. Bird mites are usually spotted when young birds and their parents leave the nest. Mites may be seen on windowsills or air conditioning units. Most mites do not live long off the host but will bite people, if they get onto the skin. They do not cause serious bites or transmit disease. Mites should be cleaned up with soap and water. Birds should be discouraged from nesting on the building or in AC units. Rodents should be exterminated from the building and access points permanently sealed. Trapping rodents helps remove the source of mites, unlike rodenticides, which result in dead rodents within walls, which can attract other pests.



- **Scabies** – The scabies mite (human itch mite) is a parasite that burrows in layers of the skin creating small lesions containing mites and eggs. Scabies is transferred among humans by close contact. This is a medical problem that should be confirmed by a doctor and treated with scabicial cream or lotion applied to the body. **Scabies are not a pest management issue**, and do not require treatment of a room or home, however bedding and clothes should be laundered at high temperatures for sanitation reasons.



- **Spiders** – Spiders have paired mouth parts, like jaws and leave behind one or two puncture wounds when they bite. Bites are usually associated with some localized pain; however spider bites are relatively rare in the Northeastern United States, where venomous spiders are uncommon.

For more information about arthropod bites, please see *Physician's Guide to Arthropods of Medical Importance*, 4th Edition. 2003. Jerome Goddard, Ph.D., CRC Press, New York, NY

Best Management Practices for Controlling Bed Bugs

An Integrated Pest Management Approach

Pesticides alone should not be used to control bed bugs. The most effective program for eliminating bed bugs is one that utilizes Integrated Pest Management (IPM). IPM is the use of all possible methods in a logical combination that minimizes risk of pesticide exposure, safeguards the environment, and maximizes effectiveness. Facilities should have a pest management plan in place, to deal with pests including bed bugs, before they are a problem.

IPM methods include:

- **Inspect** infested areas, plus surrounding living spaces
- **Correctly identify the pest**
- **Keep records**, including dates when and locations where pests are found
- **Clean** all items within a bed bug infested living area
- **Reduce clutter** where bed bugs can hide through storage and/or disposal of items
- **Eliminate** bed bug **habitats**
- **Physically remove** bed bugs through cleaning
- **Pesticide** use, careful and according to the label directions
- **Follow up** inspections and possible treatments
- **Raise awareness through education on prevention of bed bugs**

A facility may need several cycles of inspection, cleaning, and pesticide use before bed bugs are fully eliminated. IPM also includes *prevention through education* of clients, residents, facilities managers, and landlords.

Strategies that DO NOT work

Abandoning rooms or even a whole facility is not a guarantee that bed bugs will be eradicated. Adult bed bugs can live without a blood meal for over a year and will wander to find a new host when one is unavailable.

The use of “**bug bombs**” or total release foggers is not advised. These devices release insecticide in small droplets that land on exposed surfaces and do not penetrate the cracks and crevices where bed bugs hide. This results in increased pesticide exposure to the resident and poor control of these pests. This has been linked to pesticide resistance and suspected repellency to bed bugs, causing them to spread.

Simply **discarding beds and bedding** is NOT a sound approach to bed bug management. Bed bugs will spread quickly to walls, molding, ceilings, light fixtures, electronics, TV remote controls, alarm clocks, and spaces within and along floor boards, and the edges of carpets. If items are discarded they should be wrapped in plastic before transport and LABELED as “infested with bed bugs” or made unsalvageable.

Often people discard furniture and belongings that are infested with bed bugs. When doing so, it is a good practice to destroy or deface the items to prevent others from unknowingly

collecting infested items. Bed bugs are likely being transferred from place to place through infested furniture and discarded objects. Slash mattresses and plush furniture, break box spring frames, and label items with the word “bed bugs” to prevent the spread of bed bugs in your community.

Responsibilities of building management and staff:

- Encourage tenants or guests to report bed bugs (unreported and uncontrolled bed bugs will spread quickly)
- Keep records of bed bug (or other pest) complaints on site in a log book
- Respond quickly to complaints with an inspection and intervention
- Develop an aggressive bed bug control protocol with elimination as the goal
- Raise tenant or guest awareness about bed bugs
- Institute a prevention program, centered on awareness
- Refer tenants and guests to the proper sources of help (medical, mental health, financial, and social services)

Responsibilities of residents:

- Read and follow all guidelines given by building management for reporting signs of bed bugs, and for cleaning and room preparation.
- Cooperate with staff and management in preventing and controlling bed bugs whether your individual living space is infested or not.
- Know the signs of bed bugs and check constantly for signs of them in your living space.
- Encourage other tenants to follow guidelines and cooperate with management.

Room Preparation

Preparation of a room for bed bug treatment is essential to the successful management of these pests. Most pest managers prefer to conduct an inspection before any cleaning or rearranging has occurred. This gives the pest manager a sense of the full extent of the problem and prevents the disturbance and spread of bed bugs before treatment. However, once bed bugs are located and the size of the problem has been estimated, room preparation must be done, usually by the resident. Some residents will need help preparing their living space for inspection and treatment.

Suggested room preparation steps include organizing belongings and placing them in bags, laundering all clothing and bedding, moving furniture away from the walls, and emptying furniture of items for better inspection. See the Room Preparation Checklist on page 36 for detailed information.

Inspection

A thorough inspection is important to determine how widespread the infestation is and the best way to manage bed bugs. Adult bed bugs can hide in any spaces as thin as a piece of paper. Young bed bugs are even smaller. When conducting an inspection, move slowly and

avoid disturbing hiding bugs, so they don't scatter. Keep in mind that in a low infestation, the bed bugs will be concentrated close to sleeping areas. Items away from the sleeping area will be at a low risk of infestation. Prioritize the risk of infestation from high to low to concentrate inspection and treatment time to the most infested areas. Look first before touching to avoid injury from hidden sharp objects or weapons.

The recommended inspection tool kit includes:

- Magnifying glass
- Strong flashlight
- Plastic zip-top bags for collecting specimens
- A probe, such as a “credit card tool”, made by cutting any plastic card into a long triangle, for checking in narrow spaces.
- Pyrethrin or compressed air (for cleaning computers) for flushing bed bugs from cracks and crevices
- Screwdrivers for removing light switch and electrical plates
- Other tools (a small tool kit) for disassembling furniture
- Alcohol, glass-cleaning or baby wipes, for evidence that stains are bed bug droppings (see below).
- Cotton swabs for checking stains in crevices
- Sticky traps may be useful if placed under the bed and checked regularly.



A lighted magnifying glass, screwdriver, and a crevice tool made from a NYC Metro Card are all very useful for inspecting. Photo by J. Gangloff-Kaufmann

Signs of bed bugs:

- Live bed bugs of all sizes (poppy seed to apple seed size)
- Confirm that what you find is a bed bug (see References section to locate a Cooperative Extension diagnostic laboratory).
- Droppings in the form of dark colored stains on cloth or bumps on hard surfaces
- Shed skins
- Eggs, although very small, will be found among droppings or in crevices where adults hide.

Inspecting the bed:

Inspection for bed bugs starts in the place where people sleep and moves out from there to other parts of the room. This should be conducted before room preparation steps are taken.

- **Mattress inspection**
 - Along the top and bottom seams, and along each side of the piping material sewn onto these edges
 - Under mattress handles and along or inside air holes
 - Between the mattress and box spring, platform or frame
 - Inside folds of material and under buttons

- If mattresses are covered in vinyl plastic, look inside seams and rips in material.
- Use alcohol or baby wipes to rub suspected bed bug droppings. If the spots dissolve into a reddish brown color, this could indicate bed bug droppings and should be a reason to continue inspecting until a live bed bug is found.



Bed bugs may be found along piping seams, under pillow tops, between the mattress and box spring, inside air holes, or underneath mattress handles. Do not overlook tears in the fabric or stitching holes when inspecting for bed bugs. Photos by J. Gangloff-Kaufmann.

- **Box spring inspection**

- Points where the box spring sits on the bed frame, (lift slowly to avoid scattering bed bugs)
- The top surface of the box spring, inside folds of material
- Along seams and where the material is tacked to the frame
- Turn over the box spring and remove the thin cloth layer on the underside.
- Use a flashlight, a hand lens and a crevice tool to check the spaces between box spring frame parts.
- Look around and beneath furniture staples and tacks.
- Use a flushing agent to chase bed bugs out of hiding spots.
- Double faced tape or carpet tape can be placed on the underside of furniture to capture wandering bed bugs. This is a monitoring tool, not a control strategy.



Check between the mattress and box spring and along every fold of material for signs of bed bugs Photo by D. W. Coard.

- The **bed frame** and **head board** inspection

- Wood beds (especially captain's beds) and head boards (especially wicker) are preferred hiding spots for bed bugs over metal bed frames, but bed bugs will

hide in crevices on metal and plastic, or where a mattress touches a metal frame.

- Visually inspect and use the crevice tool in all joints of the frame where parts meet.
- Turn the frame over and inspect from the underside.
- Check screw and nail holes for bed bugs.
- Take the bed apart to check between parts.
- Remove the headboard from the bed and check for bed bugs along the joints and on the wall behind it.
- Wicker furniture provides infinite hiding spots for bed bugs. Anything made of wicker should probably be discarded. See below for disposal of infested items.



Tiny spaces in the bed frame and other furniture, such as a peg hole for a shelf, are ideal hiding spots for bed bugs. Photos by J. Gangloff-Kaufmann.

Inspecting other furniture and storage areas:

Furniture, such as night stands, will be likely places to find bed bugs, since they can easily crawl to distant hiding spots. As the bed bug population grows, overcrowding may cause them to wander. Furniture near the bed can become infested and infestation can quickly spread away from the bed if no control measures are taken.

- Empty drawers and shelves of the furniture closest to the bed.
- Place items into plastic bags to be inspected and cleaned.
- Pull out drawers and inspect every corner and the undersides, using the crevice tool to check under the metal drawer guide.
- Use the crevice tool to inspect gaps wherever the tool will fit, such as between the shelf and bookcase frame.
- Turn over all furniture to inspect the underside.
- Be sure to inspect screw and nail holes.
- Plastic and metal furniture may harbor bed bugs, follow the same inspection procedures.



Bed bugs hiding in the screw hole of an office chair. Photo by L. Sorkin.

- Electronics, such as lamps, remote controls, alarm clocks, and radios should be placed into plastic bags for further inspection. If bed bugs are found in the frame of the furniture where the radio or clock sits, further inspections of those items and possible treatment are warranted.
- Office-style chairs should be inspected by turning them over and looking under seams where fabric attaches to the frame. Also check screw holes.

Plush furniture, such as a couch, will harbor bed bugs, even if residents are not sleeping there. In these cases, inspection will be more difficult due to the many inaccessible hiding spots.

- Inspect pillows and cushions, particularly the seams and the folds around zippers.
- Look at and under legs of chairs and couches.
- Turn over the furniture and remove the thin cloth backing under each piece.
- Pay special attention to staples and where material is stapled to the frame.
- Look inside at all wood parts of the frame.
- If the piece is highly infested, consider disposing of it in a proper manner (see below for furniture disposal guidelines).



Bed bugs and debris on the underside of an upholstered chair. Photo by L. Sorkin.

Inspecting the room perimeter:

Once established, bed bugs will spread toward the perimeter of the room, including walls, moldings, and rugs.

- Look at moldings or the joint between the floor and wall closest to the bed.
- Use the crevice tool to check behind moldings. The tool will chase bed bugs out of hiding if used in a sweeping upward motion.
- Fold back the edges of wall-to-wall carpets to inspect for signs of bed bugs.
- Pay attention to the tack strip of carpets.
- Look under the edges of area rugs.
- Using a screwdriver, remove electrical switch and outlet, and phone jack plates to inspect. If bed bugs are hiding in these areas, signs may be evident along the edges and on the back of the plate.
- Inspect everything hanging on the walls. If framed art or photos are present and there is evidence of bed bugs nearby, open the frame to inspect inside or under the paper backing.
- Check under loose wallpaper and areas of peeling paint.



Base molding next to the wood leg of a bed. Photo by J. Gangloff-Kaufmann.

- Take down curtain rods and inspect inside them and underneath hardware on the walls.
- Look at closet, bathroom and other door frames, along hinges, and in the bore hole for the latch on each door.
- Make a note if bed bugs are found on walls. Ceiling lights and fixtures with bed bugs could indicate that they are moving from the upper floor unit.
- If bed bugs are on walls, they may hide under ceiling moldings and in smoke detectors.



Phone jack next to the bed. Photo by J. Gangloff-Kaufmann.

Inspecting unusual locations:

Bed bugs may turn up in unexpected places in moderate and large infestations. If the infestation is large, every object in the affected area should be carefully inspected.

Bed bugs have been found in such locations as:

- Television and other remote controls, in the battery compartment
- Telephones, cell and cordless phones
- Lamps and alarm clocks
- Computers and other electronics
- Cardboard boxes in closets and under the bed
- Children's toys and stuffed animals
- Jewelry boxes
- Brick walls and "popcorn" or other textured ceilings
- Books, magazines, newspapers, and files
- Inside hollow doors
- Ceiling light fixtures, smoke detectors
- Heating units, air conditioners and ducts
- Wheelchairs



Bed bugs hiding in the tab of a dictionary. Photo by P. Stravino.

Bed bug detecting dogs

Several companies in the United States offer bed bug detection using dogs, specifically trained for locating bed bugs. These services are another tool in the fight against bed bugs and can be especially useful in situations where bed bugs are suspected, but have not been located. The dogs are not always accurate. Combining the services of a bed bug detection dog with a trained pest control professional can lead to immediate results of finding and eliminating obscure harborages. A 2-dog system is also used to reduce the problem of "false positives". When the dog signals for bed bugs, a pest control technician should be present to confirm and later treat the area. Dogs can positively indicate a bed bug problem but it is unclear whether using a bed bug dog can absolutely rule out bed bugs (for example, if bed bugs are hiding in an area inaccessible to the dog). The dog handler team should be recognized by a certifying organization, such as the National Entomology Scent Detection Canine Association.

Reporting and Recordkeeping

It is critical for managers of multiple-unit housing of any type to encourage residents to report suspected cases of bed bugs to the facility manager. If a bed bug problem is not addressed immediately, it will grow quickly and spread throughout the facility room by room. Eliminating a widespread problem is MUCH more expensive and difficult than a limited one.

Management should keep the following pest information records for all types of pests:

- Date of the complaint
- Type of complaint (bites, bug sightings, damage to property)
- Unit or room number
- Date of first pest inspection
- Results of the inspection, what was found, how much was found
- Dates of pest management activities
- What pest management strategies were used, such as cleaning, pesticide treatments, resident education

Educating Residents and Staff

The administrators and facilities managers of homeless shelters, group homes, dormitories, apartment buildings, and other types of housing should seek to better educate residents about bed bugs and how to prevent them. New York City's Department of Health and Mental Hygiene offers fact sheets on bed bugs to educate the public. This document also contains fact sheets for resident education.

Treatments for Bed Bug Elimination

Controlling bed bugs is a difficult and time and money consuming activity. However, **bed bugs can be eliminated** with a coordinated effort that includes cooperation of the residents and landlord or property management. There is no single tool or activity that, used alone, will eliminate bed bugs, including pesticides. Multiple techniques are always required because bed bugs are small, good at hiding, and reportedly live without feeding for up to a year. In some cases, bed bugs are resistant to the pesticides used against them, meaning that many will survive treatment. **The reduction of household clutter is absolutely necessary for fighting bed bugs.** Despite the challenges, the technology of bed bug control is getting better. Pest managers are becoming more knowledgeable as bed bugs become a greater issue.

Treatment of a living area for bed bugs should focus on containment of the infestation. Do everything possible to avoid spreading bed bugs to new locations.

A combination of the following steps will be needed for bed bug control:

- Clean and organize the bed, bedroom, other living areas, furniture and belongings, including elimination of clutter
- Physical removal of bed bugs and eggs using a vacuum

- Barriers, such as mattress encasements and sticky barriers (sticky traps may be useful for monitoring but will not help control bed bugs)
- Steam (to kill all life stages)
- Heat or cold treatments (to kill all life stages)
- Eliminate bed bug hiding spots
 - Fix peeling wallpaper and paint
 - Caulk or seal cracks and crevices around the room and on furniture
 - Seal floors or the spaces between floor boards or tiles
 - Make other repairs to the living area to reduce hiding spots
- Chemical applications
 - Low risk pesticides
 - Professional use pesticides
 - Professional fumigation
- Prevention of reinfestation

It is important to consider that a bed bug infestation in a living area (bedroom, apartment, dormitory room, shelter room or unit) might spread to adjacent units or those below, above or to the sides. This is especially true if the population is high or if pesticides are used in the original unit. Adjacent units should be inspected and if bed bugs are found or residents notice bites, they should be treated as if infested.

Housekeeping Procedures

Thorough cleaning, in the form of vacuuming and washing floors and furniture, is an essential step in bed bug and cockroach control. Cleaning, alone will not eliminate bed bugs but is necessary to crash high populations. Cleaning removes debris that may contribute to allergies and asthma, and removing bugs, droppings, and cast skins allows the inspector to spot new activity. Vacuuming does not easily remove eggs and bugs hiding in cracks.

In places, such as shelters, cleaning teams or the facility management may be responsible for the majority of housekeeping duties. Cleaning for bed bugs should focus on sleeping and lounging areas, (whereas cockroach control depends on sanitation in cooking and eating areas). However for cleaning to have any impact, the resident must cooperate by reducing clutter, organizing, and bagging their belongings. There may be a need to store their belongings temporarily. Be certain every item is bagged until it can be cleaned of bed bugs. Units should always be cleaned before new tenants move in.

A cleaning procedure for bed bugs begins with vacuuming, using a HEPA-equipped vacuum that is dedicated only to pest control. Although a regular vacuum is acceptable, a HEPA-equipped vacuum will reduce the spread of allergens. A crevice tool will be needed to focus suction in small spaces, cracks and crevices. Use the crevice tool with a scraping motion to dislodge bugs and eggs, because bed bugs cling to wood and fabric and the eggs are cemented to the surface where they are laid. A brush attachment can also be used but must be cleaned carefully to prevent the spread of bugs. See below for proper handling of the vacuum cleaner and vacuum bags.

Cleaning and organizing a room or home

Cleaning and organizing a room or home for bed bug management can be as burdensome as changing residences. It is, however, an extremely important first step to control bed bugs, because bed bugs will thrive in a cluttered living area. Vacuuming and cleaning should be done before a pesticide application. Cleaning should be carried out in a systematic way, beginning with removing items from the infested room or home. Soap or detergent will aid in the clean up of bed bug debris and allergens, making the environment healthier and more tolerable for those living there. Essential oil soaps (pine, orange or lemon), enzyme soaps, and sudsy detergents are good choices. Bleach and ammonia do not kill bed bugs and should not be used to combat them. Their vapors can also be harmful.

Steps to follow include:

- Scan the room for items on the floor. Make a plan for each item, and how it will be quarantined (closed into a plastic bag, for example), inspected, sanitized of bed bugs, and stored until further notice.
- Place clothes, shoes, plush toys, pillows, and bedding into large clear plastic bags and seal them tightly to be laundered. Place the bags away from the infestation site.
- Alternatively, plastic tote bins that have an airtight seal can be used for items that cannot be laundered, such as hard toys, electronics, books, breakable items, etc. Be prepared to store these items for a period of time until they can be thoroughly inspected or enough time has passed that bed bugs are dead – at least a year.

Vacuuming:

- Once the room has been “stripped” of all personal belongings, begin vacuuming the bed, paying special attention to the mattress seams.
- Use a crevice tool and a scraping motion.
- Remove the mattress and box spring from the bed frame and inspect and vacuum all surfaces, removing all loose debris and visible bed bugs.
- Flip the bed frame over and vacuum and crevices where bed bugs may hide. This is especially important for wooden bed frames and captain’s beds.
- Vacuum inside and under drawers of night stands, dressers, and other furniture in the room.
- Turn over each piece of furniture and vacuum the under sides of each.
- Pay attention to screw and nail holes, using a credit card crevice tool.
- Vacuum along the bottoms of all walls and the moldings. If molding or wallpaper is loose lift or remove and vacuum beneath.
- Make sure to vacuum around heating units.
- Vacuum along carpet edges.
- Vacuum plush furniture with a carpet beater attachment or by patting the furniture while vacuuming to flush out bed bugs.
- If a vacuum brush attachment is used it is possible some live bugs or eggs could be caught in the brush bristles. Wash the vacuum brush with hot water and detergent if this is a concern.

Handling a bed bug vacuum: A vacuum used for bed bugs can have live bed bugs inside and it will be important to avoid transferring bed bugs to new locations.

- **Dedicate a vacuum for the purpose of pest control in your facility.**
- After each use remove the vacuum bag and dispose of it in a sealed plastic bag.
- Clean the brush attachment with hot water and detergent.
- Stuff a paper towel in the hose end to prevent bed bugs caught in the hose from escaping.
- Store the pest control vacuum in a large plastic garbage bag that is closed tightly.
- Inspect the vacuum before each use to be sure no live bed bugs are on the outside.

Washing Surfaces and Furniture:

- Wash all furniture (non-plush) and hard surfaces in the room using an orange, lemon, or pine based soap or detergent cleanser. Pay attention to crevices and spaces in the frame.
- After removing the mattress and box spring from the bed frame, wash the bed frame liberally with soap and water.
- Wash cribs and children's bed frames rather than using pesticides.
- Wash the floors, moldings, window sills, and walls generously.
- Steam or hot water heating units can be washed as well. Do not wash electrical heating units.

Rugs and carpeting

- Many small rugs can be placed into the dryer on a hot setting for 30 minutes.
- If the room has a large area rug, the rug can be steam cleaned within the same time frame that other bed bug control measures are taking place, although steaming should be done before pesticide applications are made. Rugs can be sent out for professional cleaning, as well. Wrap in plastic for transport and warn the cleaning company.
- Wall to wall carpeting can harbor bed bugs and should be removed, especially in a heavy infestation, or steam cleaned, paying very close attention to the edges. Previous inspection will help determine where to concentrate steaming efforts. Carpeting may also be treated with a labeled pesticide.
- The carpet tack strip left behind after wall-to-wall carpet is removed should also be removed for safety purposes, as well as bed bug management.



Bed bug eggs and fecal stains along the edge of the carpet. Photo by R. Cooper.

Use of Steam Cleaning, Heat, and Cold Treatments

Steam treatments, when properly applied, will kill all life stages of bed bugs, including the eggs, which are protected from the effects of most pesticides. It is recommended that a facility at risk of getting bed bugs invest in a steam cleaner for fighting bed bugs. Combined with pesticides and other methods, steam is very effective and can be used to reduce cockroach allergens, dust mites, and for many other health-related cleaning purposes. Steam can be used on mattresses and plush furniture, such as couches and chairs. However steam will only kill bed bugs in places where the steam can reach. Move the steam cleaner nozzle slowly to maximize depth.

The best choice in a steam machine is a professional type with large water-holding capacity, many types of attachments, and variable output rates. Dry-steam or low vapor steamers are better because they use and leave behind less moisture. When steam is used, steam cleaning should be done before vacuuming for several reasons. Steam will flush bed bugs out of their hiding spots to be killed or vacuumed. Steam kills bed bugs that will then need to be cleaned up anyway. And reducing the number of live bed bugs vacuumed up reduces the chance that the vacuum will become infested and spread bed bugs to new areas. Details of the use of steam for controlling bed bugs can be found in the book *“Bed Bug Handbook”* (Pinto, Cooper and Kraft, 2008). See the section titled References for more information.



Steam cleaning the baseboard. Note that the wand is covered with a terry wash cloth to increase and retain heat. Photo by R. Cooper.

Heat treatments come in many forms. However, other than compartment heat treatments or whole-building heat treatments, there are no set standards, except for using a hot air dryer for clothes and linens. Because New York City limits the use of propane generated heat sources, large scale and compartment heat treatments are not widely available in New York.

The use of cold temperatures or freezing to kill bed bugs is often recommended, however this method can vary in effectiveness. Placing household items, such as books, into the freezer may kill some bed bugs, however it has been shown that some bed bugs can recover from being frozen. Items treated in this way must be stored in a freezer for a long period of time (possibly a month) or must be very quickly frozen to an extremely cold temperature to kill all the bed bugs. A new rapid freeze technology called Cryonite has been developed. This method uses carbon dioxide snow to rapidly freeze and kill bed bugs. This leaves no pesticide residue. This system is available in New York.

Use of Pesticides

Pesticides are an important tool in the fight against bed bugs, however they should be applied by a licensed and well-trained pest management professional. Many legal over-the-counter and some illegal products are readily available to the public. When working with residents it is very important to stress that they should not apply pesticides to city owned and operated

buildings. Residents should not attempt to do their own pest control. They should contact their building management to report pest problems and should be reminded to follow the guidelines for cleaning and room preparation.

Incorrect use of pesticides for bed bugs poses several risks:

- Overexposure to pesticides can cause or exacerbate already existing health issues.
- Children are more susceptible to toxic effects of pesticides than adults.
- People tend to treat places where they see bed bugs, including the bed, which may result in more pesticide exposure.
- Unskilled use of pesticides can result in the spread of bed bugs into adjacent rooms.
- Bed bugs are developing resistance to pesticides used against them.

When bed bugs appear in a communal living facility, it is best to hire a pest management professional and work closely with their technician to manage bed bugs safely and effectively. The technician will conduct an inspection to confirm and locate bed bugs. This person will then make recommendations for preparing the room for treatment. Cleaning should be performed before pesticide treatment.

Only a few types of pesticides are available for use against bed bugs. They come in different formulations (liquid, aerosol, dust) but many have the same mode of action. Some low-risk products are available. Consult a pest management professional for information about treatment choices. The types of pesticides that are commonly used for the control of bed bugs include:

- Liquid insecticide for treatment of moldings, carpet edges, cracks and crevices.
- Aerosol insecticides for treating bed frames, box springs, furniture, cracks and crevices.
- Dusts (that may or may not include an insecticide compound) used in cracks and crevices, inside walls, behind electrical outlet covers and switch plates.
- Fumigants are gases used for treating whole buildings, or for container treatments of the contents of a home. Fumigants are different than foggers.
- Foggers, commonly called “bug bombs” are liquid aerosol insecticides that are released into the air of an indoor space. **They are not effective for bed bug control.**

What to Look for When Hiring a Pest Management Professional

- The pest management company should be licensed by the state and insured.
- Technicians should be fully licensed in the state and certified pest management professionals.
- The company should be a member of a professional organization, such as the National Pest Management Association (see www.pestworld.org to locate a member).
- The company should have a staff entomologist or access to one.
- Technicians should have experience with bed bug management.
- Choose a company based on their quality of service, not the price. Get several proposals for service if possible and compare them.
- A pre-inspection should be conducted to assess the scope of the work.

- The proposed work should follow the steps of integrated pest management, not just pesticide application.
- Technicians should be straightforward and open when discussing details of their service.
- Understand what guarantees are being offered. Bed bug management may be difficult to guarantee, because reinfestation from an outside source is possible.

Preventing a Bed Bug Infestation

Furniture and Room Guidelines

Bed bugs thrive under certain conditions which are enhanced by the availability of hiding spots close to their human hosts. Bed bugs have a strong preference for paper and wood, over metal and plastic. Porous surfaces provide more humidity and egg-laying locations. Furniture choices can greatly contribute to the control of bed bugs.

Guidelines for furniture include:

- Replace wood frame beds with metal frame beds to discourage bed bug hiding and egg-laying on beds.
- Eliminate head boards completely. Bed bugs hide and thrive in head boards.
- Replace all plush furniture with metal and plastic, or items easily cleaned with soap and water.
- Adding smaller cushions that can be placed in a dryer is one way to make residents more comfortable. Cushions should be dried on a hot setting if bed bugs are an issue.
- Use only white or light colored sheets.
- Use wooden baby cribs, but choose models that are painted white. Paint existing wood-colored cribs white. Fill gaps in the frames with silicone caulk. This will allow for much better inspection and reduce need for treatment. Avoid using pesticides on baby cribs!
- Vinyl-covered or seamless mattresses are recommended for adult beds and cribs.
- If vinyl mattresses have holes, consider repairing them with tape or discarding them.
- Do not discard regular (non-vinyl) mattresses, only to replace them with other regular mattresses. Bed bugs will reinfest the new bedding quickly. Use mattress encasements (see below).
- If a box spring is being used, be sure to encase it too. The box spring is more likely to harbor bed bugs than the mattress.
- Wooden dressers, wardrobes, tables and other furniture can be painted white for easy inspection. Any crevices where a credit card will fit should first be sealed with silicone caulk to eliminate hiding spots.



A metal bed frame and vinyl mattress will minimize bed bug problems. Photo by Black Widow Pest Control.

- Discard any wicker furniture. Wicker provides infinite harborage to bed bugs and is impossible to treat effectively.

Mattress Encasements

Mattress encasements are zippered enclosures that cover the entire mattress, as if it were bagged. Encasements should always be used for non-vinyl mattresses and box springs in bed bug prevention and management. Special bed bug-proof encasements are made of high quality cloth material, so they do not tear easily, and they have no folds around the zipper for bed bugs to find shelter. Cheaper vinyl encasements are available but need to be installed carefully to avoid tears in the vinyl. If a small hole appears, duct tape can be used to repair it. Holes **MUST** be repaired to prevent bed bugs from either gaining protection on the inside of the cover, or to prevent bed bugs from escaping from the infested bedding. Encasing both mattress and box spring eliminates the need to discard bedding by trapping bed bugs inside and providing a smooth simple outer surface that can be inspected, vacuumed and cleaned easily. **It is highly recommended that mattresses and box springs be encased, to preserve the sleeping area and to make bed bug inspections quick and easy.**

Other room guidelines:

- Moldings and joints around the room perimeter (floor, doors, cabinets, and windows) should be caulked with silicone sealant to eliminate hiding spots for both bed bugs and cockroaches.
- Openings around pipes or other structures that come through walls, floors and ceilings must be sealed. This will help with bed bugs, mice and cockroaches.
- People should keep sleeping in the room to avoid spreading bed bugs to other rooms or apartments, when possible.
- Residents should not store belongings under the bed when dealing with a bed bug infestation. This provides plenty of hiding spots that are difficult to clean.

Issues between rooms:

Often, bed bugs infesting a room or unit will make their way to an adjacent room or unit through electrical, heat and phone line conduits. It is important to identify cases where this happens and approach the spread from both sides of the wall.

Evidence that may suggest room to room movement of bed bugs includes:

- Bed bugs in ceiling light fixtures
- Bed bugs hiding in and coming out of electrical and switch plates on walls and bed bug droppings found on the inside of the switch plates, or near ducts
- Bed bugs frequently found in unusual locations, such as the kitchen or bathroom. In such a case, it may be that the kitchen or bathroom is located adjacent to an infested bedroom or heavily infested unit, and bed bugs are traveling along water pipes.



Bed bug fecal stains near a duct indicate harborage and possible movement. Photo by R. Cooper.

Donations of clothing and household items:

Donations of clothing, shoes, coats, toys and other personal belongings are vital to many programs that help the disadvantaged. But sometimes when people discover bed bugs in their homes, they discard many personal belongings, and it is unclear how much of these discarded personal belongings make it to the donation stream. It is therefore important to be very careful about donated items to avoid the introduction or spread of bed bugs in your facility or home. Suggested precautions for donations include:

- Wash and especially DRY on HOT all clothing, shoes, coats, linens, blankets, and plush toys before distribution.
- Sort donations on a clean linoleum floor. Prevent the escape of bed bugs into your facility by sorting inside a perimeter of carpet (double-sided) tape placed around the working space. This creates a sticky barrier that bed bugs cannot cross.
- Shake out clothing; inspect books and toys carefully using the identifying guide in this manual.
- Ban all cardboard boxes for donations from your facility. Instead use clear plastic bags.
- Keep sorted and laundered items away from items that have not been checked or treated.

Policy Statements to Minimize the Spread and Impact of Bed Bugs

Agencies and facilities managers should have policies in place that will help to prevent the spread of bed bugs. Suggested policy statements and reasoning for bed bug prevention include:

- Your belongings must be free of bed bugs, or you must be willing to work with facility staff to rid your belongings of bed bugs. – *This will prevent the introduction of bed bugs into our facility, and will help the resident to avoid future bed bug issues.*
- You may not bring into this facility items collected from the street, discarded items, donated furniture. – *With the increased number of bed bug cases, items on the streets are much more likely to contain bed bugs (the reason for being discarded). Therefore it is not safe to bring discarded or abandoned items into our facility.*
- If you have possibly been exposed to bed bugs, or suspect that you may have bed bug bites, you must tell the facilities manager. – *Early detection and management is very important for the control of bed bugs. Otherwise the number of bed bugs will increase rapidly.*
- The client must consult with a medical provider or social worker if bed bugs are suspected. – *There is help for clients with mental, physical, and financial needs that limit their ability to deal with bed bugs.*
- You must follow pre-treatment guidelines for a room you occupy. – *Following pre-treatment guidelines will allow management to help get the bed bug infestation under control. Without cooperation control will not be possible.*
- You must not use spray, fog, or dust pesticides on your own to treat for bed bugs or any other pests. – *Foggers cause bed bugs to spread, over-the-counter sprays may be ineffective, and bed bug control requires experience to know where to place*

insecticides to be effective against bed bugs. Do it yourself pesticides are illegal in city facilities. Similar laws may apply to other residences.

Handling Complaints

Bed bugs and other pests sometimes elicit fear and panic in people. Most are unwilling to live with pests, especially those that bite. However, some individuals are resigned to living with bed bugs and may be the source of an infestation in an adjacent unit or room.

Complaints about pests or bites must therefore be handled IMMEDIATELY and with concern, but also with a logical approach that relies on science and pest control expertise. The typical course of events would be complaint, inspection (of one or many units), confirmation, cleaning, treatment, future prevention, and follow up to be sure the problem was handled adequately.

Designation of a pest management coordinator in your organization can streamline the handling of complaints and infestations. There should be one person in charge of overseeing the inspection and treatment process. Often this is the building or facility manager.

Encourage clients to speak openly about bed bugs and other pests and to ask for help. Be sensitive to their concerns. Use resources available to you, and gather the contact information of experts, such as your pest control company's staff entomologist, to ensure a quick response

Intake Procedures and Bed Bugs



Clients of homeless shelters and other emergency housing may bring along bed bugs from their previous living arrangements. It is important that intake counselors understand the nature of bed bug issues and express to clients that help is available. **It is in the best interest of a shelter or group home to know whether a client has been exposed to bed bugs.** Helping a client with bed bugs immediately as a preventative approach can reduce risks to other clients and reduce costs associated with eradication if bed bugs become established. Bed bugs are sometimes referred to as chinchies, chintzes, mahogany flats, red coats, and other nicknames.

Intake interviews may not include a category concerning bed bugs but exposure can be incorporated into medical questions, along with other public health pests, such as exposure to lice, scabies, and presence of cockroach allergies or asthma.

Questions should be phrased compassionately. Some suggestions are:

- Have you stayed in a place where you think you may have been exposed to bed bugs in the past three months?
- Has anyone in your family been bitten by bed bugs or do they have bites or blisters that you're concerned about?
- Bed bugs, lice, scabies and other things can cause medical concerns. Do you need help with a bed bug, or any other pest, issue?

If a potential client indicates that they believe they have been exposed to bed bugs or they know they have bed bugs, immediate help is necessary to avoid spreading them within the shelter or home. Help may be in the form of medical attention, laundering clothes, and isolating their belongings while a control strategy is formed.

- In some cases, bites will be evident, but the client may not know or be concerned that they have been exposed to bed bugs.
- If a client refuses to follow procedures for bed bugs, such as inspecting belongings, laundering, or medical attention, a social worker may need to build this into their case plan.
- Do not refuse shelter to clients with symptoms of bed bug infestations.
- Attempt to provide isolated shelter away from the rooms or beds of other clients.
- Provide large plastic bags for personal belongings. Explain that these must remain sealed.
- Provide literature to the individual or family about bed bugs and their management and prevention.
- When placing an individual or family into a shelter, notify your administration of the bed bug issue.
- Respond to bed bug complaints immediately.

Personal Protection from Bed Bugs



How to avoid picking up bed bugs at work:

Workers involved in housekeeping, facilities maintenance, medical and social work will be at risk for picking up bed bugs from an infested room or home or their contents. However, there are steps that can be taken to reduce these risks and workers must be prepared to follow these steps to protect themselves.

Follow these recommendations to reduce the risk:

- Know or ask ahead of time whether the room or space has bed bugs.
- Do not bring bags or personal belongings inside the room, carry as little as possible with you.
- For cleaning and maintenance crews, wear a Tyvek brand suit or similar protective coveralls that will prevent bed bugs from hitching a ride on the clothes or shoes. Discard the coveralls by changing immediately and by sealing the suit in plastic bag.
- Dissolving plastic bags are available that allow the user to isolate infested clothing until it can be placed in the wash. These bags dissolve in the laundry.
- For social and medical service providers, bring a portable stool to sit on and remain in the middle of the room. If this is not possible, be sure to sit on a hard chair, not on plush furniture or beds.
- Carefully shake out your clothes while standing outside before returning to your car or office.
- Bring a change of clothes and shoes for working in the field, change clothes at work and keep the field clothes and shoes in a sealed bag for laundering.
- Be vigilant about what to look for. Bed bugs are visible, but the youngest ones are very small. Inspect your own living and work space on a regular basis.
- There are currently no insect repellents that are labeled for bed bugs.

Bed Bugs for the Medical Service Provider



The common bed bug, *Cimex lectularius*, has re-emerged as a significant pest of humans in the United States, Canada, Europe, Australia, and other developed countries after a 40 year period of near absence. Other species of Cimicids will bite humans, especially the tropical bed bugs, but the most common pest is *C. lectularius*.

The adult bed bug is a flattened, reddish-brown insect that cannot fly or jump. Juveniles are small and pale. Bed bugs hide in tight spaces close to where the host sleeps. Humans are the main host and blood is the only food source. A blood meal is needed for each stage of growth, including egg-laying, so bed bugs feed often. Their population can increase dramatically in a short period of time if the issue is overlooked or ignored.

Bed bugs have not been shown to vector diseases, despite their evolution as a blood-feeding pest of humans. Medical issues associated with bed bugs include multiple itchy bites and inflammation, secondary skin infection, a minor potential for anemia from blood loss, minor risk of anaphylaxis, stress, anxiety, sleeplessness, and the potential for overexposure to pesticides used in their control.

Skin and other reactions:

Bed bugs have piercing-sucking mouth parts. They inject anticoagulant/anesthetic saliva to the wound, which causes varying degrees of inflammation. For many people bites go unnoticed. For others, bites can be extremely itchy, showing up most commonly upon awakening, since bed bugs mainly feed during the night and early morning hours.

Bed bug bites present as:

- Pruritic wheals (like mosquito bites);
- Papules;
- Groups of small vesicles with surrounding erythema and induration;
- Bullous lesions which may resemble erythema multiforme;
- Asthma exacerbations, anaphylaxis, or other systemic responses.

Lesions may also have a central punctum or puncture wound. Bites occur in clusters or lines, in open areas of the skin, and where clothing is not tight.

(From: The Health Care of Homeless Persons: A Manual of Communicable Diseases and Common Problems in Shelters and on the Streets– Part I – Bed Bugs. Healthcare for the Homeless Council. 2006. D. Buchanan and C. Cleary

Treatment of bites:

Bed bug bites are generally self-resolving in 3-10 days but bites may result in scarring. Topical or oral antihistamines can bring relief. Ultimately, effective and long term bed bug control is required to resolve this condition. Mental health support may be required for some sufferers.

Delusory parasitosis or mystery bites

Delusory parasitosis (DP), also known as Ekbom's Syndrome, is the feeling or fear that one is being infested with parasitic organisms, which may be accompanied by an actual physical sensation of itching or crawling on the skin. Sufferers may scratch, injure themselves, apply pesticides to their skin or surroundings, and often compulsively gather evidence of the infestation. Evidence may be in the form of marks on the skin, particles of cloth, fibers, and other debris, and carefully recorded observations of the parasite behaviors. Often, sufferers seek insect or mite related causes, and they may have unshakable beliefs that their bodies or surroundings are infested with bed bugs, mites, fleas, and other real and imaginary organisms.

It is critical to determine whether an insect or mite is present in the living area before considering treatments, especially pesticide use, which may exacerbate itching or other medical conditions. Bed bugs have become common enough to consider as a causal agent, but bed bugs are not the only possibility. Scabies is a condition where mites burrow into the skin resulting in lesions and open sores. This occurs on the hands, wrists and elbows, but can be all over the body. Scabies must be diagnosed through microscopic examination of skin scrapings taken from the edge of the affected area. More information on scabies can be found in medical literature. Bird mites will bite people but do not burrow into the skin or live on people. They are usually present when birds nest in vents, window sills, or air conditioning units of a living space. Rodent mites occasionally bother humans, especially when pet rodents are kept (hamsters,

gerbils) or when pest rodents are present in the home. Fleas can be present when domestic or even wild animals are living in or close to the home or room. Positive and accurate identification of a biting arthropod may require the expertise of an entomologist skilled in diagnostics.

If no arthropod can be identified in the living environment, yet the individual insists that their symptoms are

real, or if they have inflicted damage upon themselves as a result of a perceived infestation, other causes must be explored. Commonly, DP sufferers have medical or psychogenic causes of itching and prickly sensations.

Symptoms of DP may be caused by a wide variety of conditions including, but not limited to:

Diabetes, hyperthyroidism
Medications
Drug abuse
Hormonal changes
Mild allergies to environmental stimuli, such as
detergents
Dementia
Anxiety, depression
Paranoia
Nutritional deficiencies
Central nervous system infections

For a more complete treatment of delusional parasitosis see the following references:

- * Slaughter, J.R., Zanol, K., Rezvani, H., and Flax, J.F. Psychogenic Parasitosis, a case series and literature review. *Psychosomatics*, 39: 491-500. 1998
- * Hinkle, N. Delusory Parasitosis, *American Entomologist*. 2000, 46(1):17-25

Social Worker Procedures and Bed Bugs



This information is intended to provide the social worker with facts about how to begin to help a person or family with bed bugs, whether homeless, independent, or living in a group home. Bed bugs may be one of the many challenges they face and a visit with a social worker may be the first compassionate educational experience a person has about bed bugs. The introduction sheet in this manual will give you more information about bed bug biology and habits. Even transient people can be greatly affected by these insects as they are good at hiding in personal belongings when people move. Bed bugs are small wingless insects that feed exclusively on blood and live in close proximity to (not on) people.

People living with bed bugs and their bites may suffer emotional distress, as well as financial burdens of discarding property, buying products and items to control bed bugs, and the costs and stress of possibly being displaced. The elderly are particularly at risk for being displaced as a result of bed bug problems because they may not be physically able to cooperate with pre-treatment requirements, or able to clean their homes as required. **The important thing to communicate is that bed bugs can be controlled, but it takes cooperation.**

Clutter is a major obstacle in bed bug control, and many who suffer with bed bugs are overwhelmed in other ways. However, preparation for bed bug control is very important. Those in need who are suffering with bed bugs will need specific things in order to cooperate in the process of eliminating bed bugs from their room or home.

These include:

- Instructions for preparing their belongings and rooms or apartments for bed bug treatment (provided in this guidebook and available elsewhere in Spanish).
- Plastic bags for storage of belongings and clothes. Bags must be tied tightly or sealed well to prevent transfer of bed bugs into or out of bags.
- Access to laundry, particularly a dryer, to clean clothing, linens, pillows, plush toys, coats, and shoes of bed bugs. Heat will kill all life stages. Access to laundry may require money for use of a laundromat.
- Cleaning supplies or services (may not be supplied by the management or a pest control professional).
- Some may need help in the form of physical labor for cleaning, moving furniture, sorting through personal belongings, organizing their homes, and reducing clutter.
- Emotional support may be required. Many bed bug sufferers describe post-traumatic stress disorder-type symptoms associated with the stress of their infestation.
- Access to basic necessities, such as clothes or children's toys, or even a bed, if the client has discarded their belongings due to bed bugs.
- Bed bug bites may require medical care.
- If displaced as a result of bed bugs, the client may need help, possibly legal help.
- A person or family with bed bugs may require an advocate to help them get fair treatment with housing, schools, and other services.
- Reinfestation may occur if clients are picking up bed bugs in another place.

How to Move and Leave Bed Bugs Behind



Once bed bugs have been confirmed in the living area of an individual or family, there may be good reason to move them to a different area or apartment while the infested one is treated. However bed bugs may be transferred with personal belongings, causing more trouble in the new living space. Some suggestions for moving to a new location without bringing bed bugs are as follows:

- Place **all** belongings in clear plastic bags that are sealed tightly. Sort items by type (clothes, towels, sheets and blankets) and keep things that are known to be infested away from clean items.
- Have each individual shower and change into clean clothing and shoes and bag up the current (possibly infested) clothes for laundering.
- Educate the resident about protecting themselves from bed bugs and what to look for using fact sheets from this manual.
- Before personal belongings can be accessed in the new home, they **MUST** be bed bug free, or the process will be repeated.
- Provide or obtain access to laundry.
- Follow all laundering and cleaning steps for personal belongings.
- Keep items that cannot be sanitized inside clear plastic bags (electronics, appliances, books, etc.) and ask a professional pest manager how these items should be treated. Aerosol pesticides may be recommended for a faster solution. Storage of these items for one year is a non-toxic choice, but may be difficult due to space or needs. If items are kept warm, storage time is reduced.
- Provide vinyl or bed bug proof covered mattresses for the beds of each member of the household. Also cover box springs if they are present.
- Provide contact information for a person who will respond to bed bug complaints, in case bed bugs show up again.
- Whether you move permanently or temporarily, leave furniture behind if possible to allow it to be treated. Treat furniture before moving it. Take with you as few items as possible at first.
- Pets must be relocated during treatment. Leave behind their bedding and cages, unless these items can be thoroughly washed.

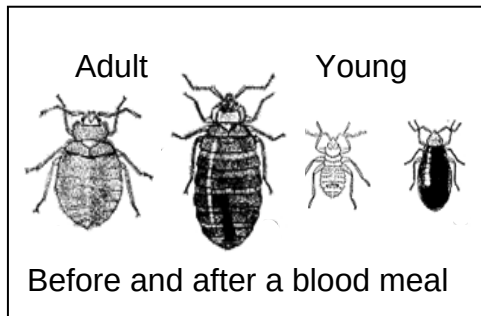
How to Protect You and Your Family from Bed Bugs



Introduction

In the past ten years bed bugs have become a serious pest in the US. Bed bugs, like mosquitoes, are insects that feed on blood. Bed bugs live in the home, especially in and around the bed, and usually bite at night when people are sleeping. They will feed at any time of day if necessary.

Bed bugs have three main stages of life, the egg, the young and the adult. Young bed bugs can vary in size from poppy seed to sesame seed, and adults can be as big as an apple seed. All are tan or brownish-red in color. They may be full of blood, as seen in the drawing to the left.



The first sign of bed bugs is usually a group of bites. If you experience bites, look for bed bugs in your bed or where you have slept recently. Have you been outside in warm weather? They could be mosquito or flea bites or something else. Everyone reacts differently to bed bug bites. Some people don't react at all, and others develop itchy lumps.

Fast Facts about Bed Bugs

Bed bugs:

- Do **not** transmit diseases to people
- May trigger asthma
- Can **not** fly or jump, but **can** run fast
- Are large enough to be seen
- Can be transported in personal belongings
- Are often found on thrown out furniture
- Can travel through a building
- Can be difficult to control
- Can be eliminated and prevented



Bed bug droppings and egg shells. Photo by Gary Alpert.

Where to Look for Bed Bugs

- Check the sheets, pillows and blankets for stains.
- Look under the mattress and pillows.
- Check the seams and puckers of the mattress and box spring.
- Look at the bed frame for bugs and stains.
- Check the floor and moldings.
- Look inside and underneath drawers.
- Radios, phones, clocks near the bed or on a nightstand may also be hiding places for bed bugs.



Bed bug adult and droppings on a mattress. Photo by Harold Harlan.

How to Help Yourself

- Don't panic, bed bugs are not life threatening.
- Call your building manager, landlord or social service provider immediately if you think there may be bed bugs in your room or bed.
- Follow all instructions given to you.
- Wash and dry your clothing and bedding on hot. 30 minutes of heat kills bugs and their eggs.
- Wash donated clothing before wearing.
- Do not take furniture or items from the street, they may have bed bugs!
- Do not try to use pesticides on your own.
- "Bug bombs" are not effective for bed bugs.
- Talk to others about it; bed bugs are common today in all types of housing. Everyone should be aware.
- Cooperate with those trying to help you.



Bed bugs and residue on back of vinyl molding. Photo by Louis Sorkin.

Prevent the spread of bed bugs by following these steps and talking about it. Ask for help!

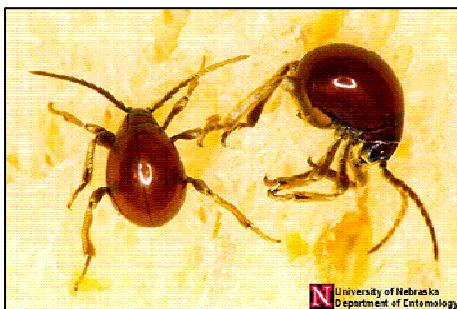
Correct identification! Bed bugs may be confused with other household insects such as cockroaches, carpet beetles, or spider beetles. If you find an insect that may be a bed bug, **SAVE IT** in a container for identification! **These are not bed bugs:**



German cockroaches

Young roaches look like bed bugs. Look for rectangular egg cases and fecal pellets. The color is more brown than red.

Carpet and warehouse beetle adults and larvae may appear in beds feeding on hair and feathers. Larvae may shed tiny hairs that cause itching but these do not bite.



Shiny spider beetles are often confused with bed bugs and ticks. They feed on dried plant material, seeds, or dried meat and do not bite humans.

What Can I Do About Bed Bugs?



Do I have bed bugs?

Bed bugs are a growing problem in all types of living situations. If you have seen bed bugs or have itchy bites that could be from bed bugs DON'T PANIC, but seek help quickly.

There are many steps that you must take to help get rid of bed bugs. Read on:

1. - **Seek advice.** Contact your building or facility manager and arrange for someone to check for bed bugs. If you see bugs, capture them on sticky tape or on a tissue and store them in a plastic bag in the freezer for identification. Insects found where you live could be one of many things. Don't assume that they are bed bugs. Do not move belongings until confirming you have bed bugs. See References for a list of Cooperative Extension diagnostic laboratories.
2. – Prepare to clean your living space thoroughly if someone confirms that bed bugs are present. Cleaning includes the following:
 - Wash and dry all clothing on hot settings. Drying on HIGH for at least 30 minutes is more important than washing to kill bed bugs.
 - Washing and drying bed sheets, blankets and pillow cases at high temperatures. Again, drying on HIGH is most important.
 - Shoes, pillows, curtains, coats, plush toys can all be placed into a dryer at a medium to high temperature.
 - Picking up and organizing your personal belongings to reduce the amount of clutter in your living space.
 - Providing access to all walls, closets, space around the bed and furniture for an inspector to search for and get rid of bed bugs.
 - Storing cleaned items in plastic bags away from the problem
 - Vacuuming and washing the floors, or letting a cleaning crew come in to clean.
 - Dispose of vacuum bags immediately, they will contain live bed bugs.
2. – Prepare to follow more thorough instructions given to you by the management. Prepare to cooperate and do what is required to eliminate bed bugs. Without your cooperation, the bugs will not be eliminated. There are no simple ways to kill bed bugs.
3. – Do not buy or plan to use any over the counter “bug bombs” or insect killers on your own. You will only spread the bed bugs further into your living space and belongings.
4. – Do not pick up discarded items on the street. Although there are many valuable items being tossed away, **today** many of these items, including clothes and shoes, are already infested with bed bugs. **Avoid taking these items. Any used furniture, even bought, should be inspected.**

Room Preparation Checklist for Bed Bugs



Preparation of a room for treatment is essential to the successful management of bed bugs. Most pest managers prefer to conduct an inspection BEFORE any cleaning or rearranging has occurred. This gives the pest manager a sense of the full extent of the problem and prevents the disturbance and spread of bed bugs before treatment. However, once bed bugs are located and the size of the problem has been estimated, room preparation must be done, and usually by the resident. Some clients may need help and the pest control professional or building management must be sensitive to this.

Suggested room preparation steps include:

- ☐ Remove all blankets, sheets, covers, pillows, bath towels, and drapes/curtains from the bed and room and place them into bags for transport to the laundry.
- ☐ Empty drawers and closets and place belongings into plastic bags. Place all clothing and coats into bags for transport to the laundry. Shoes, pillows, and children's plush toys should be bagged for the laundry.
- ☐ Plastic toys, books, electronics, and anything that cannot be washed should be bagged separately for inspection.
- ☐ The room should be empty of all cloth and plush items, except plush furniture. If possible, the pillows of plush furniture should be removed and laundered.
- ☐ Move furniture at least 18 inches away from the walls. People may need help with this.
- ☐ Remove outlet covers and switch plates on all walls.
- ☐ Picture frames should be removed from the walls and cleaned or treated.
- ☐ People and pets must leave the area during treatment and wait the stated amount of time before reentering, usually 4 hours.
- ☐ If there is a fish tank in the household, it should be covered with a towel or plastic, because fish are very sensitive to many pesticides.
- ☐ All clothing, linens and other items must be cleaned (free of bed bugs) and kept isolated until the client is moved to a new room or location, or until the bed bug problem is eliminated.
- ☐ Make sure the pest control professional can get to all furniture, closets, beds, and baseboards to inspect and treat.

Cleaning and Laundry Checklist for Bed Bugs



Pesticides, alone, will not eliminate a bed bug infestation. Inspecting and cleaning the living area and all personal belongings are critical for bed bug control and elimination. Cleaning should occur before pesticides are used. Follow all the recommended steps as they apply to the individual situation:

- ☐ Seal all clothing and linens in large clear plastic bags. Clear bags are good because bed bugs can be seen inside them.
- ☐ Seal shoes, coats, pillows, children's plush toys, and small rugs and mats in large clear plastic bags.
- ☐ Personal belongings should be inspected carefully, cleaned, and sealed in plastic bags or bins. Do not use cardboard boxes, bed bugs can hide in folds and will deposit eggs there.
- ☐ All clothes, linens, pillows, shoes, coats, and children's plush toys should be treated by placing them into a HOT dryer for 30 minutes. Do not overstuff the dryer, heat must reach all items.
- ☐ Keep cleaned items separate from items that have not been checked or cleaned.
- ☐ Unless you are sure that there are no bed bugs on personal belongings, these should remain in the bag or bin until they can be carefully inspected or washed.
- ☐ The room should be emptied of all personal belongings and floors thoroughly vacuumed with a brush attachment (which should later be washed in hot water and detergent).
- ☐ The mattress and box spring should be vacuumed to remove any live bugs and debris and immediately encased or prepared for treatment.
- ☐ Hard furniture, floors, and walls should be washed liberally with soapy water.
- ☐ Outlets and electrical switch plates should be opened and inspected for signs of bed bugs, but not washed!
- ☐ Wash in and around any non-electric heating units (such as steam pipes or radiators).

References

A list of publications that have been valuable in the development of this manual and that contain more information about bed bugs, their biology, and control:

Anonymous. Bed Bugs – A Handbook for Shelter Operators. City of Toronto, Shelter, Support, and Housing Administration. (Found at www.toronto.ca/housing/info-agenices-shelters.htm, July 2008).

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Ojo, J. Director's Rules and Regulations- How to Control Bed Bug Infestations. San Francisco Health Code. 2006.

Pinto, L.J., Cooper, R., and Kraft S.K. *Bed Bug Handbook. The Complete Guide to Bed Bugs and Their Control*. Pinto & Associates, Inc. 2008.

Potter, M.F. A Bed Bug State of Mind. *Pest Control Technology*. October 2005.

Reinhardt, K., Siva-Jothy, M.T. Biology of the Bed Bugs (Cimicidae). *Annual Review of Entomology*. 2007. 52:351-374.

Slaughter, J.R., Zanol, K., Rezvani, H., and Flax, J.F. Psychogenic Parasitosis, a case series and literature review. *Psychosomatics*, 39: 491-500. 1998

For a database of Cooperative Extension diagnostic laboratories for identification of specimens see: <http://www.csrees.usda.gov> . Click on the "Local Extension Offices" link.

Glossary of Terms

Aerosol – A liquid contained under pressure that is released in the form of fine liquid particles, in a mist.

Arthropod – Any invertebrate belonging to the phylum Arthropoda, with a segmented body, jointed legs, a chitinous exoskeleton, and undergoing molts. This includes the insects, spiders and other arachnids, crustaceans, and others.

Crack and crevice treatment – the application of small quantities of pesticide in a building into small openings, such as those found around moldings, between floor boards, expansion joints, and beneath furniture or appliances.

Encasement – A completely sealed and zippered cover for a mattress or box spring, that may be constructed of plastic or breathable fabric.

Fogger – A device that spreads a liquid chemical in the form of fine liquid particles, like a mist.

Fumigation – To use a gas or vapors of a chemical to kill or repel pests.

HEPA – High-efficiency particulate arresting, or capturing fine particulates through filtration.

Instar – The developmental stage of an arthropod, between each molt until maturity.

Integrated Pest Management (IPM) – A systematic approach to managing pests which focuses on long-term prevention or suppression with minimal impact on human health, the environment and non-target organisms. IPM incorporates all reasonable measures to prevent pest problems by properly identifying pests, monitoring population dynamics, and utilizing cultural, physical, biological or chemical pest population management methods to reduce pests to acceptable levels. (NY State DEC definition)

Pesticide – A pesticide is any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest. Pests can be insects, mice and other animals, unwanted plants (weeds), fungi, or microorganisms like bacteria and viruses. The term pesticide also applies to herbicides, fungicides, and various other substances used to control pests. Under United States law, a pesticide is also any substance or mixture of substances intended for use as a plant regulator, defoliant, or desiccant. Insecticide is the more specific term used for substances to control arthropod pests.

Pesticide resistance – The genetic change of pest species targeted by a pesticide resulting in decreased susceptibility to that chemical.