



TACKLING BED BUGS

A Starter Guide for
Bed Bug Problems



Tackling Bed Bugs:

Original Version Prepared By:
Benjamin Adrian, Olivia Dooley, Chen Huang, Michael Levkowitz
Evans School of Public Policy and Governance,
University of Washington
June 2015
Revised May 2018

This starter guide was prepared by University of Washington Evans School of Public Policy and Governance students in partnership with the Region 10 Environmental Protection Agency's Pesticides and Toxics Unit. The starter guide and accompanying report fulfill the partial degree requirements for the Evans School students.

This starter guide is version 1.1 – it has been revised by the Environmental Protection Agency following the student's original version and the Bed Bugs Handbook.

The mention of trade names or commercial products within this document do not constitute an endorsement by EPA or any of its employees. The inclusion of web links to sites describing such materials does not constitute EPA endorsement or recommendations for use.

Acknowledgments

The following individuals provided information on their work as it relates to bed bugs or risk communication, or other input on the guide:

- Mike Bentley, Entomology Graduate Student at the University of Florida Extension School
- Kaci Buhl, Project Coordinator at the National Pesticide Information Center
- Matthew Davis, Program and Policy Development Specialist at the Multnomah County Health Department, Oregon
- Holly Thompson Duffy, Pesticide Program Manager at the Indian Health Service Portland Area (Formerly staff member at the Midwest Pesticide Action Center)
- Megan Dunn, Healthy People and Communities Program Director at the Northwest Center for Alternatives to Pesticides (NCAP)
- Erik Foster, Medical Entomologist at the Michigan Department of Community Health and Human Services
- Dawn Gouge, Urban Entomology Associate Professor and Associate Specialist at the University of Arizona
- Karen M. Griego, Healthy Homes Representative - Regions IX & X & Program Environmental Clearance Officer at the U.S. Department of HUD, Office of Lead Hazard Control & Healthy Homes
- Larry Holyoke, Health and Environmental Investigator at the Local Hazardous Waste Management Program in King County
- Susan Jones, Associate Professor within the Department of Entomology at Ohio State University
- Ruth Kerzee, Executive Director of the Midwest Pesticide Action Center
- Nancy Lee, Founder and President of Social Marketing Service
- Alicia Leytem, Pesticide Specialist at the National Pesticide Information Center
- Alicia Lowe-Downes, Public Health Inspector for the Toronto Public Health Bed Bug Control Initiative
- Mike Merchant, Professor and Extension Urban Entomologist at The Texas A&M AgriLife Research and Extension Center, Dallas
- Dini Miller, Entomologist and Associate Professor in Urban Pest Management at the Department of Entomology, Virginia Tech
- Faith Oi, Entomologist at the University of Florida Extension School
- Cody Pace, IPM Consultant and Bed Bug Specialist at Eden Pest
- Karen Peterson, Pest Control Supervisor at Seattle Housing Authority
- Doug Proctor, Pest Management Professional at Seattle Housing Authority
- Rachel M. Riley, Senior Environmental Trainer at the Office of Lead Hazard Control and Healthy Homes. U.S. Department of Housing and Urban Development
- Derek Spencer, Communications and Outreach Manager at the Midwest Pesticide Action Center
- Jeffrey Strang, Environmental Health Specialist at Multnomah County Health Department, Oregon
- US Environmental Protection Agency Bed Bug Workgroup members

Table of Contents

	Introduction1
Learn the Issue	Bed Bug History3
	Bug Biology5
	A Summary of the Problem.....6
	Collaboration is Key7
	Barriers.....8
Tools	Integrated Pest Management9
	Communication.....10
	Products and Services17
	Policy Considerations22
Get Organized	Determine your Goals28
	Define your Next Steps30
Evaluate your Efforts	Logic Models and Indicators.....31
	Challenges34
	Additional Resources.....35

Introduction

Why are we here?

Bed bugs are unique. They are blood-feeding human ectoparasites that impact public health in many ways and are considered one of the most difficult pests to control in buildings.

Bed bugs are not known to spread disease,¹ but their bites can sometimes cause painful reactions in sensitive individuals. Some people may have mild to severe allergic reaction to the bites and scratching these bites can lead to secondary infections of the skin. Others may suffer from loss of sleep and anxiety, which may lead to or exacerbate existing mental health problems. Out of desperation, some people may misuse pesticides or try dangerous methods to control bedbugs that can have negative human health and environmental effects. Pesticide contamination can render buildings uninhabitable. [EPA and CDC issued a joint statement in 2010](#) that reaffirmed that bed bugs are a public health pest.

Some bed bug populations have become resistant to many pesticides commonly used in homes. Bed bugs also hide in cracks and crevices where many in-home products do not reach them. Effective control efforts therefore need to include a variety of non-chemical tactics.

Considering the effect bed bugs have on public health and the challenges associated with their control, professionals and scientists agree; it takes a coordinated group effort to address bed bug infestations in a community.

How has this issue been addressed?

Laws and resources vary widely across the country. Communities must develop an approach that works locally and plan to sustain a coordinated effort.

- In Boston, Massachusetts, the City's Department of Inspection Services (ISD) enacted policies and started a [public education campaign](#). The Boston Housing Authority (BHA) worked with experts to develop [training and policies](#) to stop the spread of bed bugs in multi-family housing. The number of [complaints has been decreasing](#) since 2012, ten years after the infestation took hold.

¹ Bed bugs have been documented as competent vectors of very few disease causing pathogens. Under normal living conditions, bed bugs have not been found to transmit pathogens to humans.

- In Cleveland, Ohio, a [collaborative task force](#) was developed including local health departments, non-governmental organizations, and businesses directly involved in the response to bed bugs. They have been meeting regularly since 2011.
- In Multnomah County, Oregon, which includes the cities of Portland and Gresham, the Department of Health took the lead, and established a [bed bug hotline](#). They created training documents and compiled resources, responding to the needs of the community.

Let's dig in

The purpose of this starter guide is to provide homeowners and tenants with useful and applicable information to aid them in supporting communities with bed bugs. The guide provides a comprehensive, high-level summary of the bed bug problem and suggestions on how to work towards control.

- An overview and background on the problem of bed bugs
- Strategies and suggestions on policy tools to address the problem
- Information on organizing community-level responses
- Approaches to evaluate success of actions
- References to additional resources

Bed Bug History

Bed Bug History

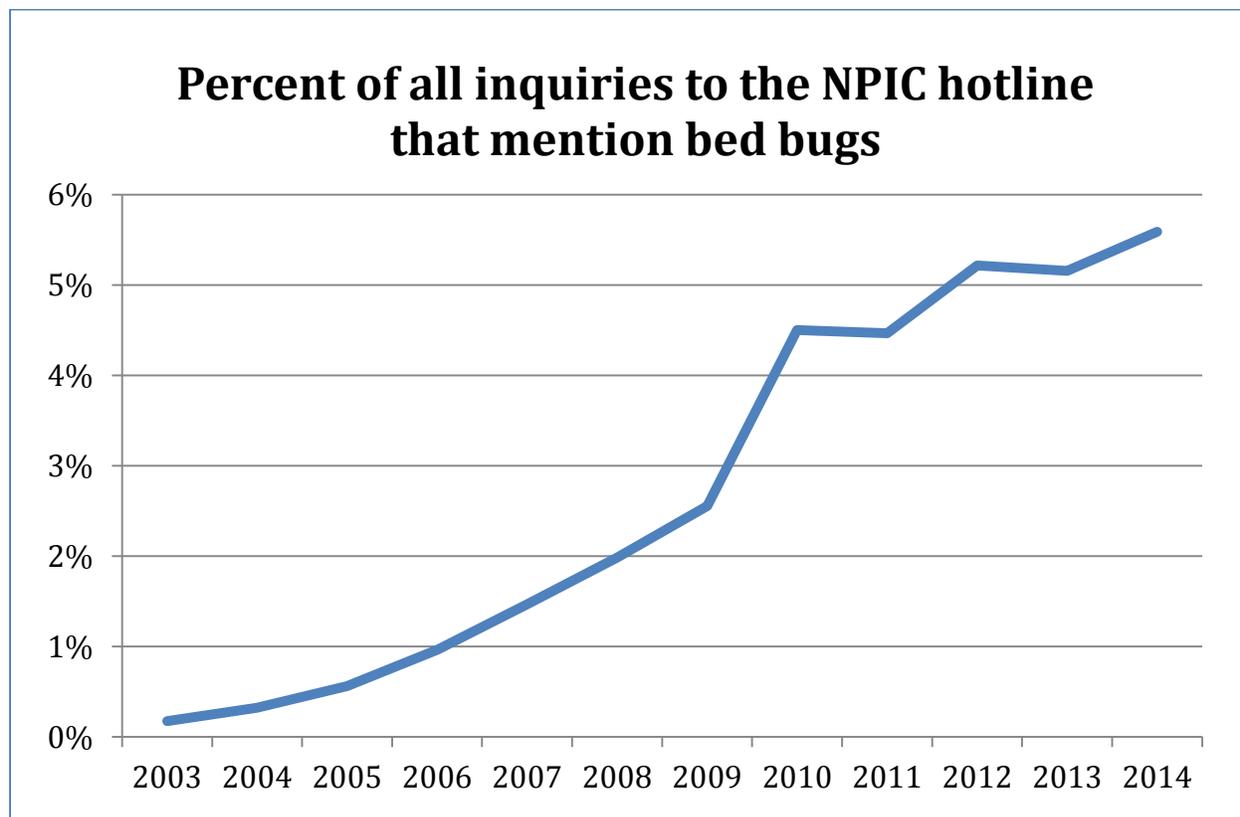
Bed bugs are not a new pest. Bed bugs have been common throughout history, but the distribution and intensity of infestations have fluctuated over time. In the early 20th century, bed bugs were very common. After World War II, bed bug infestations in the developed world declined for a period. As a result, social familiarity with the problem and methods to treat the pest also declined. The table below presents the prevalence and societal knowledge of bed bugs in the U.S. over time.²

	Pre-1900	1900-1940s	1945-1960	1960-1990
Prevalence of bed bugs	Very common	Very common	Very common, but start to decline with DDT	Infestations are rare
Societal knowledge of bed bugs and treatments:	Very high	Very high	Declining	Low/basic lack of awareness

Levels of bed bugs and bed bug awareness in history

² The following sources were used to create this table: Biehler, Dawn Day. *Pests in the City: Flies, Bedbugs, Cockroaches, and Rats*. Seattle: University of Washington Press. 2013. *Bed Bugs: The History of Bed Bugs*. Accessed February 15, 2015 from <http://www.bedbugs.org/the-history-of-bed-bugs/> Owen, James. *Bloodthirsty Bedbugs Stage Comeback in U.S., Europe*. For National Geographic News, May 13, 2004. Accessed February 22, 2015 from <http://www.pestworld.org/all-things-bed-bugs/history-of-bed-bugs/>

Since the 1990s, bed bugs have made a comeback and are now a common pest in the United States. The steady increase in the percentage of bed bug inquiries made to the National Pesticide Information Center (NPIC) over the past decade indicates that public awareness and concerns about bed bugs are on the rise.



Bug Biology

Identification

- Color yellowish-white to reddish-brown
- Adult size about ¼ inch long, about the size of an apple seed
- Eggs can be seen with a magnifying glass; elongated in shape and clear-to-white in color
- Five nymphal stages, all of which feed on blood
- Shape and morphology is oval-shaped body with six legs and two antennae; varies from flat to balloon-shaped depending on how recently they last fed
- Leave dark feces marks in hiding places (mattresses, cracks and crevices)
- Leave nearly clear exoskeletons behind every time they shed, as well as blood spots on bedsheets after they feed.

Life Cycle

- Five distinct nymphal stages of development before reaching maturity
- Require blood meal to pass from one nymphal stage to the next
- Molt (shed) each time they pass through a stage of development, leaving nearly-clear exoskeletons behind
- Can breed directly with their own offspring
- Tend to breed faster during summer months
- Adult bedbugs can live over one year



Bed bug life stages. Photo credit: Allison Taisey

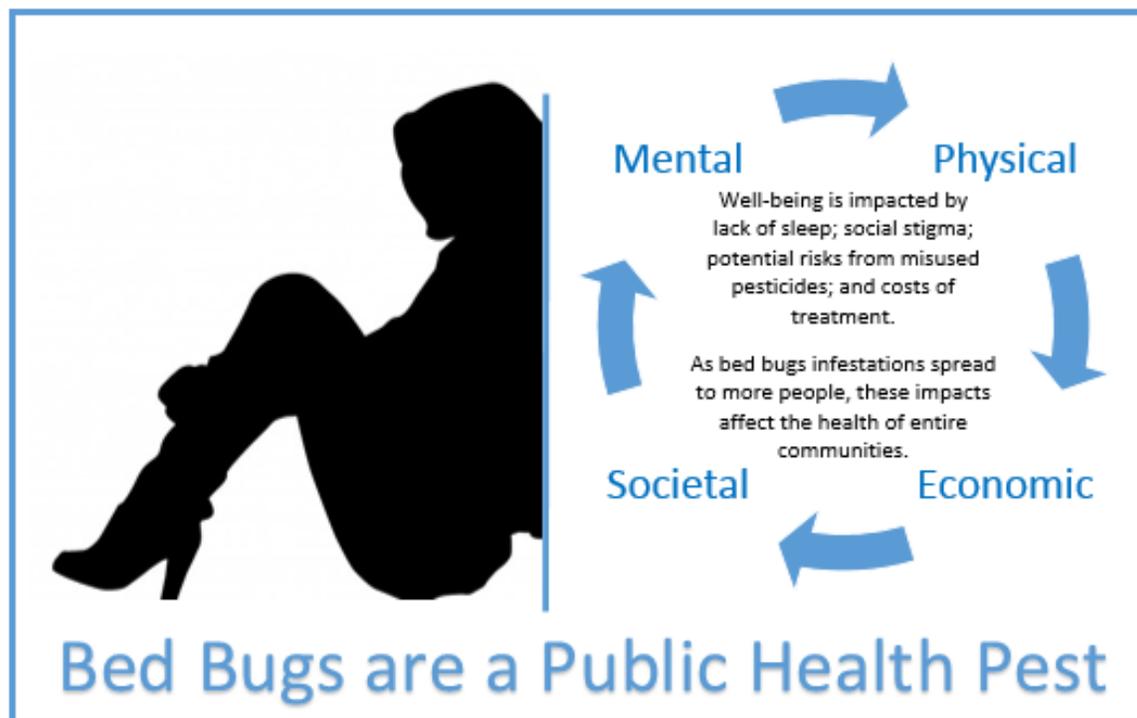
Resiliency

- Eggs laid intermittently in clusters; may be found in several locations
- Eggs are more difficult to kill than adult or nymphs
- Adults and nymphs may be able to survive for months without a blood meal
- Can regenerate infestations when even one pregnant female survives treatment
- Have developed some resistance to pesticides, and may require repeat treatments or different approaches. Bed bug resistance to pyrethroids, contained in many residential products on the market, is wide-spread.
- Adults can hide from pesticide applications or move along wires and walls to other areas.

A Summary of the Problem

While bed bugs are not known to spread disease, they are considered to be a pest of public health significance. Bed bug bites can cause allergic reactions and secondary infections in some people. Individuals who are living with bed bug infestations may be losing sleep, feeling overwhelmed by the problem, or being shunned by friends and family members who don't want the infestation to spread to their homes. Expenses related to bed bug management can be high when you factor in pest control company costs, time to clean and prep a home for treatment, and potential costs associated with the disposal and replacement of furnishings. Despair can lead people to drastic measures such as using home remedies containing hazardous materials that create a much larger health concern.

Multiple sectors of government are involved in bed bug management as bed bug-related concerns overlap with the work of agencies working on housing, public health, and toxic chemicals. As bed bug infestations spread from apartment to apartment, and throughout communities, the negative impacts associated with having a bed bug infestation can affect the well-being of an entire community. Local government leaders are best positioned to initiate a collaborative approach to find a solution that is efficient and lasting for their own community.

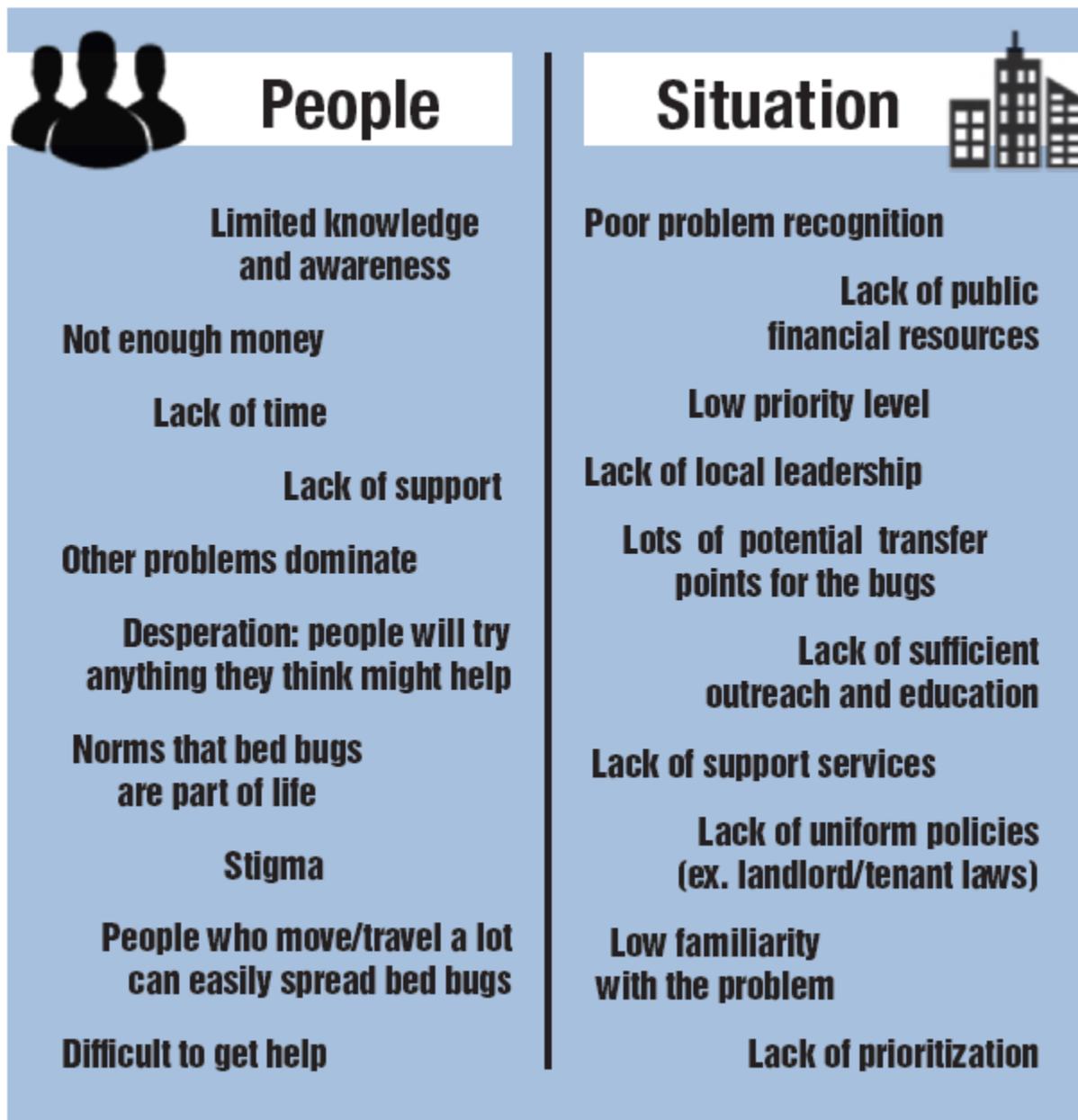


Who Is Affected By Bed Bugs

People (stakeholders to consider)	Places (potential transfer points)
Residents: renters and homeowners Landlords/property managers Tenant unions Tourism and lodging entities Community groups (cultural and religious) Non-profit agencies Pest management professionals Businesses selling pesticide products Entomologists Land grant university cooperative extension staff Housing associations School nurses	Single and multi-family housing Nursing homes Laundromats Childcare centers Schools Hotels/motels Medical centers Shelters Public transportation Jails Libraries Movie theaters Almost anywhere that people gather

Barriers

Bed bugs are difficult to eradicate for a wide range of reasons. The graphic below illustrates some of the potential barriers that people with bed bug infestations face. Local government leaders should be aware of these barriers when working to help their community deal with bed bugs.



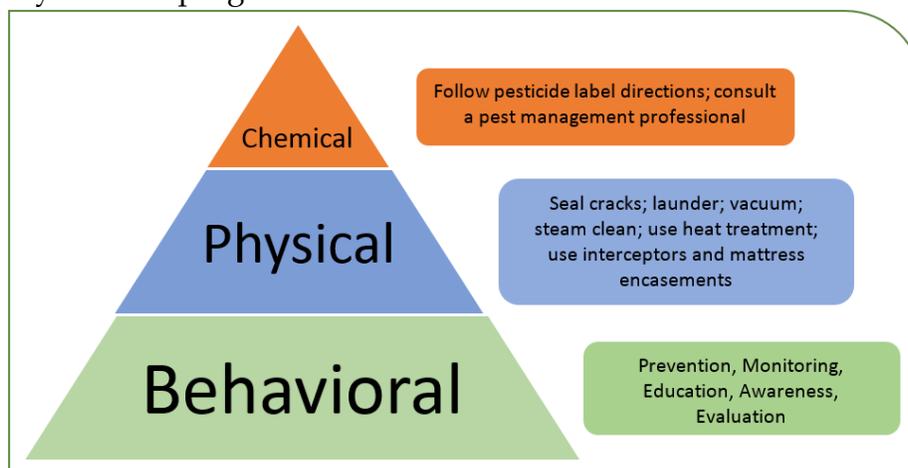
Barriers to effective bed bug control

Tools

To effectively address the bed bug problem, a collaborative approach that employs a wide range of communication tools, products and services, and policies that promote Integrated Pest Management (IPM).

Integrated Pest Management

Communities may not be able to effectively manage bed bugs without coordinated community involvement using the principles of Integrated Pest Management (IPM). IPM is an effective approach to pest management that relies on a combination of common-sense practices that present the least possible hazard to people, property and the environment. When it comes to bed bugs, local government leaders should provide messages to the public that align with the principles of the IPM pyramid depicted below. As the pyramid depicts, you should first understand the biology and behavior of the pest, be able to identify the signs of bed bugs, and understand how to monitor for bed bugs. After acquiring this knowledge and putting these behavioral practices in place, you may decide that physical methods of control for bed bugs are needed for your situation. If you decide that pesticides are needed for your situation, you should only use pesticides judiciously and only in combination with physical (non-chemical) methods of control. With an infestation, you will probably need to hire a professional; getting an experienced pest management professional involved as soon as possible can help prevent an infestation from spreading. Finally, you should continually monitor and evaluate your IPM program to ensure success.



Components of IPM

An IPM approach is especially critical to control bed bugs in multifamily housing, lodging and institutional facilities. To manage bed bugs at the local level, local government can help coordinate prevention, surveillance, education, and communication activities.

Bed Bug Myths

Refuting incorrect information can be difficult and can often backfire if done incorrectly. Given the current lack of social awareness regarding bed bugs, several myths have pervaded the general public's perceptions and beliefs about the pest and treatments. [The Debunking Handbook](#)⁶ is one resource that provides tactics for correcting misinformation. The following tactics can be applied to bed bug communication efforts:

- **Core Facts:** a refutation should emphasize the facts, not the myth. Present only the key facts

The below **facts** counter common myths about bed bugs:

- You should be able to see bed bugs with your naked eye
 - Bed bugs are an issue across the country
 - Bed bugs can be found anywhere, even the most expensive hotel; they are not a sign of poor cleaning
 - Bed bugs are not known to spread disease
 - Bed bugs are a public health pest
 - Bed bugs cannot be identified by their bites alone
 - Bed bugs do not fly or jump
 - Bed bugs do not live on your body like lice
- **Explicit Warnings:** before mentioning a myth, warn the reader that the upcoming information is false
 - **Alternative Explanation:** if you are debunking a myth, you need to provide an alternative explanation
 - **Graphics:** core facts should be displayed graphically or visually if possible

⁶ Cook, J., & Lewandowsky, S. (January 2012). *The Debunking Handbook*. Retrieved from http://www.skepticalscience.com/docs/Debunking_Handbook.pdf

The box below presents an example of a bed bug myth.

Bed bugs cannot be identified by bites alone. Human skin reacts to many environmental conditions with a reaction that appears to look like an insect bite. Many different types of insects will bite people and bites from different insects may look similar. Also, people react to bed bug bites in different ways, ranging from no reactions at all to severe allergic reactions.

Examples of Bed Bug Bites



Photo Credit: Tim Stock, Oregon State University



Photo Credit: Harold Harlan, Armed Forces Pest Management Board



Photo Credit: Harold Harlan, Armed Forces Pest Management Board



Photo Credit: Dini Miller, Virginia Tech Bed Bug and Urban Pest Information Center

Additional Resources

While bed bug information available on the web is extensive, below are specific resources that provide the public with knowledge and tools to help them tackle bed bugs in their communities.

[National Pesticide Information Center \(NPIC\) Bed Bug website](#)

- Contains information categorized into the following sections:
 - Where to start with bed bugs
 - Bed bug biology and behavior
 - Bed bug control methods
 - Preventing bed bug infestations
 - Don't let pesticides make your problem worse
 - Integrated Pest Management
- Contains links to videos, toolkits, fact sheets and brochures for easy to read, accessible information

[EPA Bed Bug Information Clearinghouse](#)

- Contains information aimed at helping communities prevent and control bed bug infestations
- Content is searchable by:
 - Audience
 - Topic
 - Type of Resource
 - Publications of general interest
 - Publications in other languages

Other Places to Look for Information

- [Bed Bugs Handbook](#)
- [StopPests.org](#)
- [Pestworld.org](#)
- [Your local cooperative extension service](#)

Resources for Organizing

- [Central Ohio Bed Bug Task Force Strategic Plan](#)
- [Woodgreen Community Services Information Guide](#)
- [University of Kansas' Community Tool Box](#)

Contacts

- For questions on pesticide misuse, certification for pesticide applicators, bed bug sniffing dogs or heat treatments, contact the appropriate [state pesticide lead agency](#)
- For pesticide issues on tribal land, contact the appropriate [EPA regional office](#)