**How do bed bugs affect landlords and tenants?**

**Abstract**

Bed bugs (*Cimex lectularius*) are annoying pests whose bites cause various medical and economic problems. In recent decades they have reappeared in the US and worldwide. In some states, this has led to the implementation of control measures such as disclosure policies in which landlords must notify potential tenants of current or past bed bug infestations in their property. It may seem that this would be detrimental to landlords, but is this really the case? To find out we developed a mathematical model to estimate the financial impact of bed bug disclosure policies on landlords over time. We determined that the cost of disclosure is high at first, but after a few years, landlords experience savings, as the prevalence of bed bugs decreases.

**Introduction**

Have you ever heard of bed bugs (Fig. 1)? They are household pests which can be quite a nuisance as they bite humans and can cause medical, social, economic and even psychological problems. The bites can cause itching, rashes, allergies and sleep loss (Fig. 2). Treatment of bed bug infestations is costly and falls on individuals, not the government.

Since the early 2000s, these pests have re-emerged in the United States and worldwide perhaps due to the use of less effective insecticides. In the US the prevalence of bed bugs in affected areas varies between 5% and 11%. This has led some states and municipalities to implement disclosure policies: the landlords must notify any potential tenants of past or present bed bug infestations.

The disclosure policies aim to protect individuals from leasing an infested household without their knowledge. It seems that these policies benefit only the tenants, as the costs fall on the landlords. These costs include direct cost for infestation treatment, turnover costs, and lost rent as tenants prefer non-infested households. But are there benefits for the landlords as well? That’s what we wanted to find out.
Methods

To estimate the financial impact of bed bug disclosure policies on landlords over time we developed a mathematical model. At first, we created a model which describes how bed bugs are spreading (Fig. 3). Much like an infection such as the flu can spread through susceptible people, bed bugs can infest susceptible rental units. In this model we account for four factors:

- People are more likely to move out of a household if there is an infestation
- Rental units can become infested either through the importation of bugs on clothes and furniture or by individuals who come from infested households
- Infested households can spread infestations to susceptible households only when they are occupied by people
- The risk of infestation depends on the infectivity of the pests and the prevalence of infested units in the population

We then adjusted the model to the presence of disclosure policies. This model assumes that tenants are selective, or less likely to want a disclosed unit. Our primary aim was to evaluate the costs due to disclosure: treatment costs, rental turnover costs and costs due to vacancy.

We ran our model with a total of 1000 units and we set:

- An average cost of bed bug treatment to $1225 (as reported by pest-control professionals)
- An average turnover cost of $1000 (as reported by property managers)
- An average monthly rent of $1000 (as reported by the American Community Survey)

Results

Our model showed us that:

- The cost of disclosure is high initially for landlords because disclosed units stay unrented
- Costs decrease steadily because landlords begin to save money on treatment, and by the fifth year landlords experience savings overall (Fig. 4)
- Initial costs are greater when bed bug prevalence is higher and when tenants are more selective
- Higher initial costs lead to greater savings in the future

- Disclosure reduces the prevalence of bed bugs over time; infested units are less likely to be rented when they are disclosed, which reduces the number of households that can spread bed bugs
Conclusion

It is extremely difficult to eliminate bed bugs! Be on the lookout for these signs of bed bugs. There are several things you can do to keep bed bugs out of your home:

- Never pick up furniture, especially mattresses and beds, from the street. If you buy second-hand furniture make sure you check closely for signs of bed bugs.
- When traveling, check mattresses, especially the corners and seams, for signs of bed bugs.
- If you think you have found a bed bug at home or away, tell your family right away. Take a picture of the bug and find an expert to send it to. A good place to start is your state’s university.
- Learn how to stop bed bugs from spreading.

Discussion

Our findings reveal that the impact of disclosure policies on landlords changes over time. Even though many landlords fear they will suffer from significant financial burden, our model predicts that disclosure would actually result in savings in a relatively short time. Our model shows that there are two key factors which influence the initial costs and the savings over time: how selective the renters are and the prevalence of bed bugs. The selectivity of the renters depends on the market: in big cities, there is a lot of demand for rental units so tenants can’t afford to be choosy. In this case, initial costs for the landlords would be lower. When the other factor, prevalence, is high, disclosure policies initially lead to more vacant rental units but then eventually to greater savings because the prevalence decreases.

We also found that tenants benefit from disclosure. By reducing bed bug prevalence, disclosure reduces the need for tenants to replace infested furniture or attempt ‘do-it-yourself’ treatments, which can damage property or make tenants sick if performed incorrectly. We predict that tenants would experience savings from the first year a disclosure policy is enacted.

Figure 4: Impacts of disclosure on landlord and tenant costs and bed bug prevalence over time. The dotted black line shows the costs to landlords over time. The different bars show the different types of costs: cost due to unrented vacant units (“vacancy”), cost due to treating infested units (“treatment”) and cost from moving tenants into vacant units (“turnover”). The solid red line shows the prevalence of bed bug infestation over time.
Glossary of Key Terms

**Bed bug** – a small wingless insect that sucks blood and is usually found in houses - especially in beds. Its bite can cause various health (and other) problems. Bed bugs are very hard to treat and are very resilient; resistance to treatment chemicals is not uncommon.

**Infestation** – the presence of a large number of insects (or other pests) in a place, which can result in property damage or health issues.

**Insecticide** – a chemical that can kill insects.

**Landlord** – someone who rents out land or housing.

**Prevalence** – in our study, the percent of rental units that are infested in a particular place at a given time.

**Tenant** – a person who pays rent to live in housing belonging to a landlord.

**Turnover costs** – the expenses involved in repairing, advertising, and showing units to possible tenants.

Check your understanding

1. What problems can bed bug bites cause?
2. What is the primary aim of the bed bug disclosure policies?
3. What costs do the disclosure policies lead to for landlords?
4. What does higher bed bug prevalence mean? And what does it mean for landlords?
5. Does higher prevalence help or prevent further bed bug spread?

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