

# Bed Bug Resurgence and Control: Where Do We Go from Here?

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# Outline

1. Impact of bed bug infestations
2. Prevalence of bed bugs and their distribution patterns
3. Control methods
4. Challenges
5. Effective bed bug management strategies
6. The future of bed bug management

# Health Impact from Bed Bug Bites

- Overall, 68% of the residents reported symptoms and 32% did not report symptoms after being bitten
- Among those with self-reported symptoms:
  - pain – 89%
  - itchiness – 21%
  - welts – 15%
  - insomnia – 9%



One day after bite



Three months after bite



# Symptoms after bitten by approximately 20 bed bugs

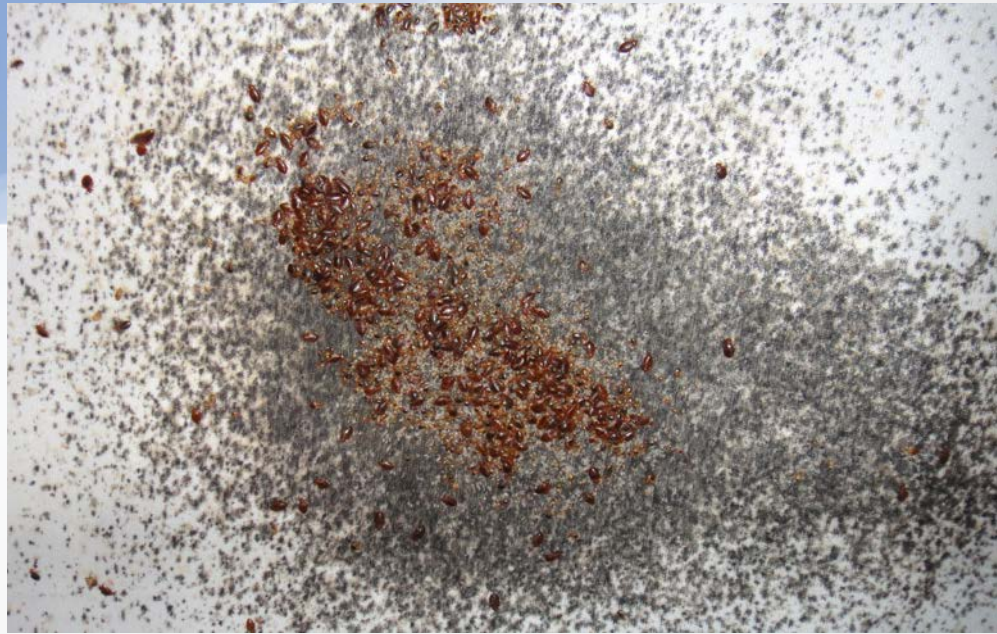


# Systematic allergic reactions

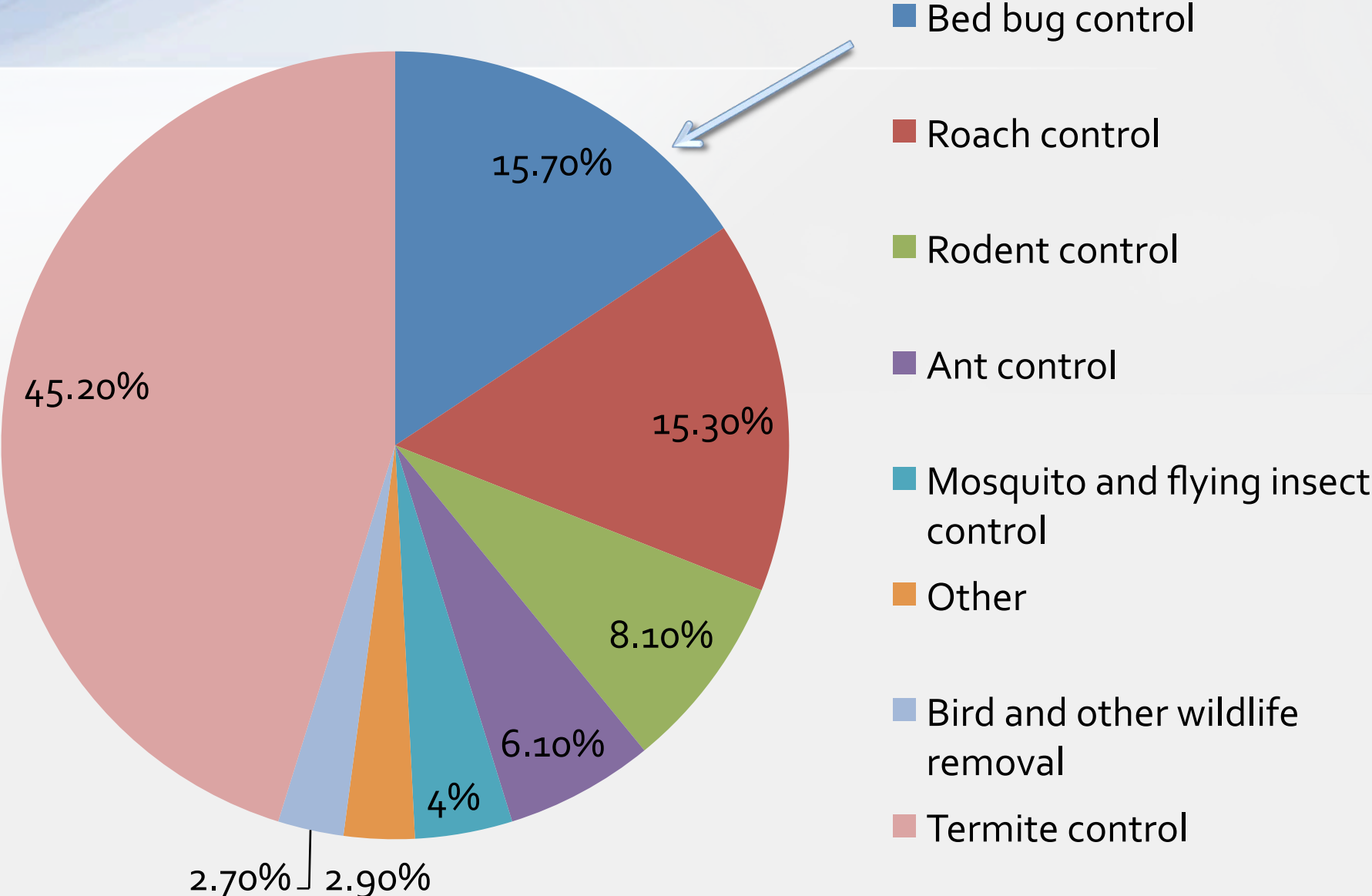


50 minutes  
after bites





# 2011 U.S. Pest Control Product and Services





# Bed Bug Resurgence in the U.S.

- Re-emerged in the late 1990s
- Hotels, single homes, apartments
- A number of surveys documented the resurgence of bed bugs (Gangloff-Kaufmann et al., 2006; Potter 2006, 2008; Potter et al., 2011)
- Factors: increased travel, insecticide resistance, lack of knowledge and effective control materials



# Prevalence of Bed Bugs

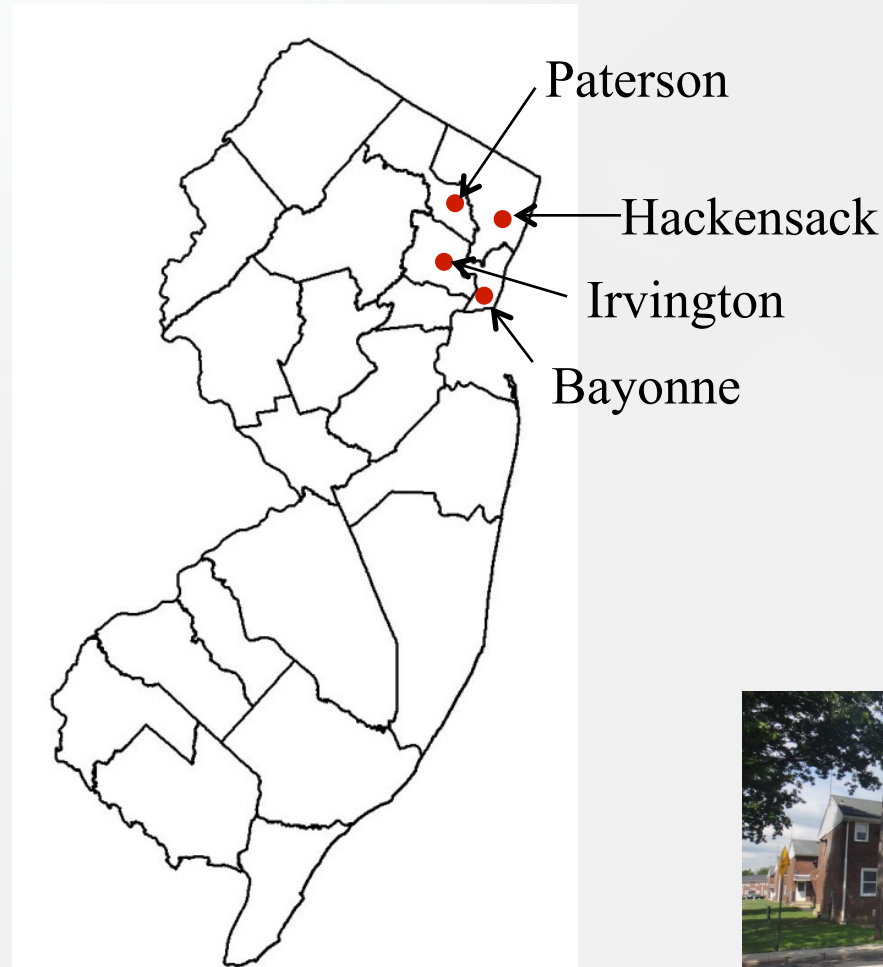
- New York Public Housing (Gounder et al., 2014)
  - Of the 176,327 NYCHA households, 6.6 % registered a bed bug complaint during 2010–2011
- Virginia (Wong et al., 2013)
  - 5-19.4% infestation rate in low-income housing
- Philadelphia (Wu et al., 2014)
  - 11.1% of the 596 interviewed residents reported recent infestations and 2.5% had existing infestations



# Bed Bug Survey in New Jersey, 2014

## Methods:

- Interview residents
- Visual inspection
- Lay interceptors for 2 weeks



2,372 low-income apartments

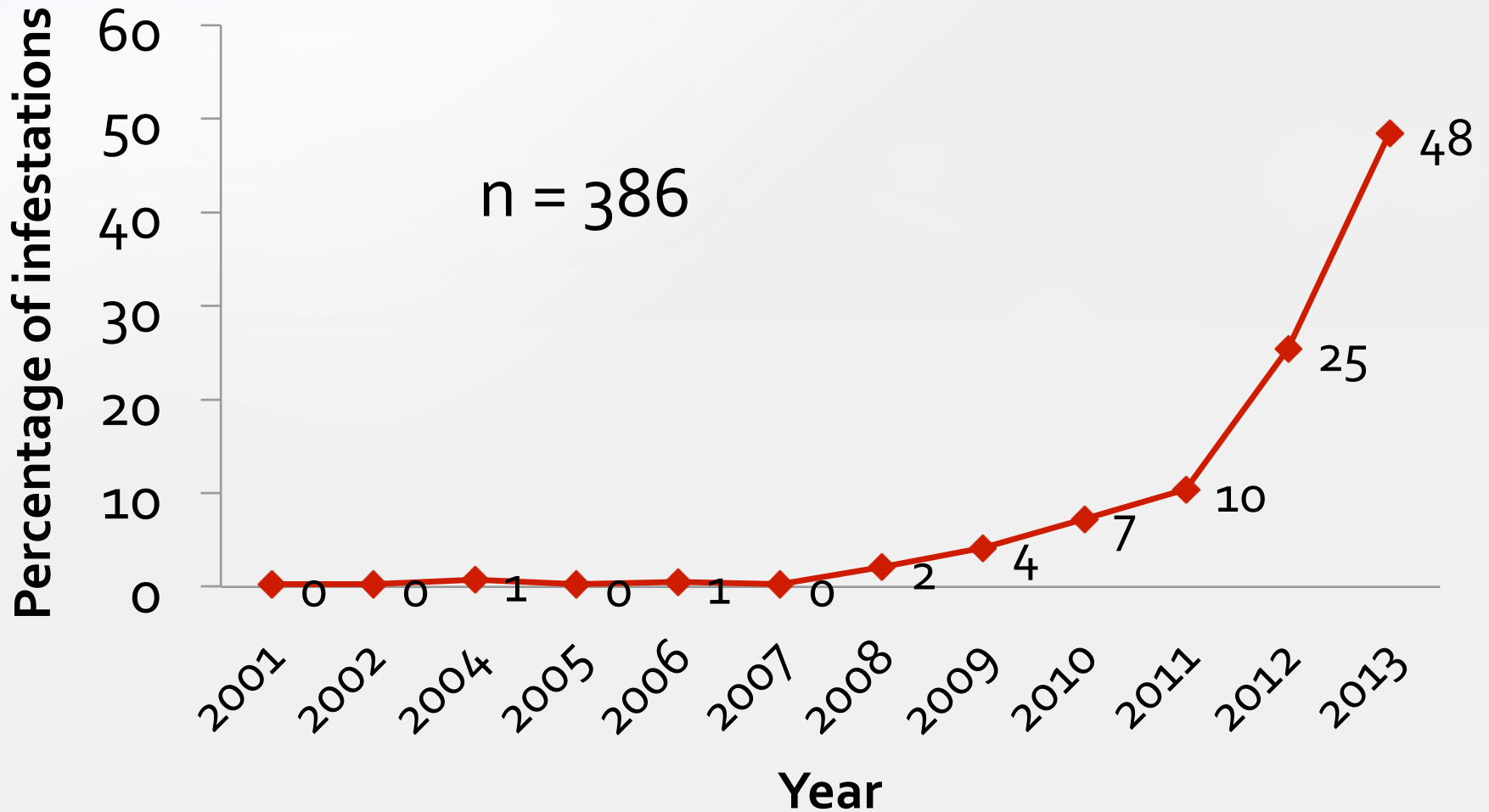
# Survey Results

- 26% experienced bed bug infestations
- 12.3% had existing bed bug infestations
- Only 47% of the residents were aware of bed bugs while being infested
- Management offices were aware of < 33% of the infestations

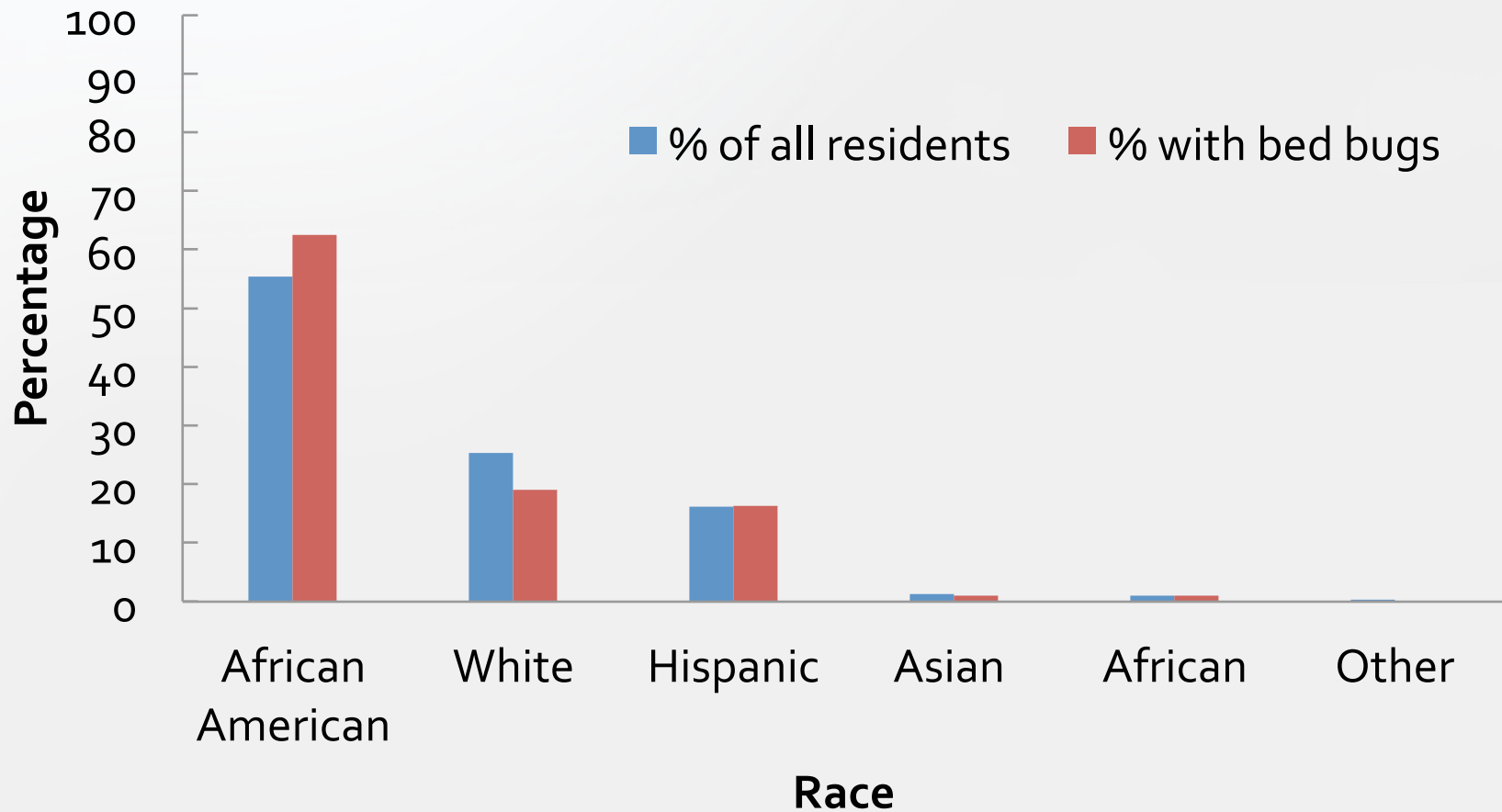
Wang et al., 2016. J. Med. Entomol.



# Patterns of New Bed Bug Infestations in Four Low-income Communities in New Jersey



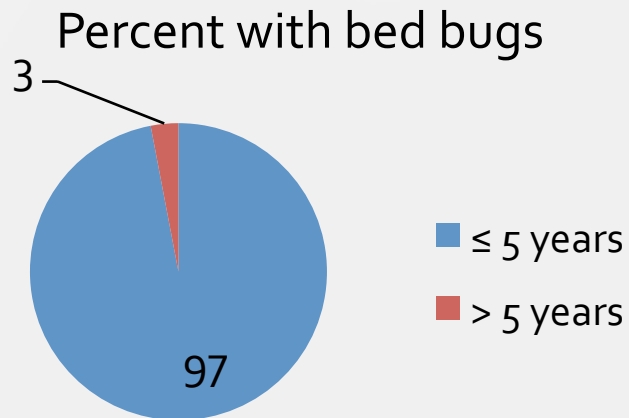
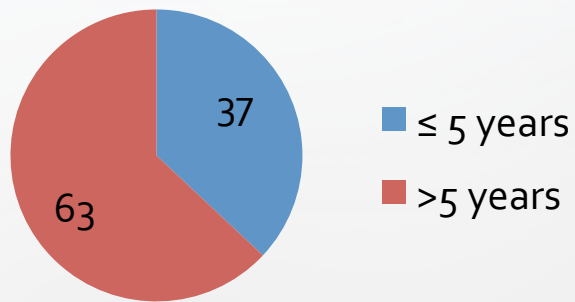
# Relationship between Bed Bug Infestation and Ethnicity



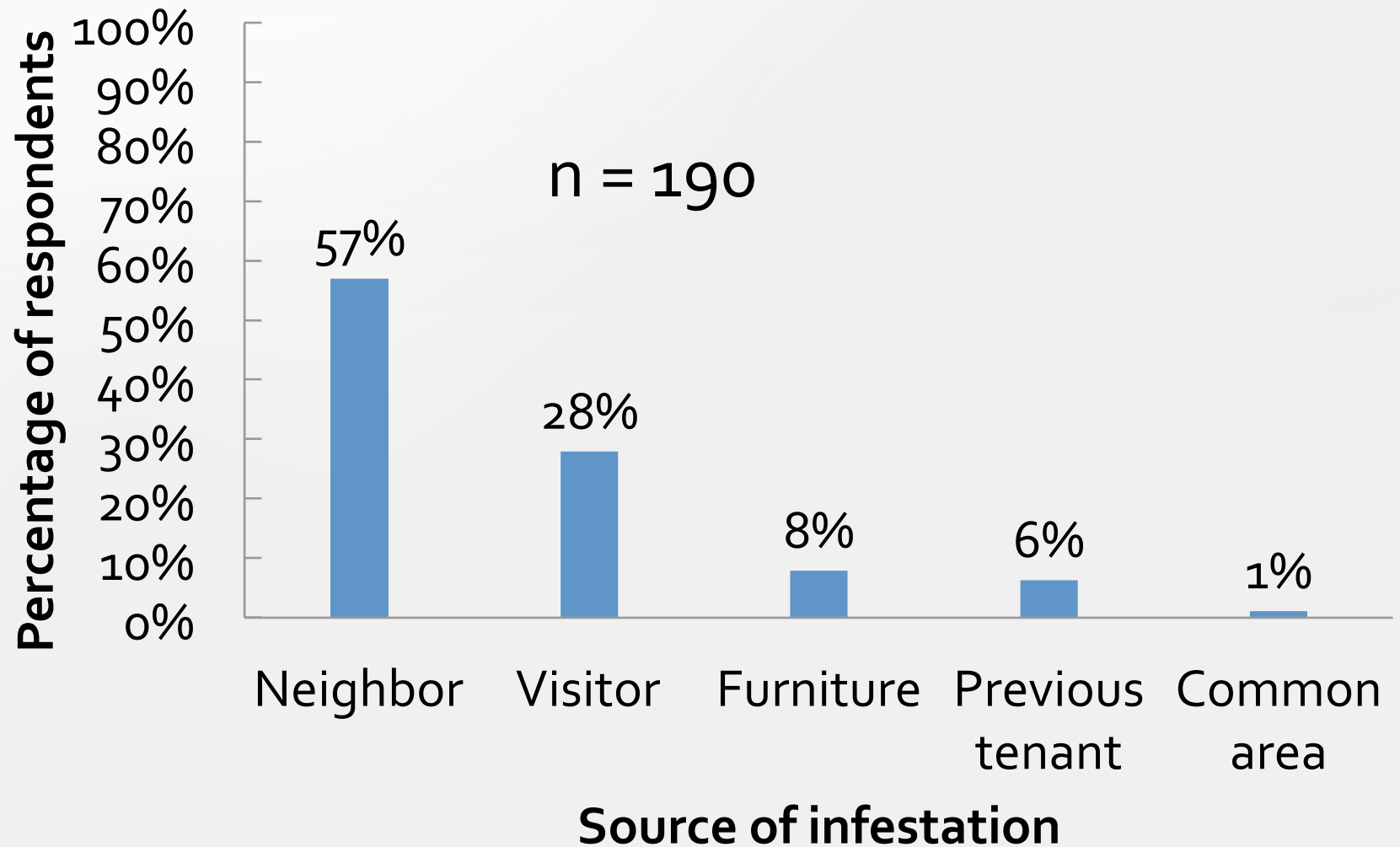


# Relationship between Bed Bug Infestation and Length of Residency

Years of residence



# Source of Bed Bug Infestation based on Resident Interview





59% used pesticides

Formulation	Percentage
Spray	95%
Dust	7%
Fogger	5%



# Insecticides Used for Bed Bug Control by Residents (n = 245)

Type	Percentage
Pyrethroids	72%
Household products (alcohol, degreaser, ammonia, Clorox, baby oil)	22%
Inorganic insecticides, essential oils, non-pyrethroids	19%



# Non-chemical Treatment Methods

- 27% discarded beds
  - 23% discarded sofas
- (n = 523)



# Current Bed Bug Control Methods by Professionals

- Monthly contracted service
  - Each infestation receives 1-3 treatments
  - No monitoring of bed bugs
  - Termination based on no-complaints by residents
- Treatment methods
  - Sprays (pyrethroids, pyrethroid-neonicotinoid mixtures, insect growth regulator, enzymes)
  - Dust (diatomaceous earth dust, CimeXa, Tempo, etc.)
  - Mattress encasements, steam, portable heat chambers, interceptors

# How Long Does It Take to Eliminate a Bed Bug Infestation?

- Among the 88 residents who knew their apartments had active infestations at the time of survey
  - 57% had bed bug for more than 6 months
  - 36% of them had bed bugs for more than a year

# Challenges and Obstacles



# Infrequent Laundering



- 93-99% of the bed bugs are on furniture (*Potter et al. 2006. Wang et al. 2007*)

# Clutter

- Amount
- Where the clutter is?



Difficult



Easy



# Presence of Difficult-to-Treat Furniture





Improper preparation





# Refuse Access



57 bed bugs in interceptors (5/2014)

# Bed Bug IPM

- Proactive inspections
- Incorporating non-chemical treatment methods
  - Steamer, mattress encasement, vacuuming, etc.
- Use interceptors to monitor treatment result
- Re-treat until elimination is confirmed
- Prevent new infestations
  - Educate the public to reduce human-assisted passive dispersal
  - Policies

## Case of Successful Elimination - Indianapolis

- Estimated around 2,000 bed bugs. Bible folder has > 50 bed bugs

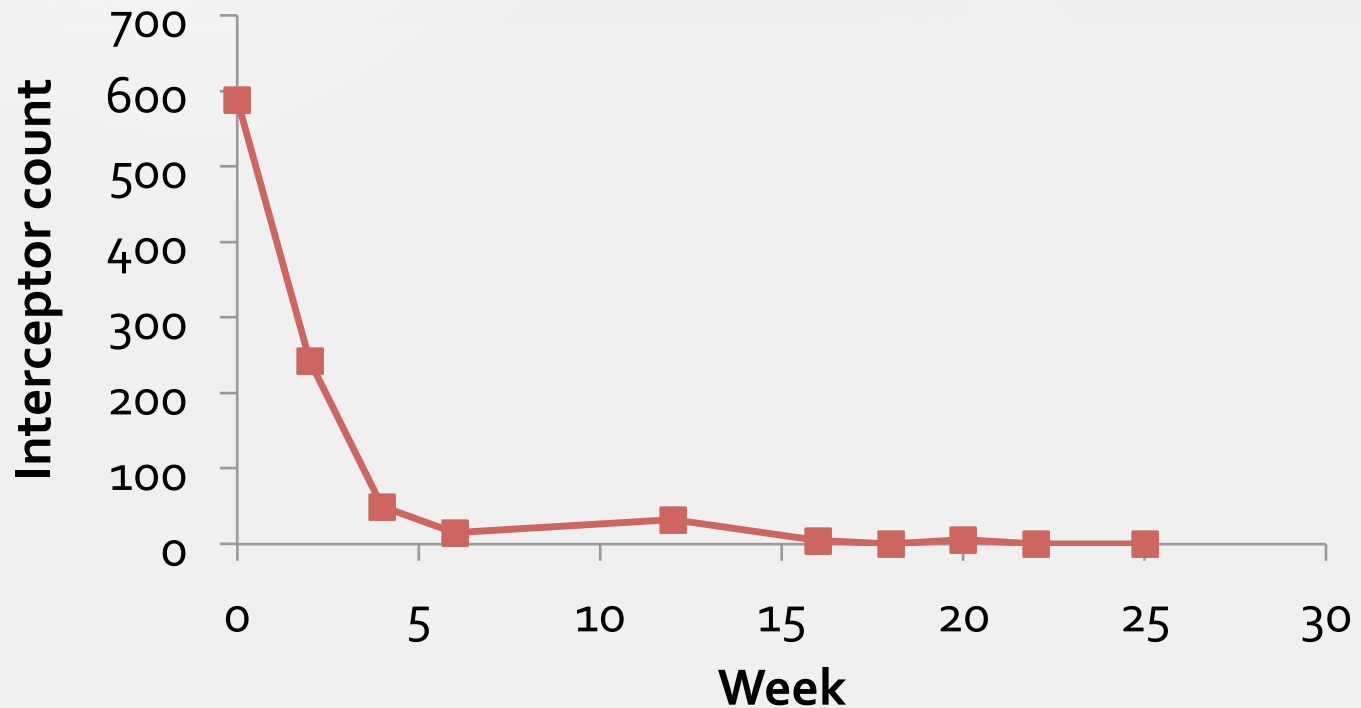


4 weeks after installing encasement



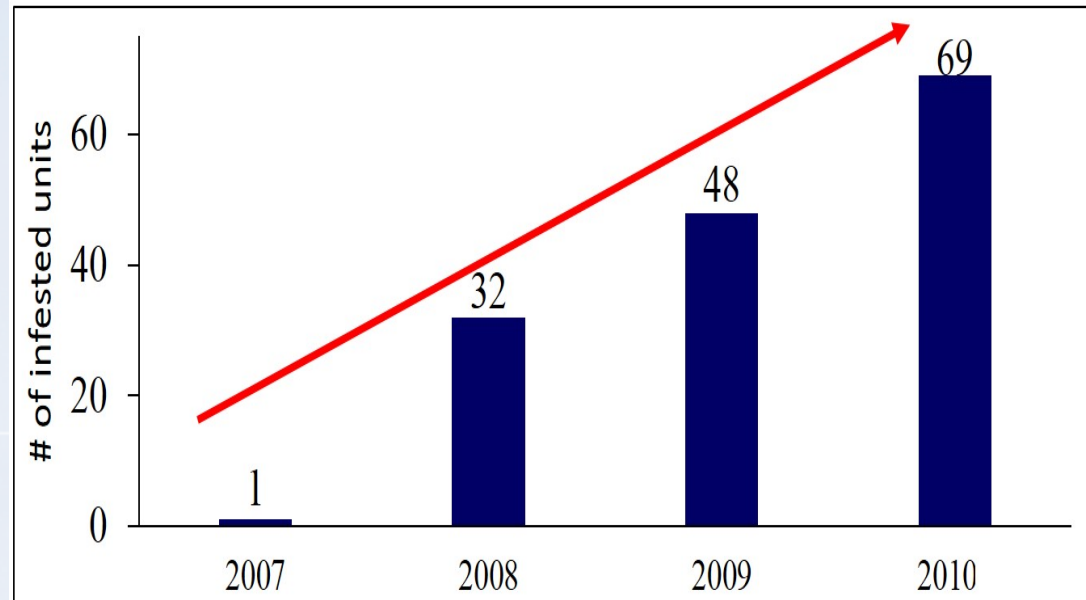


- Treatments
  - 0, 2 wk: DE, encasement, bagging, vacuuming, hand removal
  - 10, 12 week: replacing encasement, Tempo dust
- Elimination at 22 wk.



# Community-wide Bed Bug IPM in Jersey City, NJ

- Four high-rise buildings (358 apts.)
- Chronic bed bug problem starting in 2007
- 1/3 of infestations were recurring



# Community-wide inspections at 0, 6 and 12 months

- Verbal survey of residents
- Interceptors under legs of beds & furniture (14 d)
- Visual inspection of apartments with zero trap catch

## **Inspection results**

### **Initial inspection:**

- 55 infestations identified (71% unreported)

### **Six and twelve month inspections:**

- 14 new infestations

# Treatment protocol

Treatments performed by in-house technician

- Non-chemical methods
  - Vacuum & steam (furniture)
  - Encasement of mattress & box springs
  - Bagging of linens & clothing (provided tokens)
  - Portable heat box (items that can't be laundered)
  - Interceptors under legs of beds, chairs & sofas
  - Additional interceptors (~12) throughout apt.
- Chemical methods
  - Targeted treatment in areas of activity
    - ❖ Mother Earth<sup>®</sup> (100% diatomaceous earth)
    - ❖ Phantom<sup>®</sup> aerosol (0.5% chlorfenapyr)



# Results: Complex-wide IPM Program

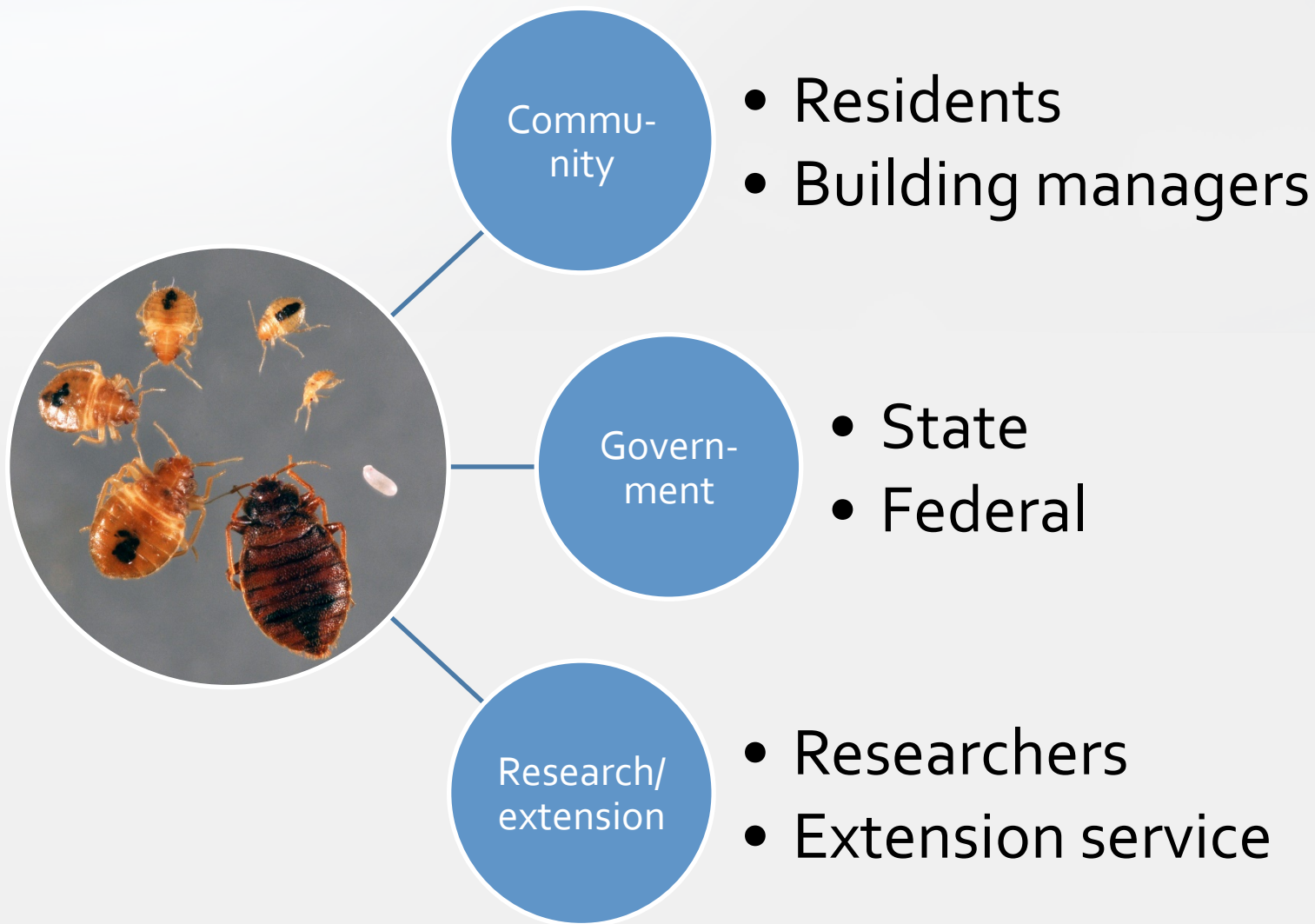
- Eliminated 96% of treated infestations
- Reduced the infestation rate from 15% to 2%

## Conclusions

1. Most infested units (71%) are not reported by residents
2. Interceptors are effective for detection of infestations, evaluating treatments, and confirming elimination
3. Residents are not reliable for determining elimination (76% incorrectly reported elimination)

Where Do We Go from Here?

# Engagement



# Increase Support from Government Agencies and Communities





# Community-wide bed bug inspection and control campaigns

- Low-level infestations are much easier to control
- Prevent spread of bed bugs among apartments within a building and a community



# Education to the Residents





# Education to Building Staff



# Effective Pest Control Contracts and Policies

- Contracts: Low cost should not be the sole standard
- Quality check: Housing staff?
- Remove obstacles: Help residents with disabilities or who would not cooperate



# Research on More Cost Effective Methods for Control of Bed Bugs

- More cost-effective methods and tools for bed bug control
  - Insecticide resistance
  - Lack of effective control materials
  - Lack of knowledge by professionals and residents

# Acknowledgements

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