



Joint Statement on Bed Bug Control in the United States from the U.S. Centers for Disease Control and Prevention (CDC) and the U.S. Environmental Protection Agency (EPA)

Introduction and Purpose

The Centers for Disease Control and Prevention (CDC) and the U.S. Environmental Protection Agency (EPA) developed this document to highlight emerging public health issues associated with bed bugs (*Cimex lectularius*) in communities throughout the United States.

Bed bugs (**Photo 1**) have been common in U.S. history. Although bed bug populations dropped dramatically during the mid-20th century (1), the United States is one of many countries now experiencing an alarming resurgence in the population of bed bugs. Though the exact cause is not known, experts suspect the resurgence is associated with increased resistance of bed bugs to available pesticides, greater international and domestic travel, lack of knowledge regarding control of bed bugs due to their

prolonged absence, and the continuing decline or elimination of effective vector/pest control programs at state and local public health agencies.

In recent years, public health agencies across the country have been overwhelmed by complaints about bed bugs. An integrated approach to bed bug control involving federal, state, tribal and local public health professionals, together with pest management professionals, housing authorities and private citizens, will promote development and understanding of the best methods for managing and controlling bed bugs and preventing future infestations. Research, training and public education are critical to an effective strategy for reducing public health issues associated with the resurgence of bed bug populations.

Impact of Bed Bugs on Public Health

Although bed bugs are not known to transmit disease, they are a pest of significant public health importance. Bed bugs fit into a category of blood-sucking ectoparasites (external parasites) similar to head lice (*Pediculus humanus capitis*). Bed bugs, like head lice, feed on the blood of humans but are not believed to transmit disease. Other ectoparasites, such as body lice (*Pediculus humanus corporis*), are known to transmit several serious diseases. Differences in the biology of similar species of pests, such as body lice and head lice (or bed bugs) can greatly impact the ability of pests to transmit disease.



Photo 1. Bed Bug. Photo courtesy of Dr. Harold Harlan, Armed Forces Pest Management Board Image Library

Bed bugs cause a variety of negative physical health, mental health and economic consequences. Many people have mild to severe allergic reaction to the bites with effects ranging from no reaction to a small bite mark to, in rare cases, anaphylaxis (severe, whole-body reaction) (2). These bites (**Photo 2**) can also lead to secondary infections of the skin such as impetigo, ecthyma, and lymphangitis (3,4). Bed bugs may also affect the mental health of people living in infested homes. Reported effects include anxiety, insomnia and systemic reactions (1).



Photo 2. Skin Reaction to Bed Bug bites. Photo courtesy of Dr. Harold Harlan

Research on the public health effects of bed bugs has been very limited over the past several decades, largely due to the noted decline in bed bug populations in the latter half of the 20th century. Now that bed bug populations are rapidly increasing, additional research is needed to determine the reasons for the resurgence, the potential for bed bugs to transmit disease and their impact on public health.

Economically, bed bug infestations are also a burden on society. Although the exact dollar amount is not known, the economic losses from health care, lost wages, lost revenue and reduced productivity can be substantial. The cost of effectively eliminating bed bugs may be significantly more than the cost of eliminating other pests because bed bug control usually requires multiple visits by a licensed pest control operator and diligence on the part of those who are experiencing the infestation. Control in multi-family homes is much more difficult than in single family homes because bed bugs frequently travel between units, either by direct transport by humans or through voids in the walls. There are additional costs and complexities associated with coordinating and encouraging participation from multiple residents.

When a community starts to experience bed bug infestations, control is often more challenging because:

- Local public health departments have very limited resources to combat this problem and bed bugs frequently are not seen as a priority.
- Municipal codes struggle to identify those responsible for control of bed bug infestations. Tenants and landlords often dispute who is ultimately responsible for the cost of control and treatment. Treatment costs are high and transient populations make it difficult or impossible to assign responsibility.
- Pesticide resistance and limited control choices make treatment even more difficult. Some bed bug populations are resistant to almost all pesticides registered to treat them. Residents may use over-the-counter or homemade preparations that are ineffective (or even dangerous) and may promote further resistance.
- Pesticide misuse is also a potential public health concern. Because bed bug infestations are so difficult to control and are such a challenge to mental and economic health, residents may resort to using pesticides that are not intended for indoor residential use and may face serious health risks as a result. Additionally, residents may be tempted to apply pesticides registered for indoor use, but at greater application rates than the label allows. This results in a much greater risk of pesticide exposure for those living in the home. Pesticides must

always be used in strict accordance with their labeling to ensure that the residents and applicators are not exposed to unsafe levels of pesticide residues.

Bed Bug Biology

Bed bugs are small, flat insects that feed on the blood of sleeping people and animals. They are reddish-brown in color, wingless, and range from 1 to 7 millimeters in length. They can live several months without a blood meal.

Infestations of these insects usually occur around or near the areas where people sleep or spend a significant period of time. These areas include apartments, shelters, rooming houses, hotels, nursing homes, hospitals, cruise ships, buses, trains, and dorm rooms.

Bed bugs are experts at hiding. They hide during the day in places such as seams of mattresses, box springs, bed frames, headboards, dresser tables, cracks or crevices, behind wallpaper, and under any clutter or objects around a bed. Their small flat bodies allow them to fit into the smallest of spaces and they can remain in place for long periods of time, even without a blood meal. Bed bugs can travel over 100 feet in one night, but they tend to live within 8 feet of where people sleep.

Bed bugs are usually transported from place to place as people travel. Bed bugs travel in the seams and folds of luggage, overnight bags, folded clothes, bedding, furniture, and anywhere else where they can hide. Most people do not realize they can transport stow-away bed bugs as they travel potentially infesting new areas, including their homes, as they relocate.

One of the easiest ways to identify a bed bug infestation is by bite marks that appear on the face, neck, arms, hands, and any other body parts. However, these bite marks may take as long as 14 days to develop in some people so it is important to look for other clues when determining if bed bugs have infested an area. These signs may include the exoskeletons (**Photo 3**) of bed bugs after molting, bed bugs in the fold of mattresses and sheets, a sweet musty odor, and rusty-colored blood spots from their blood-filled fecal material that is often excreted on the mattress or nearby furniture.



Photo 3. Bed Bug Exoskeletons. Photo courtesy of Dr. Harold Harlan, Armed Forces Pest Management Board Image Library

When bed bugs bite, they inject an anesthetic and an anticoagulant that prevents a person from feeling the bite. Because bites usually occur while people are sleeping, most people do not realize they have been bitten until marks appear. The bite marks are similar to that of a mosquito or a flea - a slightly swollen and red area that may itch and be irritating. The bite marks may be random or appear in a straight line. Other symptoms of bed bug bites include insomnia, anxiety, and skin problems that arise from profuse scratching of the bites.

Everyone is at risk for bed bugs bites when visiting an infested area. However, anyone who travels frequently and shares living and sleeping quarters where other people have previously slept has an increased risk for being bitten and for spreading a bed bug infestation.

Integrated Pest Management for Bed Bugs

The current national problem with bed bugs is likely due to the convergence of three human behaviors: lack of awareness of the historical and biological link humans have with bed bugs, increased international travel, and past over-reliance on pesticides. Bed bugs are a “nest parasite” that resides in the human nest – the bedroom. Over time, bed bugs have evolved to develop resistance to many of the chemical pesticides currently used. In fact, bed bugs were widely resistant to DDT by the mid-1950s (5).

Integrated pest management (IPM) is an effective and environmentally sensitive approach to pest management that relies on a combination of common-sense practices. IPM programs use current, comprehensive information on the life cycles of pests and their interaction with people and the environment. This information, in combination with available pest control methods, is used to manage pest damage by the most economical means, and with the least possible hazard to people, property, and the environment.

Bed bug control is most effective when an IPM approach is implemented with diligent participation by the residents. In multi-family housing, diligent participation is also required of the building management. IPM takes advantage of all appropriate pest management options, including the judicious use of pesticides. Although bed bugs may sometimes be controlled by non-chemical means alone, this approach is often very difficult, potentially less effective, and usually more resource intensive. A comprehensive IPM program to control bed bugs may include a number of methods such as:

- using monitoring devices,
- removing clutter where bed bugs can hide,
- applying heat treatment,
- vacuuming,
- sealing cracks and crevices to remove hiding places,
- using non-chemical pesticides (such as diatomaceous earth) and
- judicious use of effective chemical pesticides

A coordinated community IPM program can alleviate both the discomfort and cost of managing bed bugs. The underlying philosophy of bed bug IPM is based on the fact that bed bug infestations will not go away without intervention. Intervention is most effective when populations are low. Such a coordinated effort could create a partnership among government, property managers, citizens, and pest management professionals to ensure an effective intervention facilitated by environmental health professionals. EPA and CDC recommend that pest management and environmental health professionals throughout the U.S. continue to use IPM strategies as they address the bed bug issue.

The Role of Government Agencies and the Public in Bed Bug Control

CDC, EPA, and other federal agencies are working closely with state, tribal and local health departments, academia and private industries to monitor and better understand the recent resurgence of bed bugs in communities throughout the United States. CDC and EPA are facilitating communications and working to expand the knowledge base among agencies and programs that may have a role in reducing bed bug populations. The two agencies are also fostering cooperation with the private sector and the public to encourage their help with this endeavor.

CDC is partnering with experts in the areas of medicine, entomology, epidemiology and environmental toxicology to better understand the resurgence of bed bugs and the methods and tools that are needed for effective bed bug control. CDC will provide timely information on emerging trends in bed bug control with the goal of developing national strategies to reduce bed bug populations. CDC recognizes that very limited research has been conducted on bed bugs during the past several decades and encourages increased bed bug research to determine the causes of the resurgence, the most effective methods of control and the potential for bed bugs to transmit disease.

EPA's primary responsibility is the dual statutory charges to ensure that the pesticides with public health uses are (1) safe and (2) effective against the pests on their labels. EPA carries out this responsibility by conducting rigorous scientific screening of pesticides and imposing limits through registration of pesticides to ensure that when used to control pests, they do not harm people or the environment.

EPA is working to ensure that pest management professionals and the public have access to the latest information on effective bed bug control tools. EPA realizes that certain bed bug populations in communities across the nation are becoming increasingly resistant to many of the existing pesticides. EPA is actively working with industry and researchers to identify new compounds (or new uses of existing compounds) to control bed bugs. In addition, EPA is working to educate the general public, pest professionals, and public health officials about bed bug biology and IPM, which is critical to long-term bed bug control.

Other federal agencies are also involved in research and education about bed bugs. For example, the U.S. Department of Housing and Urban Development (HUD) is funding research on bed bug monitoring and control in low-income, multi-family housing, along with educating public housing authorities and other housing industry groups about bed bug identification and control. Health departments can use local HUD field office personnel or local housing officials as resources when addressing bed bug issues in multi-family housing.

State, tribal, and local government agencies and health departments play a critical role in protecting the public from bed bugs. Public health departments serve on the front lines, providing information on prevention and control of bed bugs through various programs to the public and private sector.

The public, together with their local health agencies, must be involved in the control and management of bed bug populations and must be provided with the knowledge of best practices to prevent and control bed bug infestations. In some cases, a coordinated community control program may be necessary to reduce or eliminate bed bug populations.

Additional Information

For additional information about bed bugs and their control, please see the following print references:

- Cooper RA, Harlan HJ. Ectoparasites, part three: bed bugs and kissing bugs. In: Mallis A, Hedges SA, Moreland D, editors. Handbook of pest control, ninth edition. Richfield, OH: GIE Media, Inc.; 2004. p. 495-529.
- Harlan HJ, Faulde MK, Bauman GJ. Bedbugs. In: Bonnefoy X, Kampen H, Sweeney K, editors. Public health significance of urban pests. Copenhagen: World Health Organization; 2008. p. 131-53.
- Miller DM. Bed bugs (Insecta: Hemiptera: Cimicidae: Cimex spp.). In: Capinera J, editor. Encyclopedia of entomology. Dordrecht, Netherlands: Kluwer Academic Press Springer; 2008. p. 405-17.
- Usinger RL. Monograph of Cimicidae. Lanham, MD: The Entomological Society of America; 1966.

For additional information about bed bugs and their control, please see the following Web sites:

- U.S. Environmental Protection Agency:
<http://epa.gov/pesticides/controlling/bedbugs.html>
- Centers for Disease Control and Prevention:
<http://www.cdc.gov/nceh/ehs/Topics/bedbugs.htm>
- Bed Bug Hotel Safety:
<http://www.oregon.gov/DHS/ph/pl/docs/bedbughotel.pdf>
- Central Ohio Bed Bug Task Force Information: <http://centralohiobedbugs.org/>
- Cornell Bed Bug Guide:
http://www.nysipm.cornell.edu/publications/bb_guidelines/
- Harvard School Public Health Bed Bug Management:
<http://www.hsph.harvard.edu/bedbugs/>
- National Pest Management Association: <http://www.pestworld.org/for-consumers/pest-frequently-asked-questions/bedbug-faq>
- National Pesticides Information Center: <http://npic.orst.edu/pest/bedbug.html>
- New Jersey Bed Bug Fact Sheet:
<http://www.nj.gov/health/eoh/phss/documents/bedbugfactsheet.pdf>
- University of Kentucky Bed Bug Fact Sheet:
<http://www.ca.uky.edu/entomology/entfacts/entfactpdf/ef636.pdf>
- University of Minnesota Bed Bug Information for Travelers:
<http://www.extension.umn.edu/distribution/housingandclothing/M1196.html>

References

1. Anderson A, Leffler K. Bed bug infestation in the news: a picture of an emerging public health problem in the United States. *Journal of Environmental Health*. 2008;70(9):24-7, 52-3.
2. Thomas I, Kihiczak GC, Schwartz RA. Bed bug bites: a review. *International Journal of Dermatology*, 2004;43:430-3.
3. MedlinePlus [Internet]. Bethesda (MD): National Library of Medicine (US); [updated 2010 Feb 17]. Impetigo; [updated 2010 Jan 12; cited 2010 Feb 17]. Available from <http://www.nlm.nih.gov/medlineplus/impetigo.html>.
4. Burnett JW, Calton GJ, Morgan RJ. Bed bugs. *Cutis* 1986;38(1):20.
5. Pinto LJ, Cooper RA, Kraft SK. *Bed bug handbook: the complete guide to bed bugs and their control*. Mechanicsville, MD: Pinto and Associates, Inc.; 2007.