The ABC's of Indoor Health: Allergens, Baits, Cockroaches

A Tale of Cockroach IPM in 2 Environments

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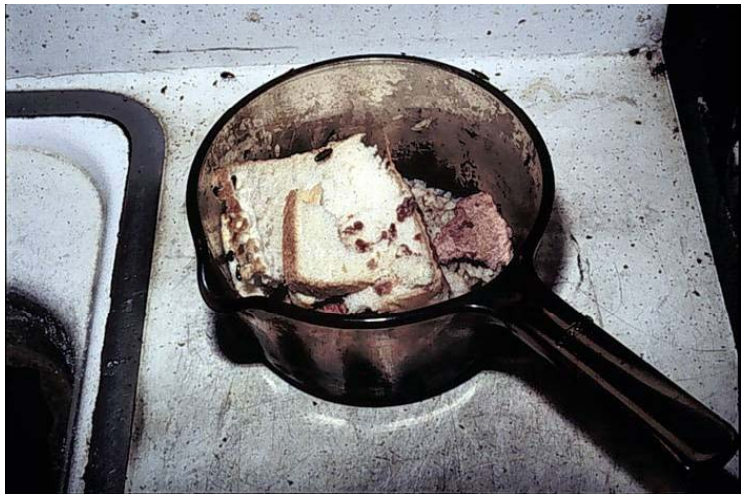
Outline

- Why roaches?
- Allergens & allergen mitigation
  - Conventional vs. IPM approaches



Why cockroaches?
Medical & Veterinary importance

1. Cockroaches as disease vectors?
2. Antibiotic resistant microbes – farms
3. Indirect effects
    - Pesticide use
    - Nuisance
4. As allergen-producers: asthma

Medical and economic cost of asthma: USA (CDC)

~30 million affected, ~9 million children

~$13 billion for related health care

The New England Journal of Medicine

1997

THE ROLE OF COCKROACH ALLERGY AND EXPOSURE TO COCKROACH ALLERGEN IN CAUSING MORBIDITY AMONG INNER-CITY CHILDREN WITH ASTHMA

DAVID L. ROSENSTREICH, M.D., PEYTON EGGLESTON, M.D., MEYER KATTAN, M.D., DEAN BAKER, M.D., M.P.H., RAYMOND G. SLAVIN, M.D., PETER GERGEN, M.D., HERMAN MITCHELL, PH.D., KATHLEEN MCNIFF-MORTIMER, M.P.H., HENRY LYNN, PH.D., DENNIS OWNBY, M.D., AND FLOYD MALVEAUX, M.D., PH.D., FOR THE NATIONAL COOPERATIVE INNER-CITY ASTHMA STUDY*

37% of Inner-City Children with Asthma are Sensitized to Cockroach Allergens!



Allergens in cockroach feces
Poop arithmetic 101

1 fecal pellet = ~1 mg

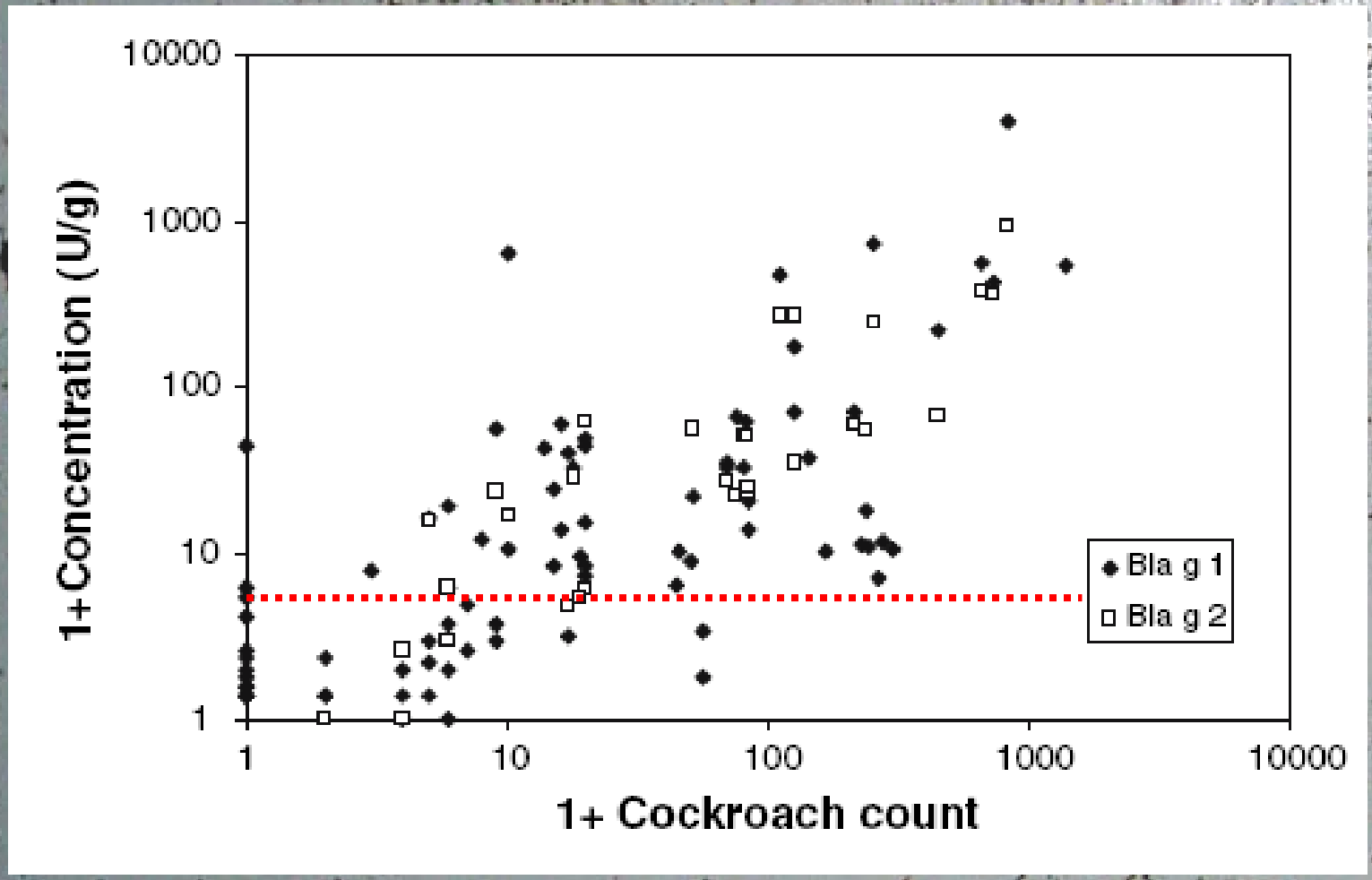
1 mg feces = 500 Units Bla g 1

1 female = 3 mg feces per day

1 day = ~1500 Units Bla g 1

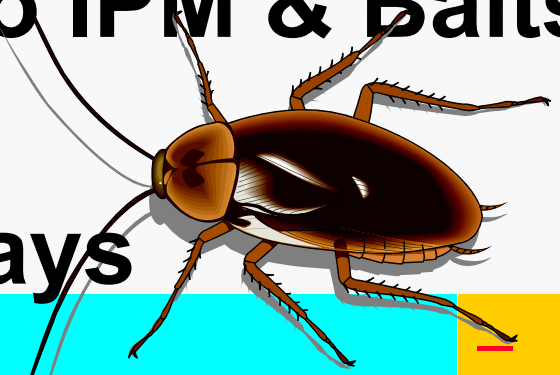
		per grm dust
Human sensitization threshold	**=**	**2 Units**
Morbidity (illness) threshold	**=**	**8 Units**

More cockroaches = More allergen



Wang *et al*. 2008. *J Community Health* 33: 31–39

Controlling roaches
Transition to IPM & Baits

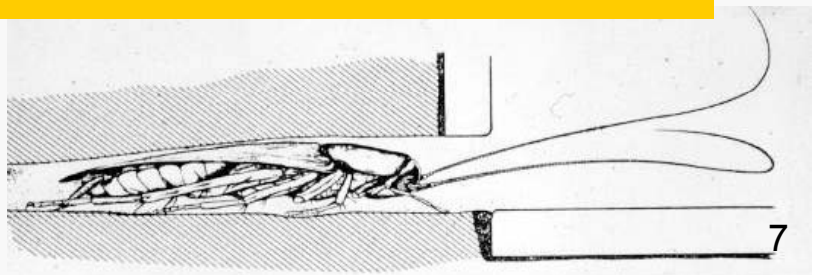


Sprays

- Fast acting
- Long lasting residual
- Broad spectrum
- Extensive coverage: >AI
- Some odor

Baits

- Slow acting
- Long lasting residual
- Specific
- Point sources: <AI
- No odor



I. Schools – Conventional *vs.* IPM

Conventional:

- Calendar-based, no monitoring
- Spray, residual

IPM:

- Monitoring-based decisions
- Physical changes to prevent pests
- Baits/gels used extensively – "reduced-risk pesticides"

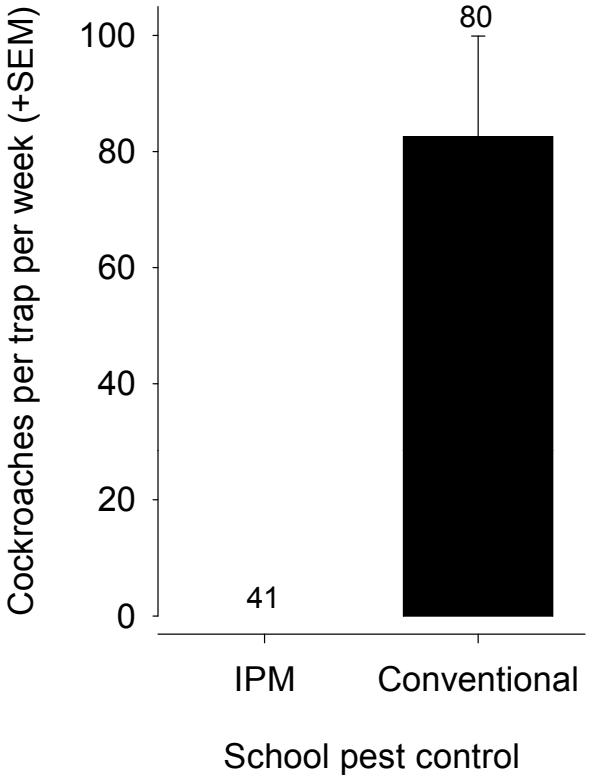
Study design:

Conventionally-treated schools → **Conventional**

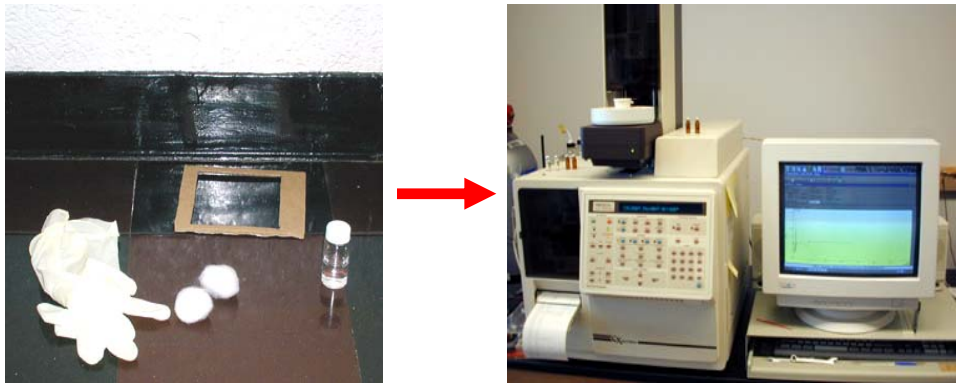
Conventionally-treated schools → **education** → **IPM**

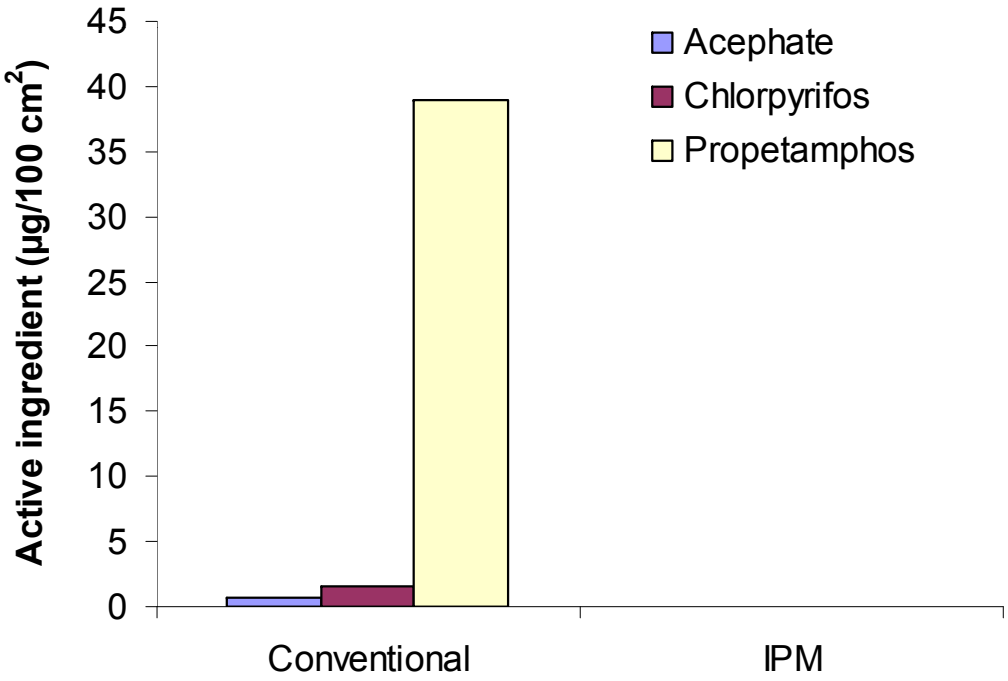
Williams *et al*. 2005. *Journal of Economic Entomology* 98: 1275–1283

Cockroach infestation



Insecticide residues on baseboard



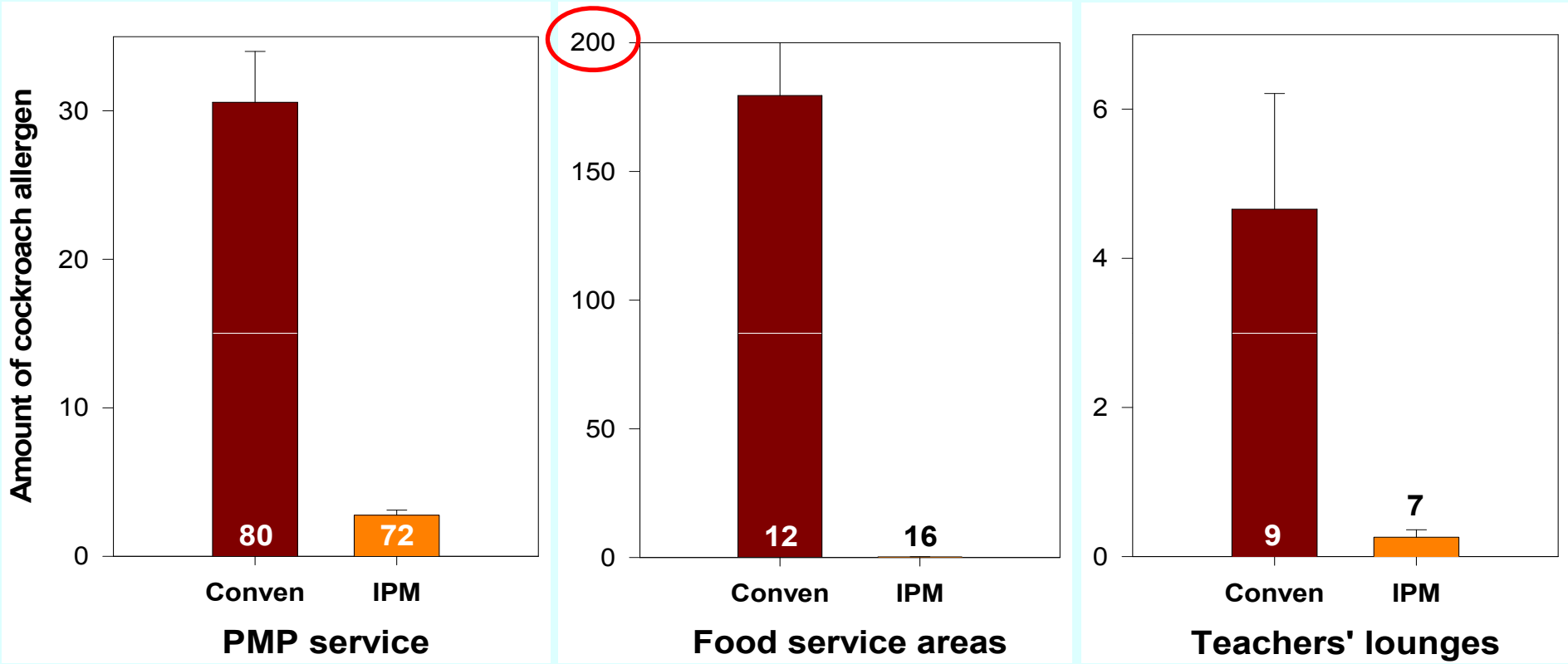


IPM vs. Conventional:

- **Fewer cockroaches**
- **Less residues**

Williams *et al*. 2005. *Journal of Economic Entomology* 98: 1275–1283

Bla g 1 (cockroach) allergen in schools

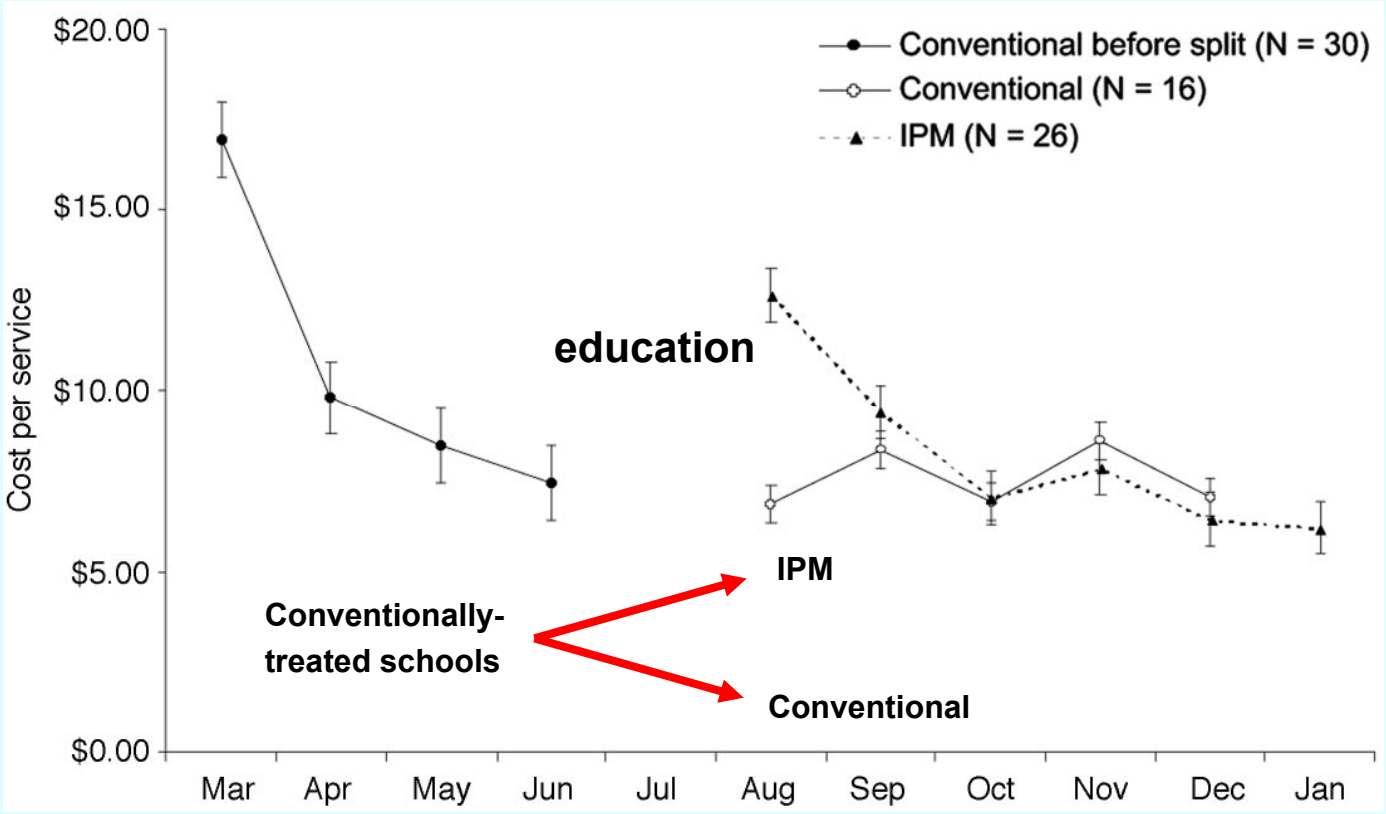


IPM vs. Conventional:

- **Less allergen**

Nalyanya *et al*., unpublished

Cost of IPM in schools



IPM vs. Conventional:

- **Fewer cockroaches**
- **Less allergen**
- **Not more expensive in the long-term**

Williams *et al*. 2005. *Journal of Economic Entomology* 98: 1275–1283

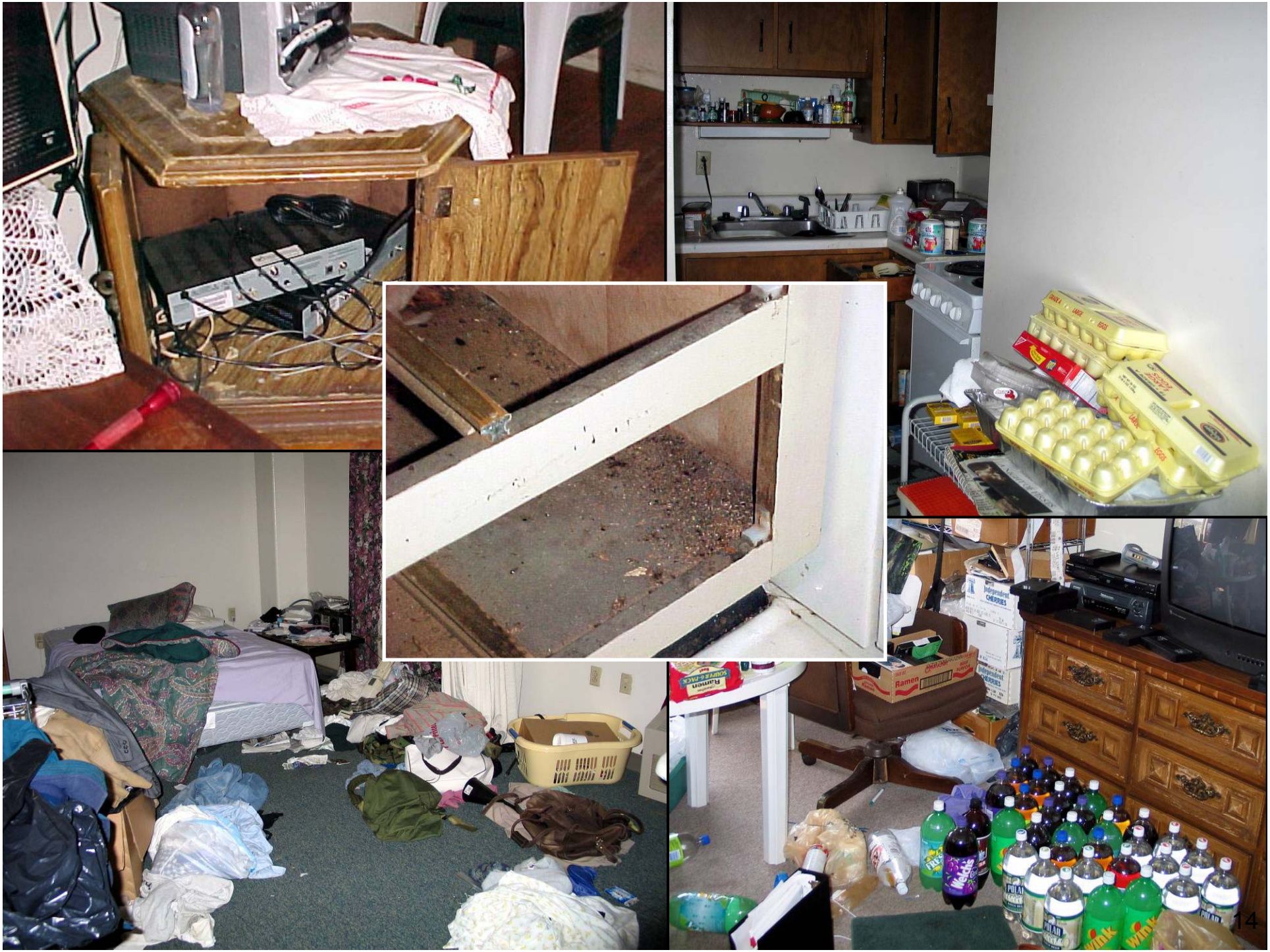
II. Homes: Allergen Avoidance –
What works (mainly dust-mite)?

- Encase mattresses, pillows (6 μm fabric)
- Wash bedding
- Reduce humidity (e.g., dust mites)
- Remove carpets
- Denaturing agents: tannic acid, bleach, others?
- Steam cleaning, intensive vacuuming
- "Allergen free conditions"
  - e.g., cold (Alaska? no), high altitude (dust mite)
  - **Role of pest control?**

Allergen mitigation studies — 2003–2007

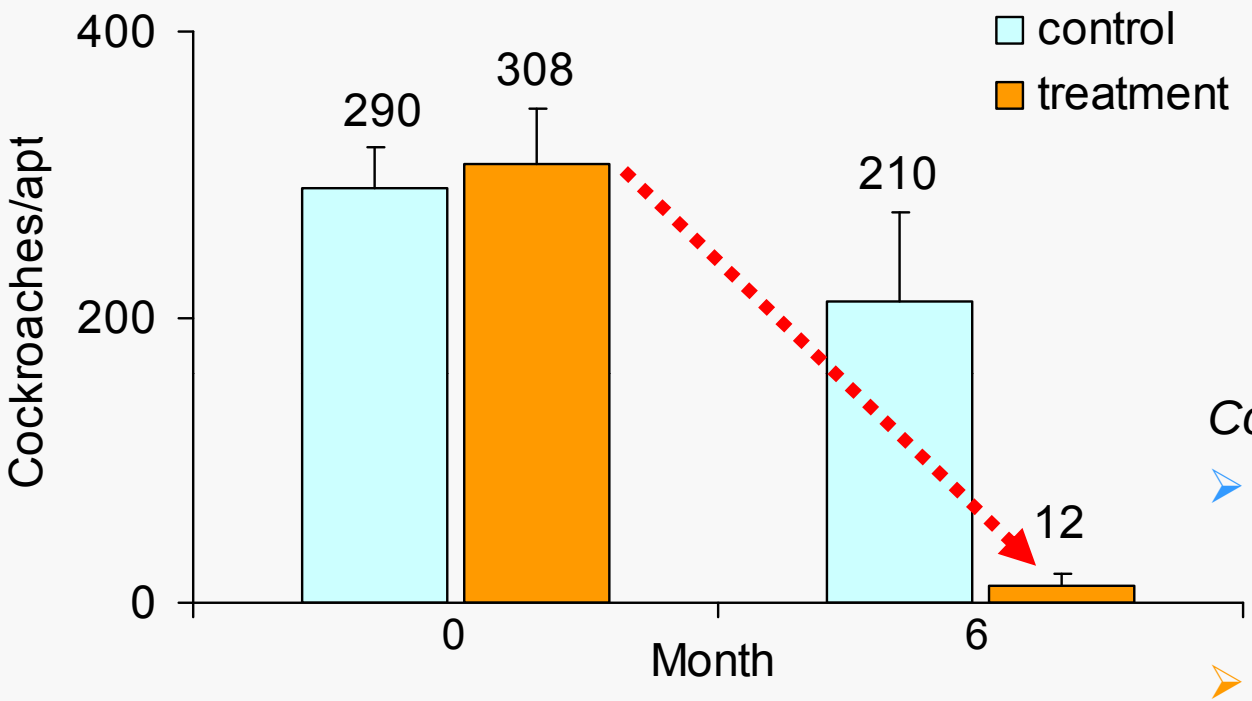
(with NIEHS)

- Cockroach-infested apartments in Raleigh; trap 50–1000 roaches
- Design:
  - Untreated homes
  - Resident education
    Professional cleaning
    Pest control: baits, monitoring


Ramen
Wink

Cockroach control in homes

Chad Gore



kitchen

living room

bedroom

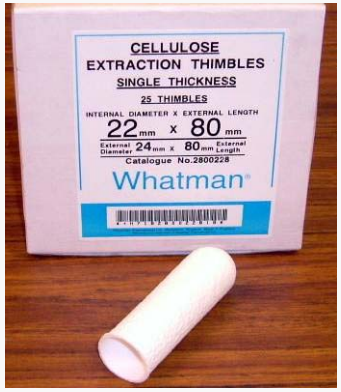
Cockroach control

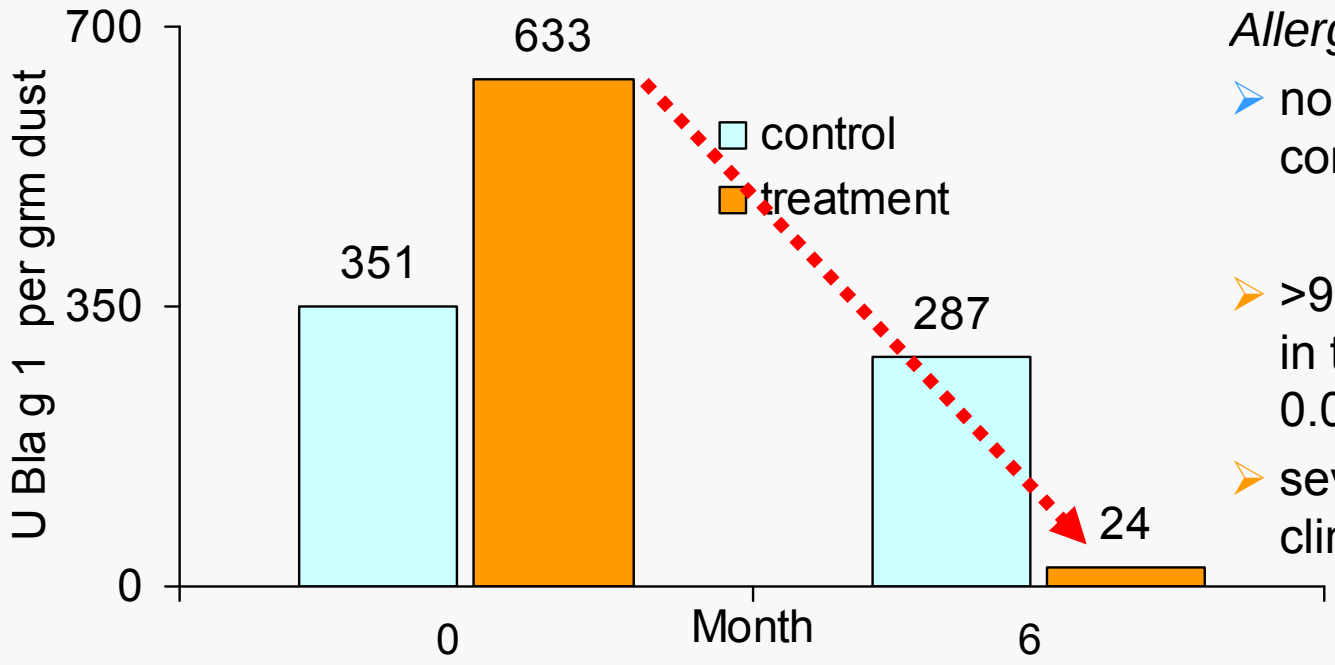
- no change in untreated control homes ($P > 0.05$)
- >97% reduction in treated homes ($P < 0.001$)
- elimination in some

hydramethylnon

Arbes *et al.* 2003. *J Allergy & Clin Immunol*

Allergens in homes





Allergen reduction

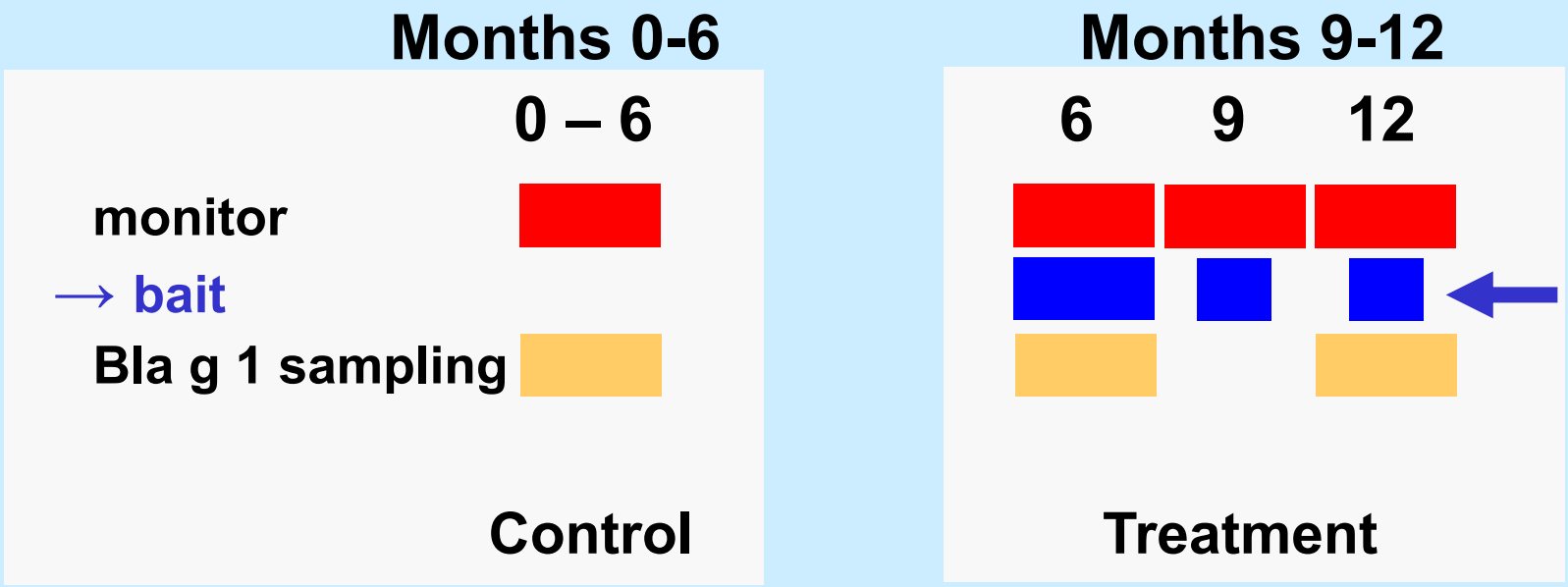
- no change in untreated control homes ($P > 0.05$)
- >96% Bla g 1 reduction in treated homes ($P < 0.001$)
- several homes below clinical thresholds

Arbes *et al.* 2003. *J Allergy & Clin Immunol*

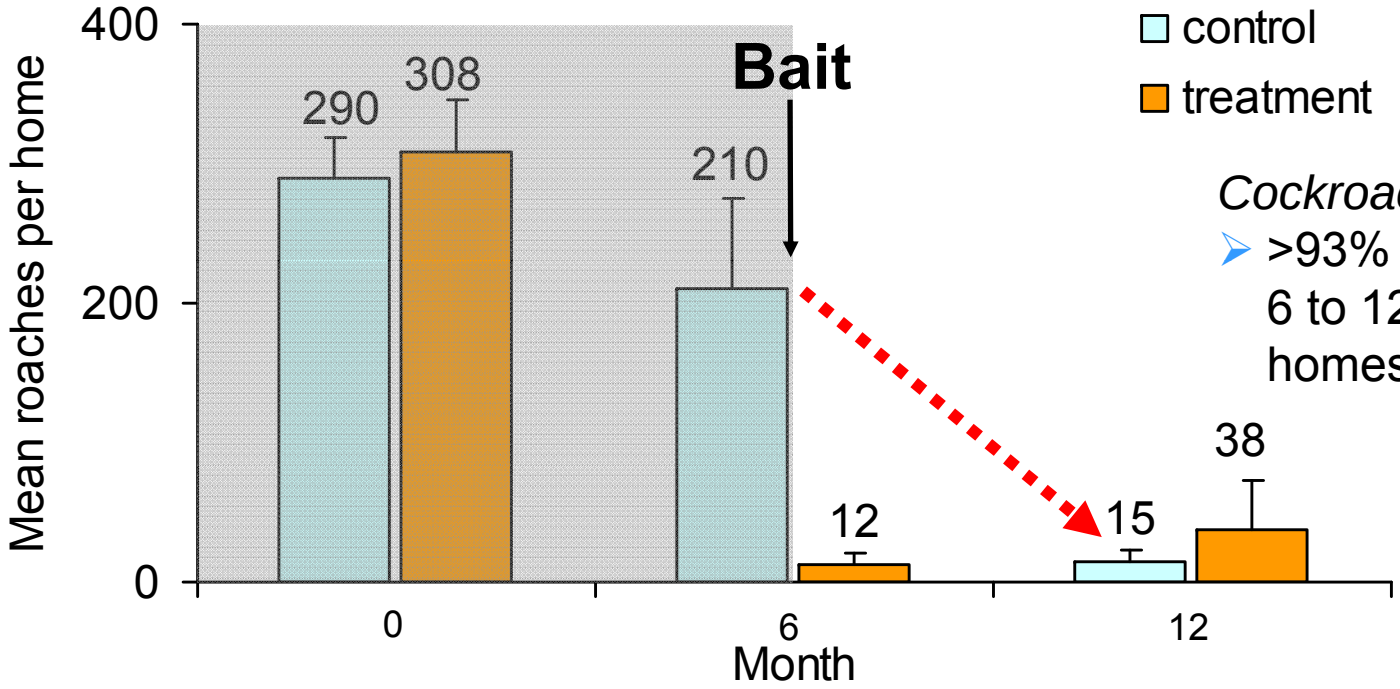
Great results due to…

1. Pest control?
   - whole-house, follow-ups, traps
2. Professional cleaning?
   - new vacuum (with HEPA filter)
3. Resident education?

Is pest control alone sufficient?



Cockroach control in homes
(months 6 to 12)

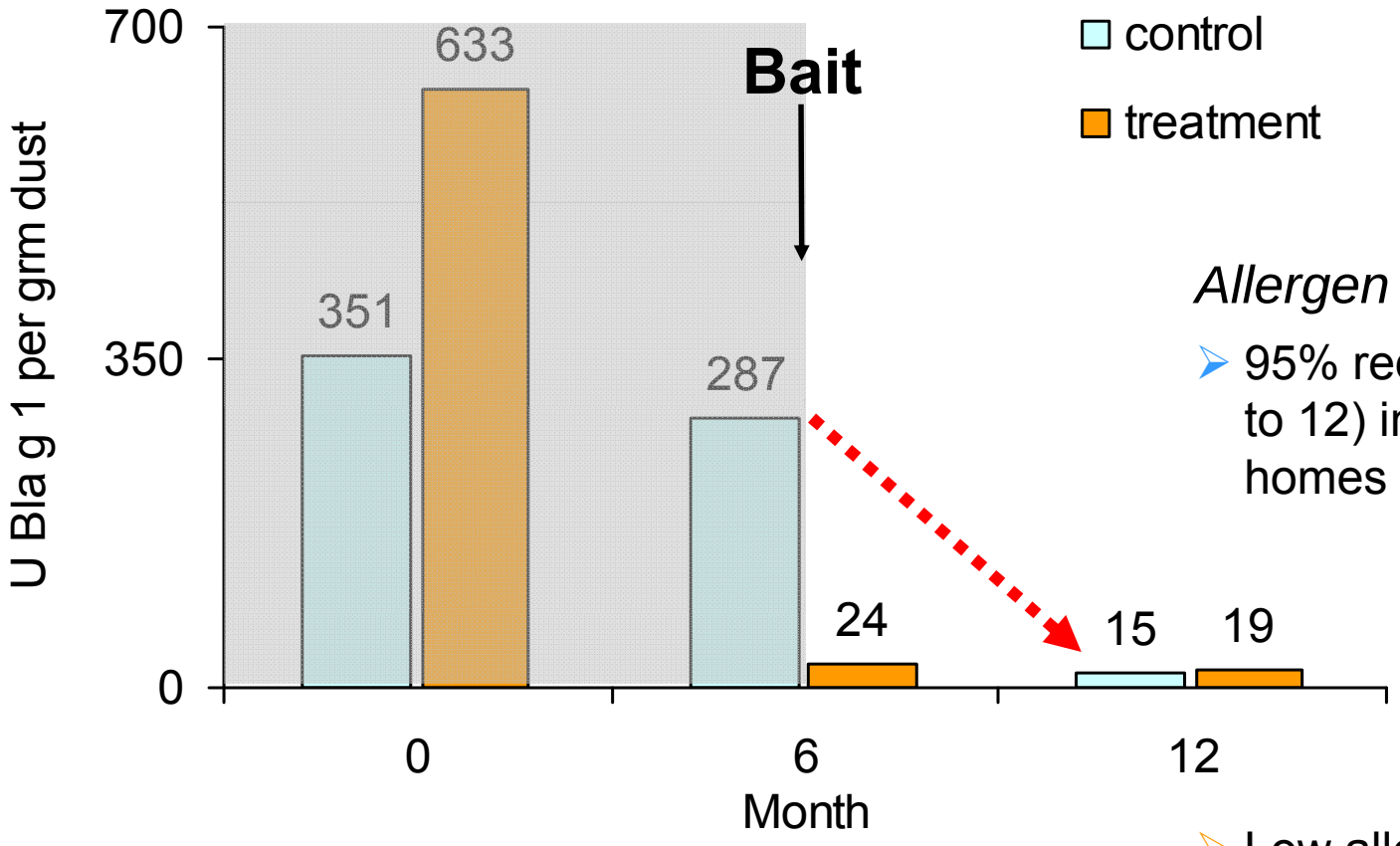


Cockroach control

- >93% reduction (month 6 to 12) in old control homes ($P < 0.001$)

- Sustained low infestation in old treatment homes

Allergen reduction in homes
(months 6 to 12)



Allergen reduction

- 95% reduction (month 6 to 12) in old control homes ($P < 0.001$)
- Low allergen levels in old treatment homes

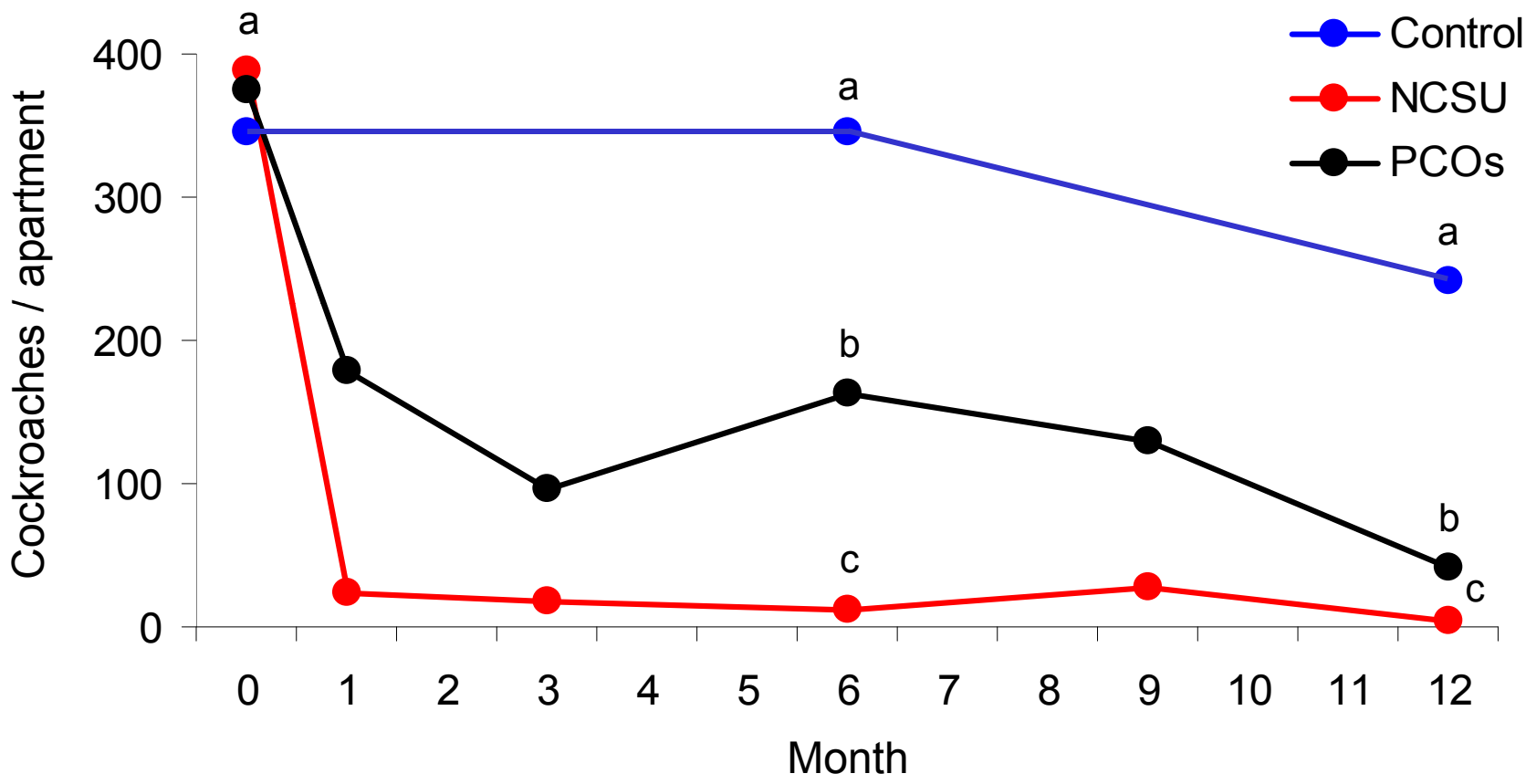
Arbes *et al.* 2004. *J Allergy & Clin Immunol*

Conclusions I: Allergen mitigation

- Allergen levels can be reduced below clinically relevant thresholds (1st time!)
- Allergen reductions can be sustained with continued cockroach control
- Contrary to previous studies, cockroach control *alone* can significantly reduce allergen levels = effective pest control is key to allergen reduction!

Arbes *et al.* 2003. *Journal of Allergy and Clinical Immunology* 112: 339–345
Arbes *et al.* 2004. *Journal of Allergy and Clinical Immunology* 113: 109–114

Can PMPs control cockroaches & reduce allergen as effectively?



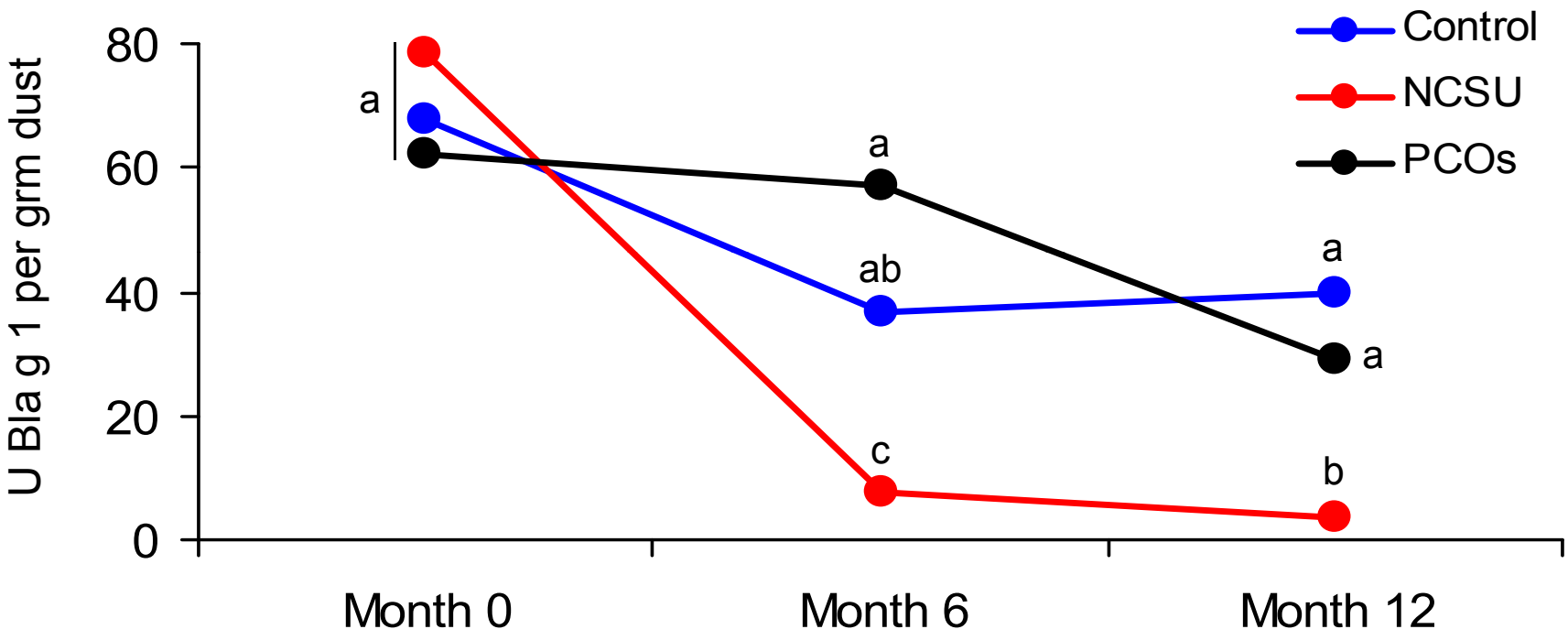
NCSU: M6 = 97% reduction
M12 = 99% reduction

PCOs: M6 = 53% reduction
M12 = 76% reduction

Sever *et al.* 2007. *Journal of Allergy and Clinical Immunology* 120: 849–855

Allergen reductions: Kitchen

(similar results for Bla g 2)



NCSU: M6 = 90% reduction

M12 = 95% reduction

PCOs: M6 = 8% reduction

M12 = 53% reduction

Sever *et al.* 2007. *J Allergy & Clin Immunol*

Why the differences between NCSU & PMPs?

Economics

- Cost considerations

Total cost NCSU: $281 per home for 12 months
Baits and placement: $61 to $124
Commercial pest control contract: $475 per home

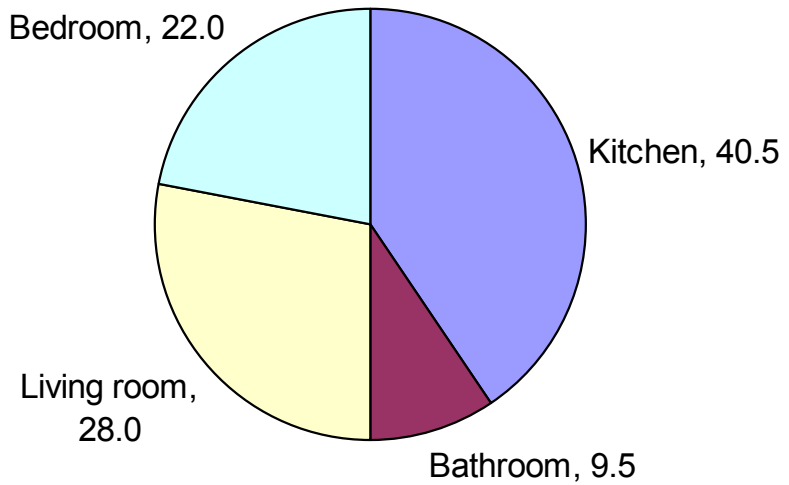
Technical & Operational

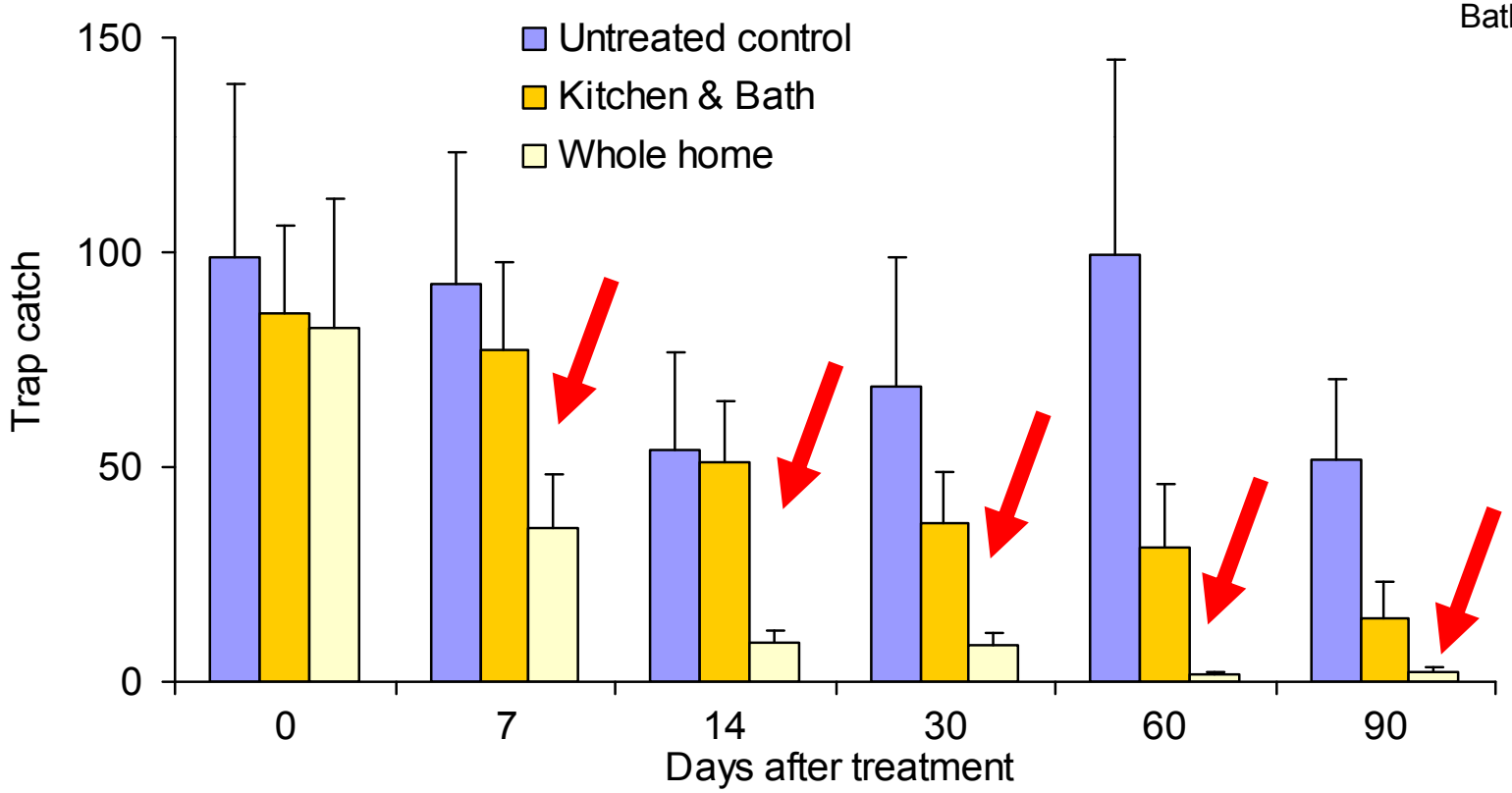
- Monitoring *vs.* no follow-ups (calendar based)
- Monitoring-based treatments
- Tactics: Baits vs. sprays
- Schedule and intensity of treatments:

Whole home *vs.* Kitchen & Bathroom?

Living room

can serve as a reservoir for re-infestations





Santangelo *et al*. (unpublished)

But… where has all the allergen gone?

Cleaning is important!

Conclusions

- Allergen levels can be reduced below clinically relevant thresholds
- Cockroach control *alone* can significantly reduce allergen levels
- Whole home gel bait treatments are more effective than label-recommended Kitchen & Bathroom treatments
- IPM approach is cost-effective and efficacious: It definitely controls cockroaches, and reduces allergen… *but*
- Allergen removal requires **FOLLOW-UP** cleaning

Conclusions: Key components of IPM

IPM components

- Inspection & monitoring
- Pest identification
- Action levels/thresholds
- Control measures
- Evaluation & record-keeping

IPM decision-making process

- ✓Is action necessary?
- ✓Where is action necessary?
- ✓When should action be taken?
- ✓What action is appropriate?
- ✓Repair, maintenance, pest exclusion, sanitation

IPM & IPM contracts

NCSU: http://ipm.ncsu.edu/urban/usdaedit.pdf
http://ipm.ncsu.edu/urban/cropsci/SchoolIPM/

UFL: http://schoolipm.ifas.ufl.edu/

IPM Inst: http://www.ipminstitute.org/

many others: search for “urban IPM” or “school IPM”

NIEHS

Darryl Zeldin
Michelle Sever
Sam Arbes


EPA–PESP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Bayer

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