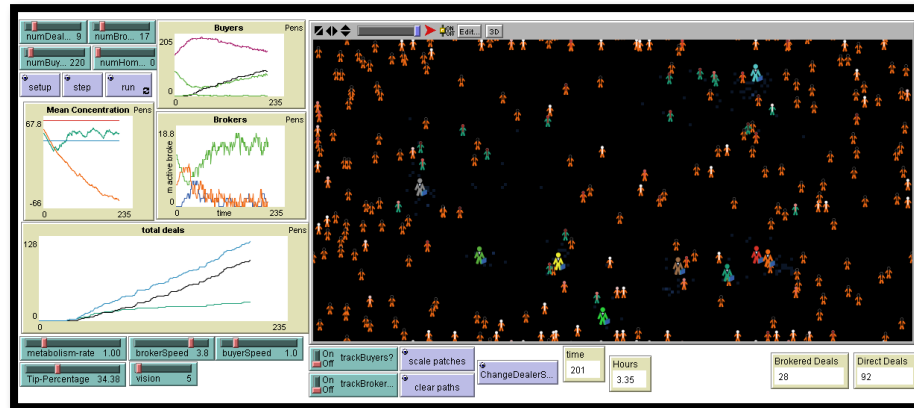


# Blending Ethnographic & Algorithmic Complexity: Applying Agent-based Modeling to the Opioid Epidemic



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**Department of Anthropology**



COLLEGE OF  
ARTS AND SCIENCES  
**CASE WESTERN RESERVE**  
UNIVERSITY

NIH, NIDA: DA09232, DA06016, & DA019476  
NSF, SBE, Cultural Anthropology: 0951501

# For my talk...

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1. How are we incorporating agent-based modeling (ABM), ethnographic, & survey research?
2. How are we applying this combination to the **opioid epidemic in Ohio?** (work-in-progress)
  - Opioid demand forecasting



# Mike Agar

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Connected with Mike... (Nov. 17<sup>th</sup>, 1993, AAA Washington DC)

My informal mentor on...

- ☞ Doing ethnography to understand: Illegal drug use, drug trends – epidemics, drug distribution
- ☞ Using Agent-Based Modeling to understand the above
- ☞ Drug policy, academia & life in general... (tacos & Jamo)



# Mike Agar

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- 2008 SfAA workshop – social complexity & ABM (Santa Fe)
- “Agent Based Modeling” (ABM) may sound like a fashion show put on by the Drug Enforcement Administration. It is not. It is a useful new tool, a computer-based thought-experiment lab for the relationship between structure and agency, a device to explore ethnographic conclusions and visually display them in a powerful and accessible way.

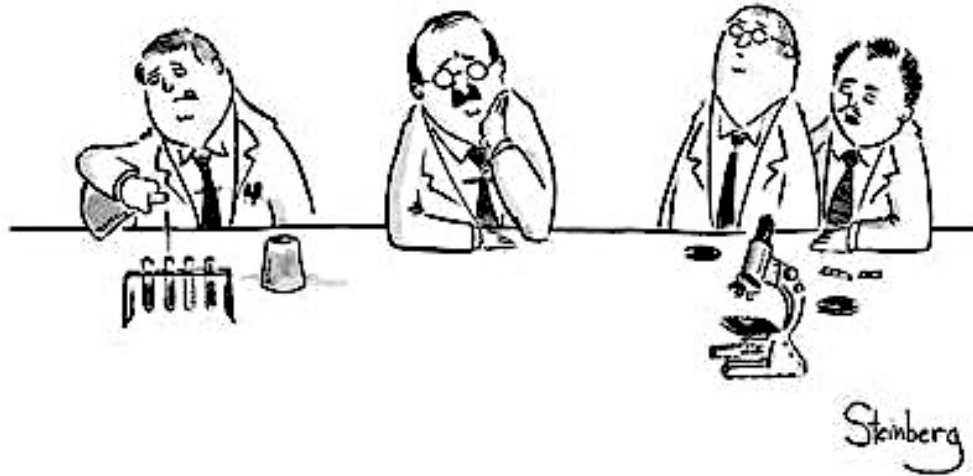
(Agar 2008, SfAA abstract)





# Mike Agar

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*"His is a thought experiment."*

How can we **apply** ABM & what is required to do this?  
(lots of conversation with Mike about this)



# Mike Agar – Algorithmic complexity

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- In comparing Complex Adaptive Systems (CAS) & ethnography:

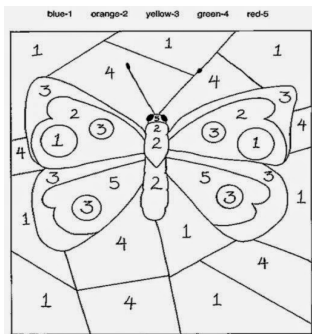
“An algorithm is just a set of procedures for doing something. So, one measures algorithmic complexity by answering a question: “Is there an algorithm to produce the expression of interest that is simpler than the expression itself? How much simpler is it?” (Agar 2004: 18)



# Mike Agar – Algorithmic complexity

## Process (method) & product

Not complex



**Paint by numbers**

Experiments

Social Science

Ethnography CAS

Very complex



**Jackson Pollock**  
(1912 – 1956)

Level of algorithmic complexity

Identifying places in our ethnography to make things “simpler?” – targets for ABM  
(lots of conversation with Mike about this)



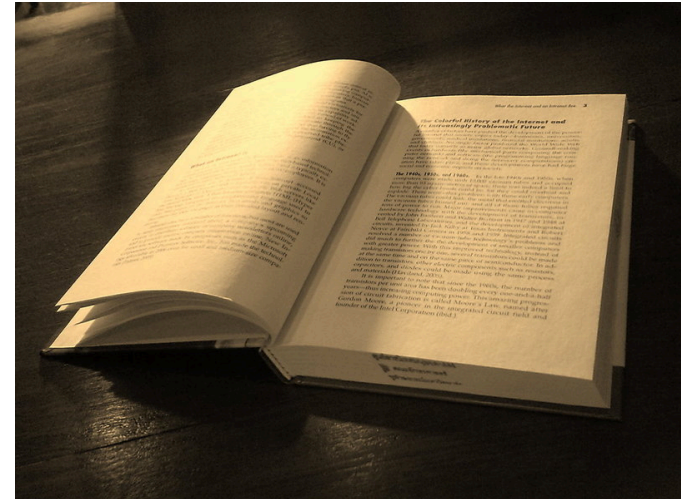
# Algorithmic complexity

FROM THIS...



The “real world”

...TO THIS



The “ethnography”



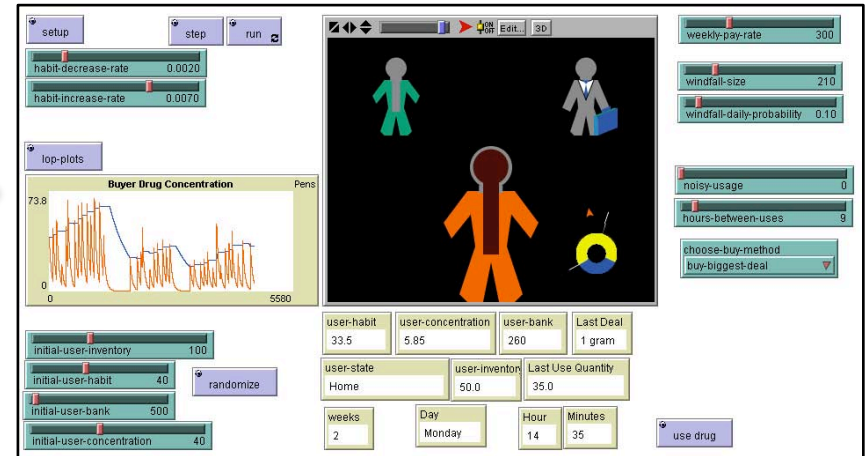
# Algorithmic complexity

FROM THIS...



The “real world”

...TO THIS



The “simulation”  
(ABM)



- The problem: The opioid epidemic in Ohio (increased demand)

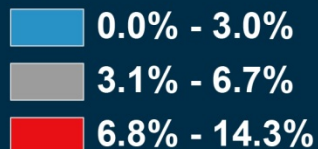


# Client Admissions for Opiate Abuse and Dependence

Ohio MACSIS Data - 2001

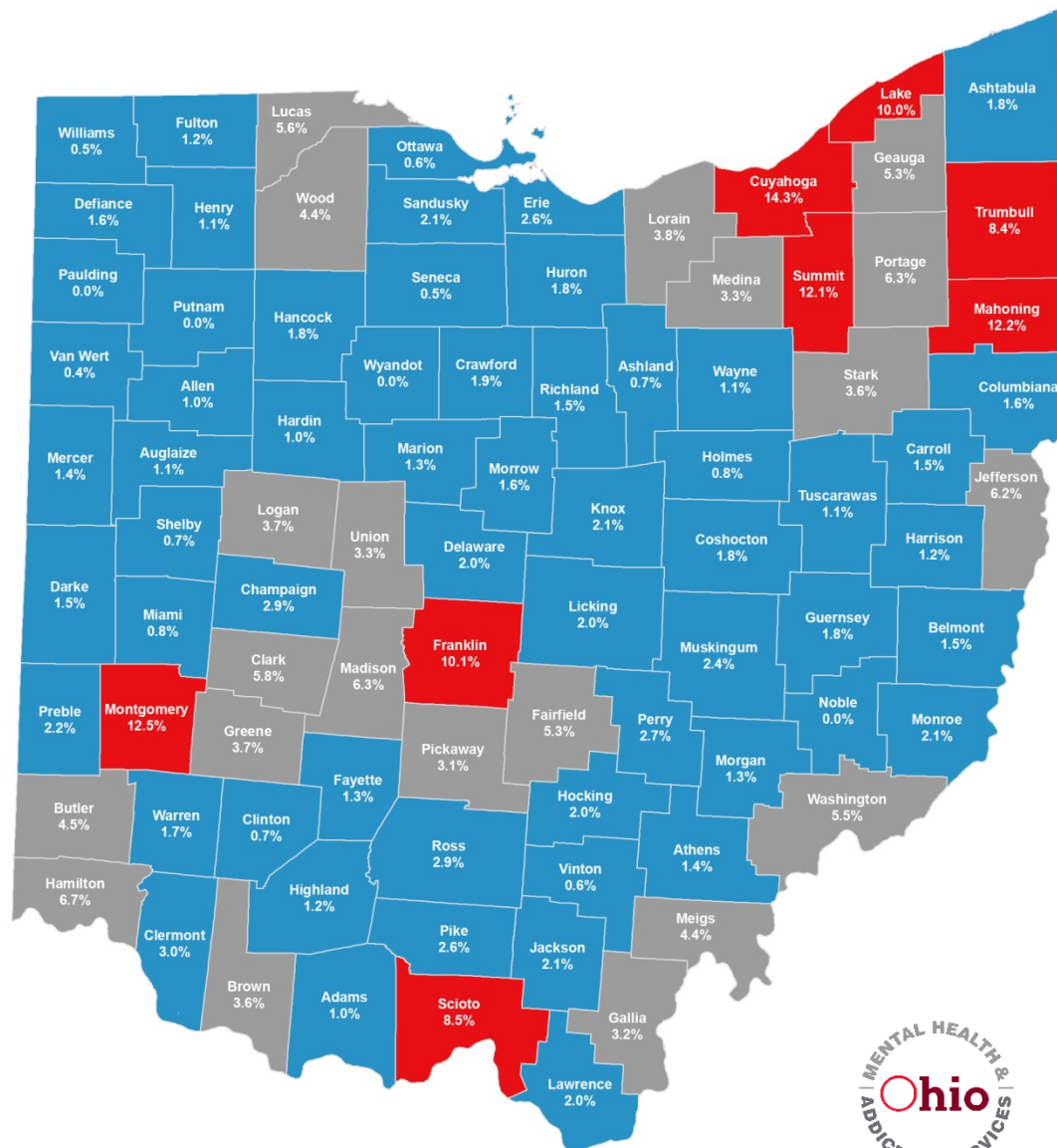
## Legend

### Opiate Addicts (%)



## Map Information:

This map represents the percentage of clients in treatment with an opiate-related diagnosis (heroin and prescription opioid). The highest concentrations of opiate admissions are in Cuyahoga (14.3%), Montgomery (12.5%), Mahoning (12.2%), Summit (12.1%) and Franklin (10.1%) counties. Noble, Paulding, Putnam and Wyandot did not have any opiate-related admissions.

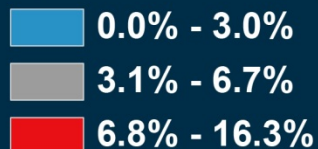


# Client Admissions for Opiate Abuse and Dependence

Ohio MACSIS Data - 2003

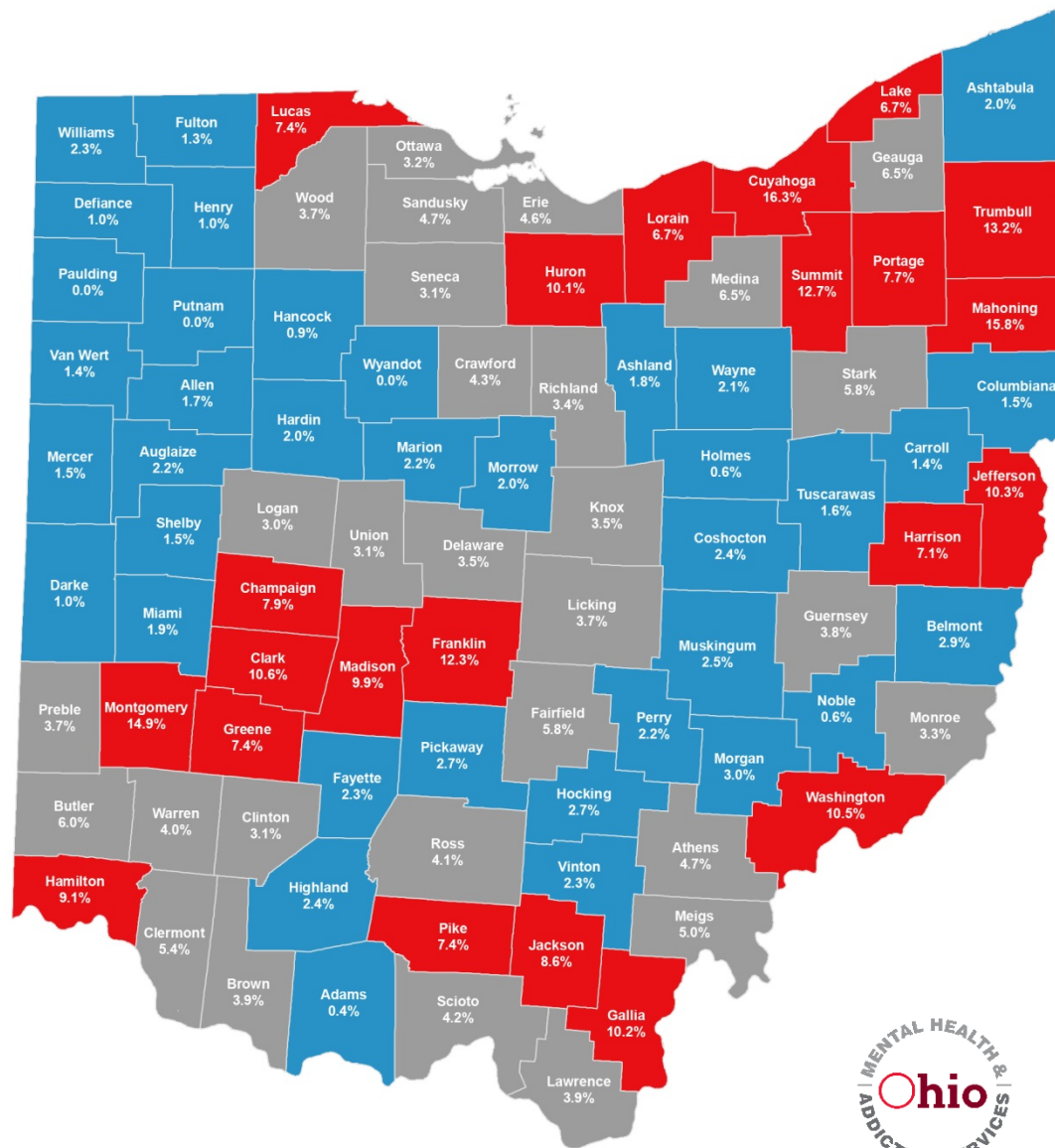
## Legend

### Opiate Addicts (%)



## Map Information:

This map represents the percentage of clients in treatment with an opiate-related diagnosis (heroin and prescription opioid). The highest concentrations for opiate admissions are in Cuyahoga (16.3%), Mahoning (15.8%) and Montgomery (14.9%) counties. Paulding, Putnam and Wyandot did not have any opiate-related admissions.



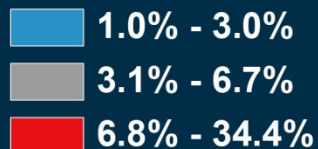


# Client Admissions for Opiate Abuse and Dependence

Ohio MACSIS Data - 2005

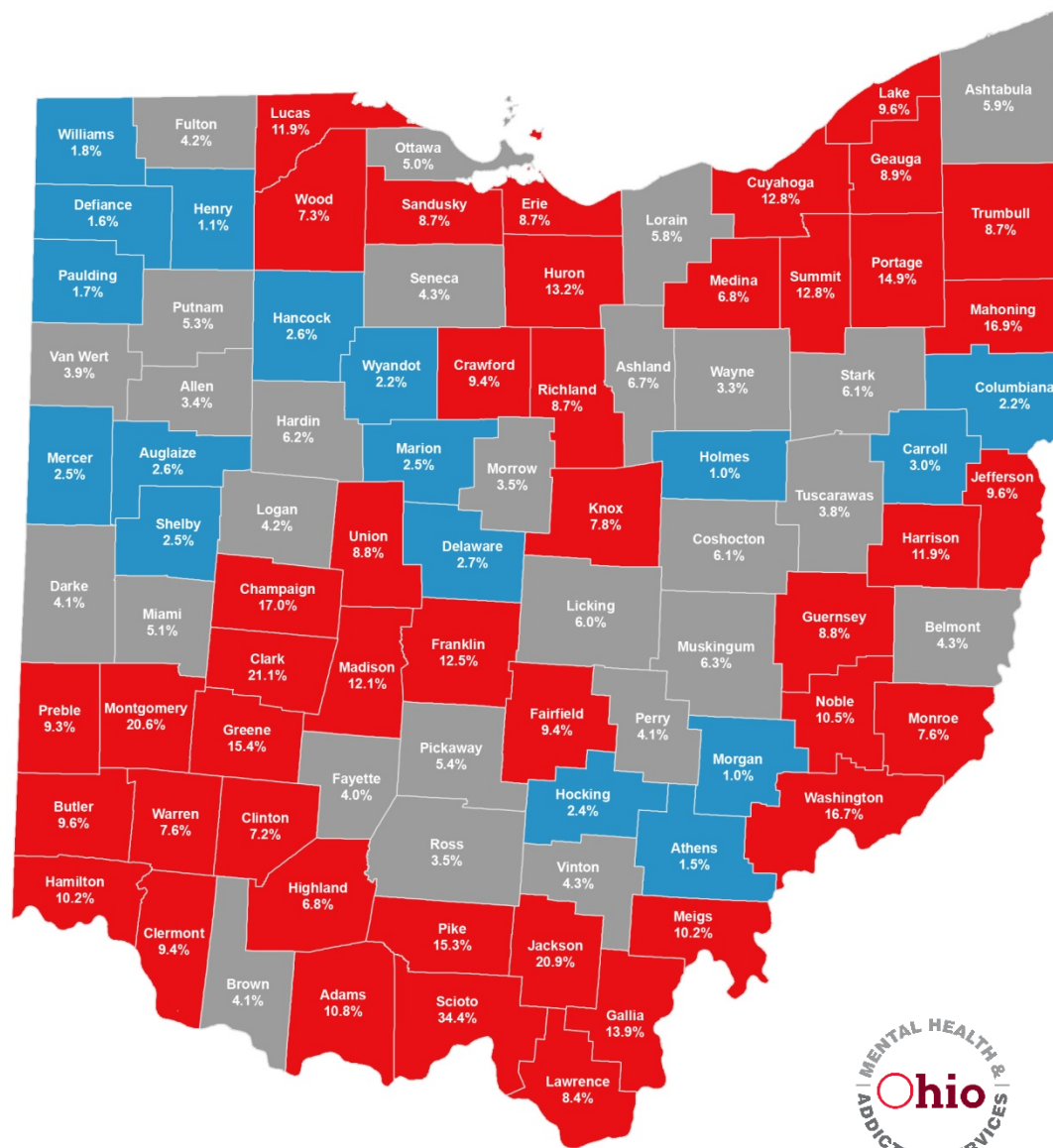
## Legend

### Opiate Addicts (%)



## Map Information:

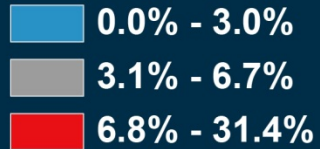
This map represents the percentage of clients in treatment with an opiate-related diagnosis (heroin and prescription opioid). The highest concentrations for opiate admissions are in Scioto (34.4%), Clark (21.1%) and Jackson (20.9%) counties. The counties with the lowest concentrations of an opiate-related diagnosis are Holmes (1.0%), Morgan (1.0%) and Henry (1.1%).



## Ohio MACSIS Data - 2007

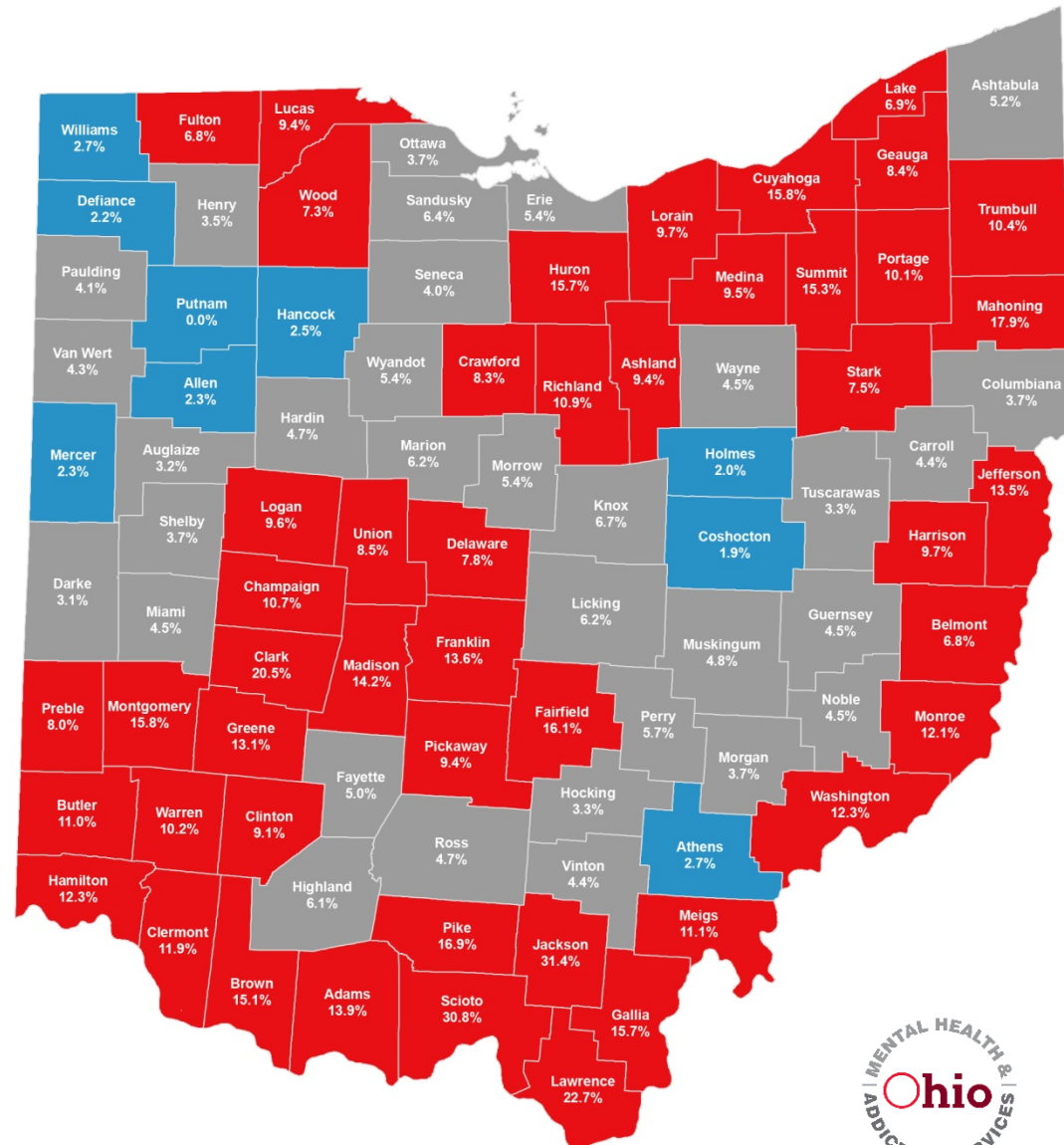
## Legend

## Opiate Addicts (%)



### Map Information:

This map represents the percentage of clients in treatment with an opiate-related diagnosis (heroin and prescription opioid). The highest concentrations for opiate admissions are in Jackson (31.4%), Scioto (30.8%) and Lawrence (22.7%) counties. The counties with the lowest concentrations of an opiate-related diagnosis are Putnam (0.0%), Coshocton (1.9%) and Holmes (2.0%).



*Data Source:*  
Data from Multi Agency Community  
Information Systems (MACSIS)  
Map produced April 2013

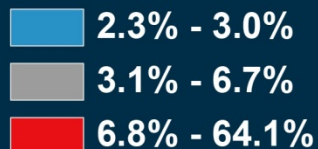


# Client Admissions for Opiate Abuse and Dependence

Ohio MACSIS Data - 2009

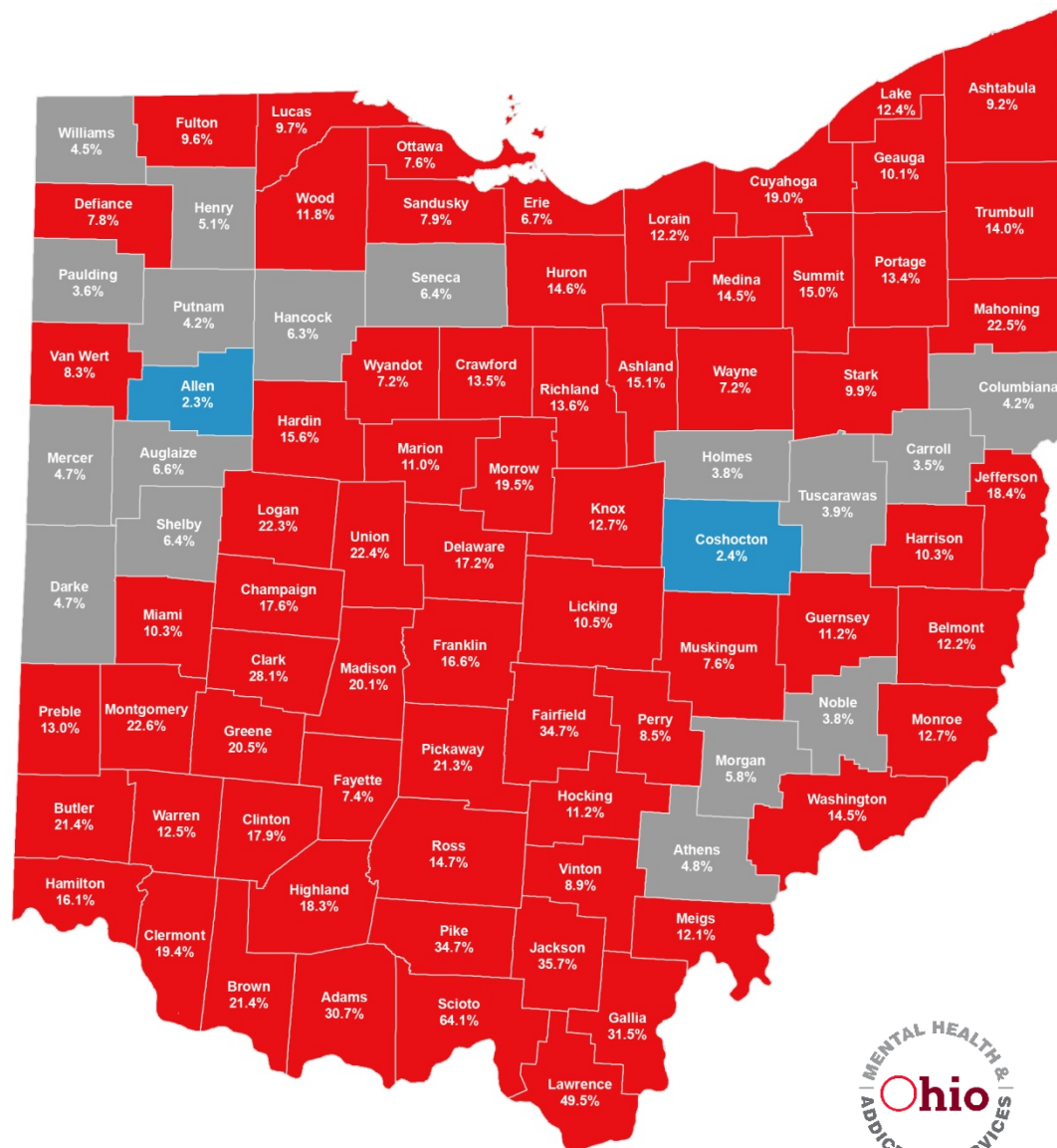
## Legend

### Opiate Addicts (%)



## Map Information:

This map represents the percentage of clients in treatment with an opiate-related diagnosis (heroin and prescription opioid). The highest concentrations for opiate admissions are in Scioto (64.1%), Lawrence (49.5%) and Jackson (35.7%) counties. The counties with the lowest concentrations of an opiate-related diagnosis are Allen (2.3%), Coshocton (2.4%) and Carroll (3.5%).





# Client Admissions for Opiate Abuse and Dependence

Ohio MACSIS Data - 2011

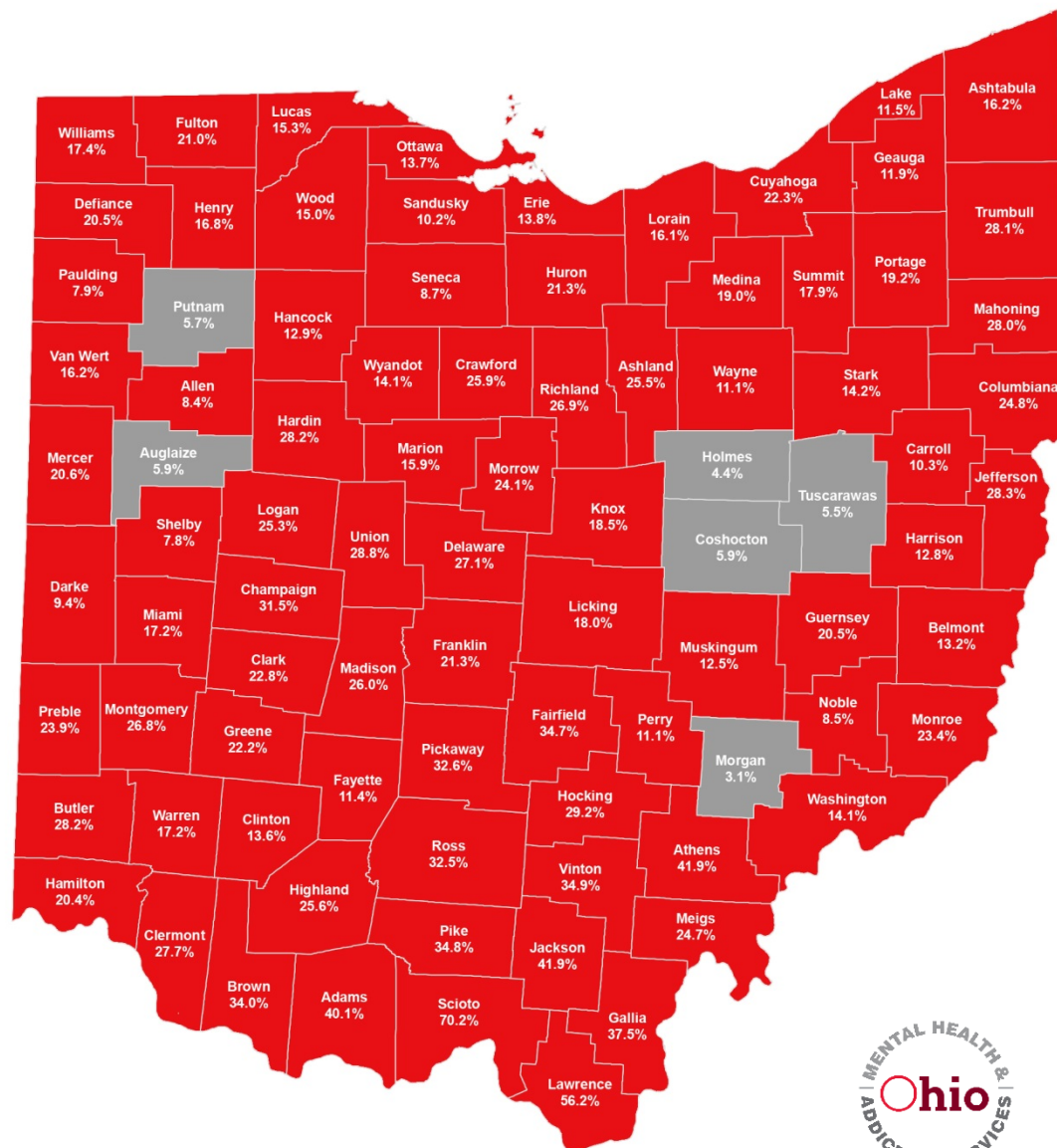
## Legend

### Opiate Addicts (%)



## Map Information:

This map represents the percentage of clients in treatment with an opiate-related diagnosis (heroin and prescription opioid). The highest concentrations for opiate admissions are in Scioto (70.2%), Lawrence (56.2%) and Athens (41.9%) counties. The counties with the lowest concentrations of an opiate-related diagnosis are Tuscarawas (5.5%), Holmes (4.4%) and Morgan (3.1%).



Data Source:  
Data from Multi Agency Community  
Information Systems (MACSIS)  
Map produced April 2013



- The ABM target behavior

**(2014)**  
**NSF study of exchange in  
the heroin market  
Cleveland**

# Heroin Market Transactions

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Dealer



Customer 1



- ✓ The conventional understanding
- ✓ Only accounts for approx. 1/3 of all sales<sup>1-2</sup>
  - Dealers desire to remain hidden

[1] Needle, H.R., Mills, A.R.: Drug Procurement Practices of the Out-of-Treatment Chronic Drug Abuser, National Institute on Drug Abuse, NIH Publication No. 94-3820 (1994)

[2] Johnson, B.D., Goldstein, P.J., Preble, E. et al.: Taking Care of Business: The Economics of Crime by Heroin Abusers, Lexington Books, Lexington, MA (1985)

# Heroin Market Transactions

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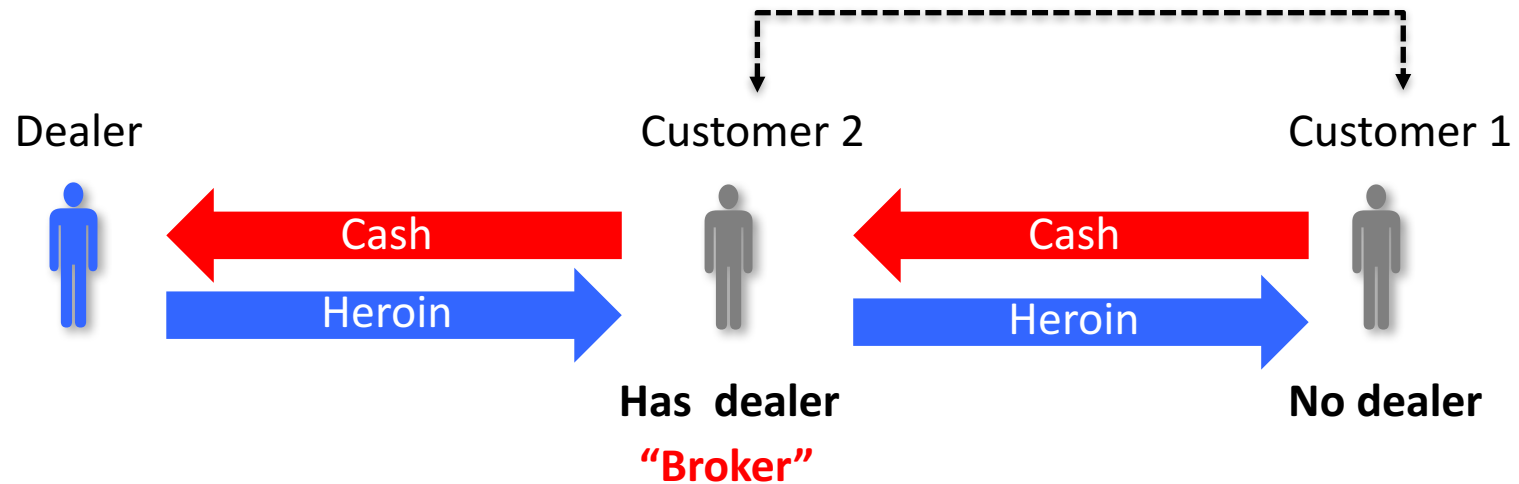
Market  
Barriers

Customer 1



- ✓ How does **a neophyte** heroin user buy the drug?
- ✓ How do they...
  - Identify a heroin seller?
  - Communicate interest in buying heroin?
  - Avoid arrest?
  - Avoid “bogus innovations?”
  - Avoid being ripped-off? What’s the true market price?

# Heroin Market Transactions



- ✓ Users (initially) acquire heroin through fellow users & **not dealers**
- ✓ Brokered transactions are **common** (a.k.a. “copping drugs for others”)
  - Recognized in the literature since the 1960’s<sup>1-3</sup>

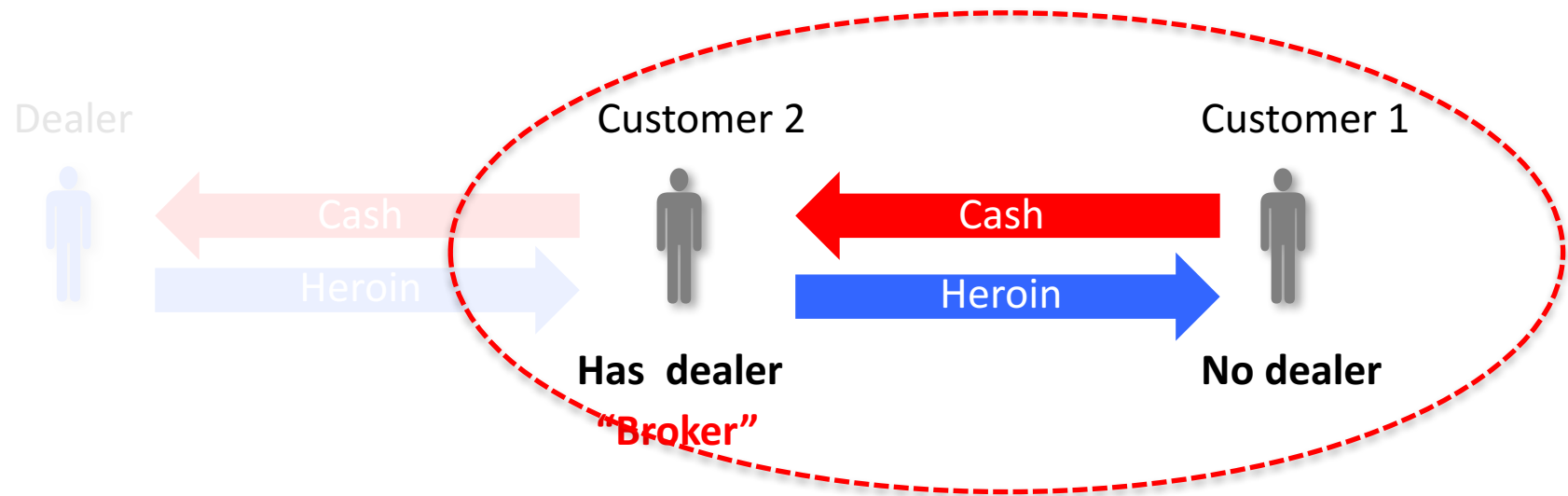
[1] Preble, E. & Casey, J. (1969). Taking Care of Business: The Heroin User's Life on the Street. *International Journal of the Addictions* 4(1) 1-24.

[2] Johnson, B. D., Goldstein, P. J., Preble, E., Schmeidler, J., Lipton, D. S., Sprunt, B., & Miller, T., (1985). *Taking Care of Business: The Economics of Crime by Heroin Abusers*. Lexington, MA: Lexington Books.

[3] Goldstein, P. J. (1981). Getting Over: Economic Alternatives to Predatory Crime Among Street Drug Users. In Inciardi, J. A. (ed.) *The Drug-Crime Connection* (pp. 67-84). Beverly Hills, CA: Sage Publications.



# Heroin Market Transactions



✓ A broker conflates a dealer & a peer<sup>1-2</sup>

2. Social consequences
3. Psychosocial consequences

Too much  
algorithmic  
complexity

[1] Hoffer L. (2016) The Space Between Community and Self-Interest: Conflict and the Experience of Exchange in Heroin Markets. *The Economics of Ecology, Exchange, and Adaptation: Anthropological Explorations Research in Economic Anthropology*. (36) 167-196

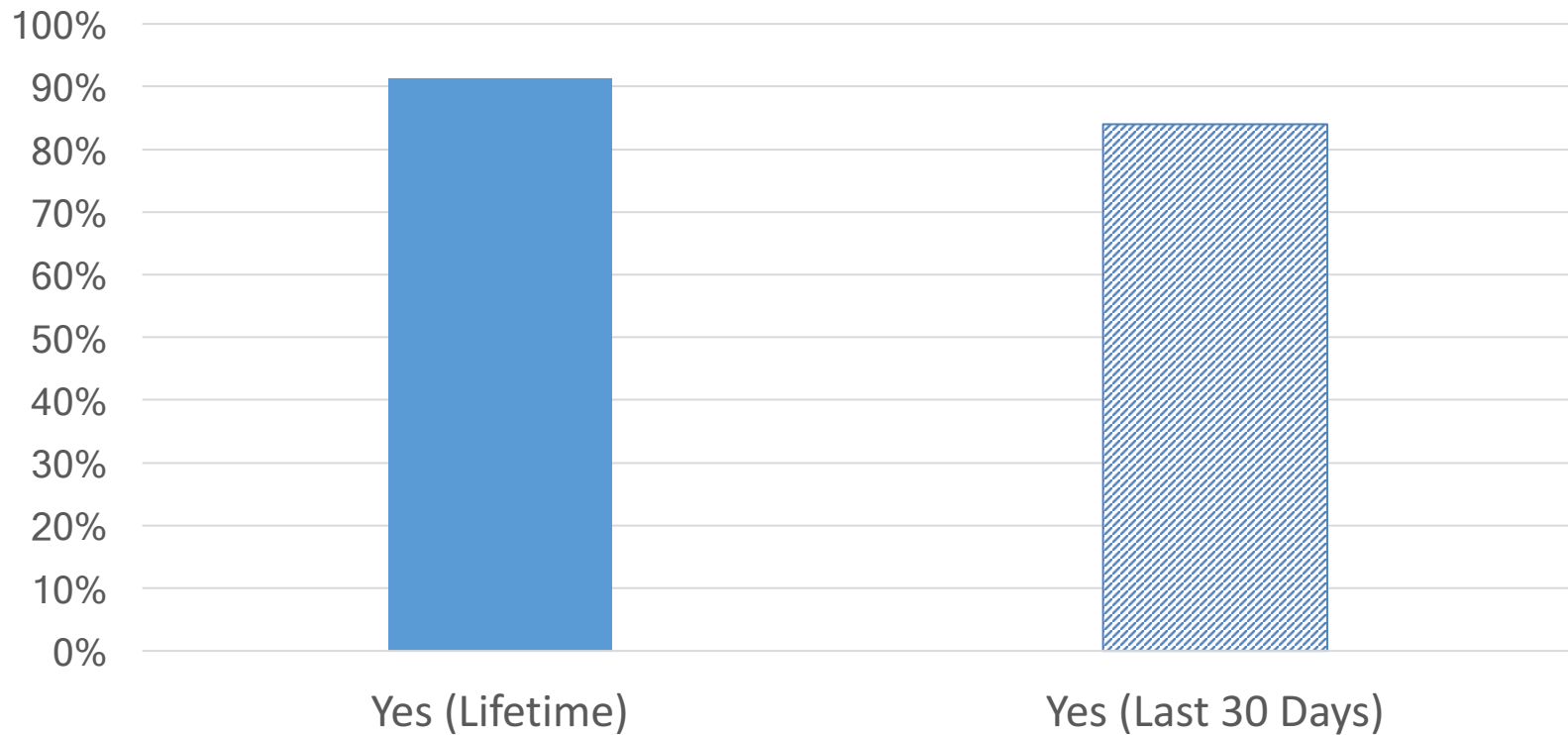
[2] Hoffer L. (2017) The Fuzzy Boundaries of Illegal Drug Markets and Why They Matter. (In) Pickard H., Ahmed S. (Eds.): *The Routledge Handbook of Philosophy and Science of Addiction*. Taylor & Francis. (Forthcoming)

- Data collection to inform ABM parameters

**(2016)**  
**NIH survey on drug access**  
**Cleveland**

# Drug Acquisition – Broker transactions

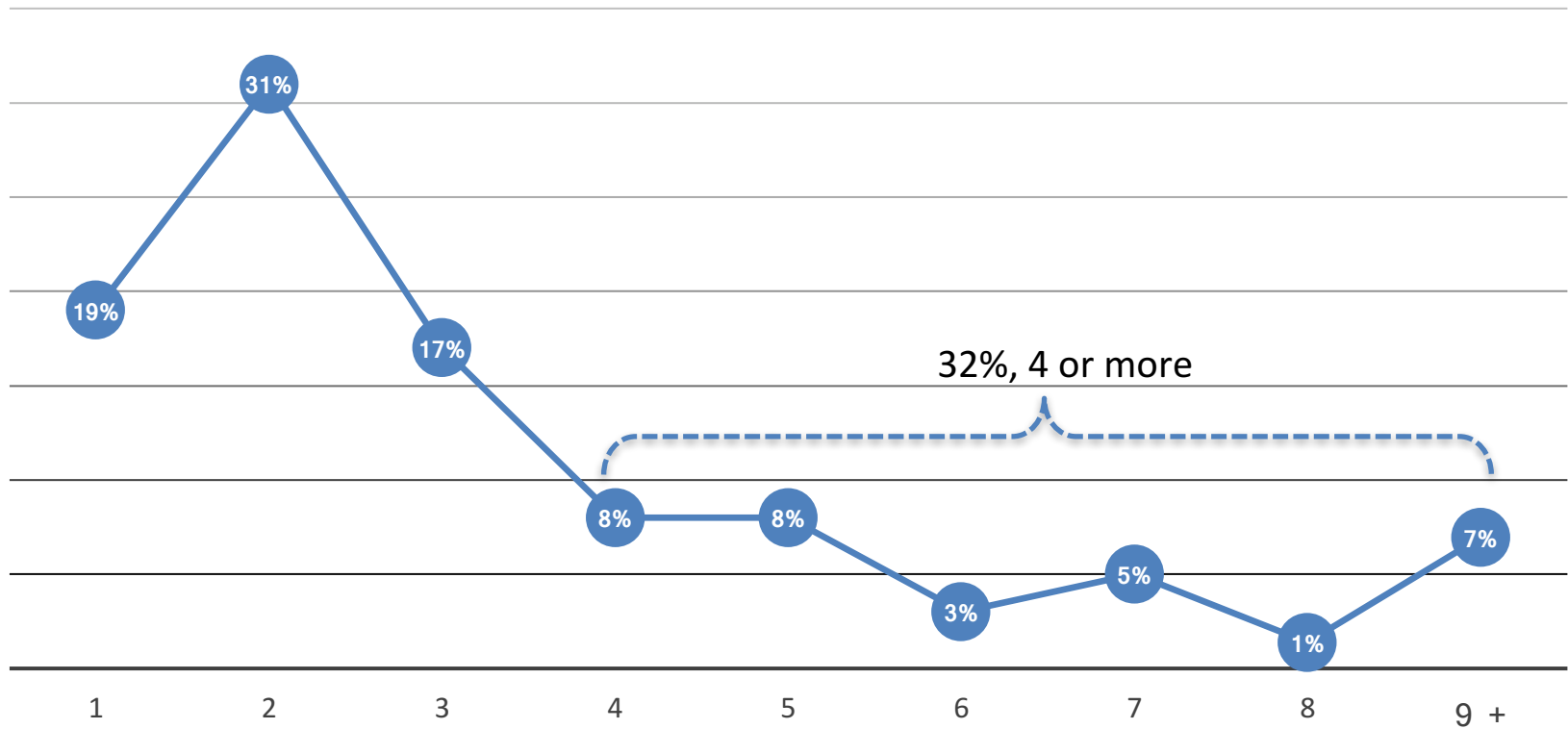
Have you ever been given money to buy drugs for someone else?



N=158

# Drug Acquisition – Broker transactions (Range)

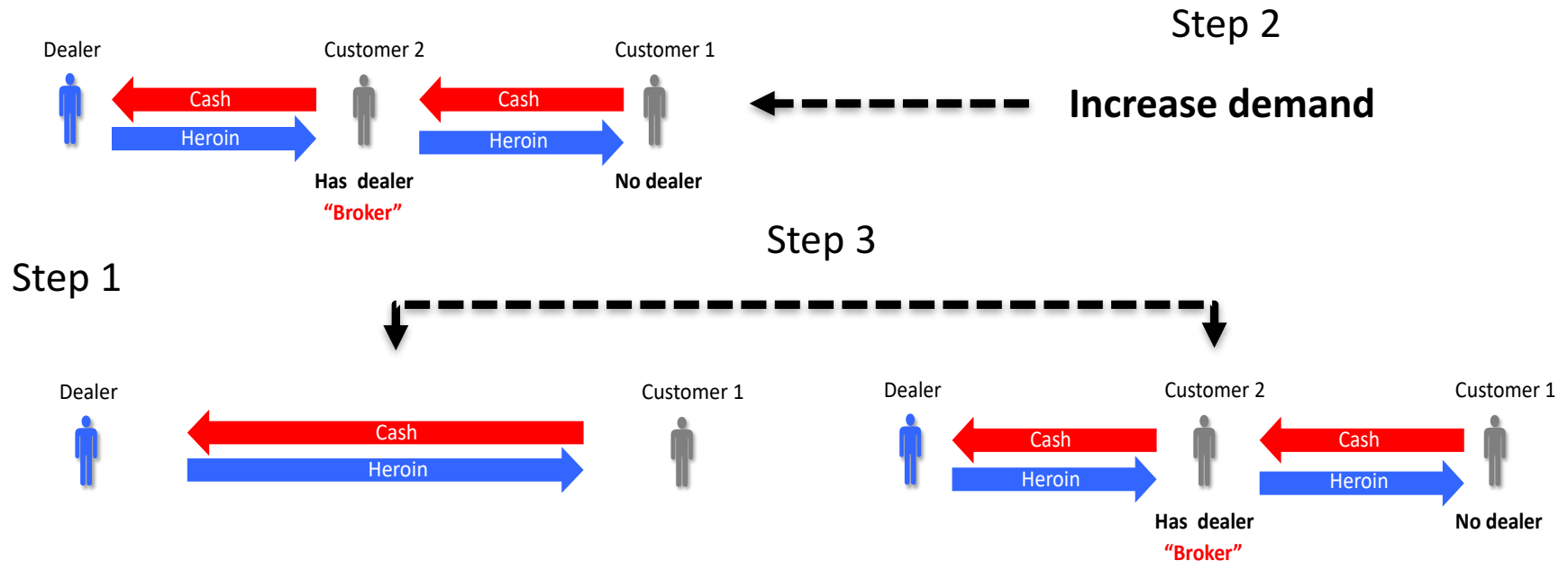
In the last 30 days, how many different people have you bought for?



N=158

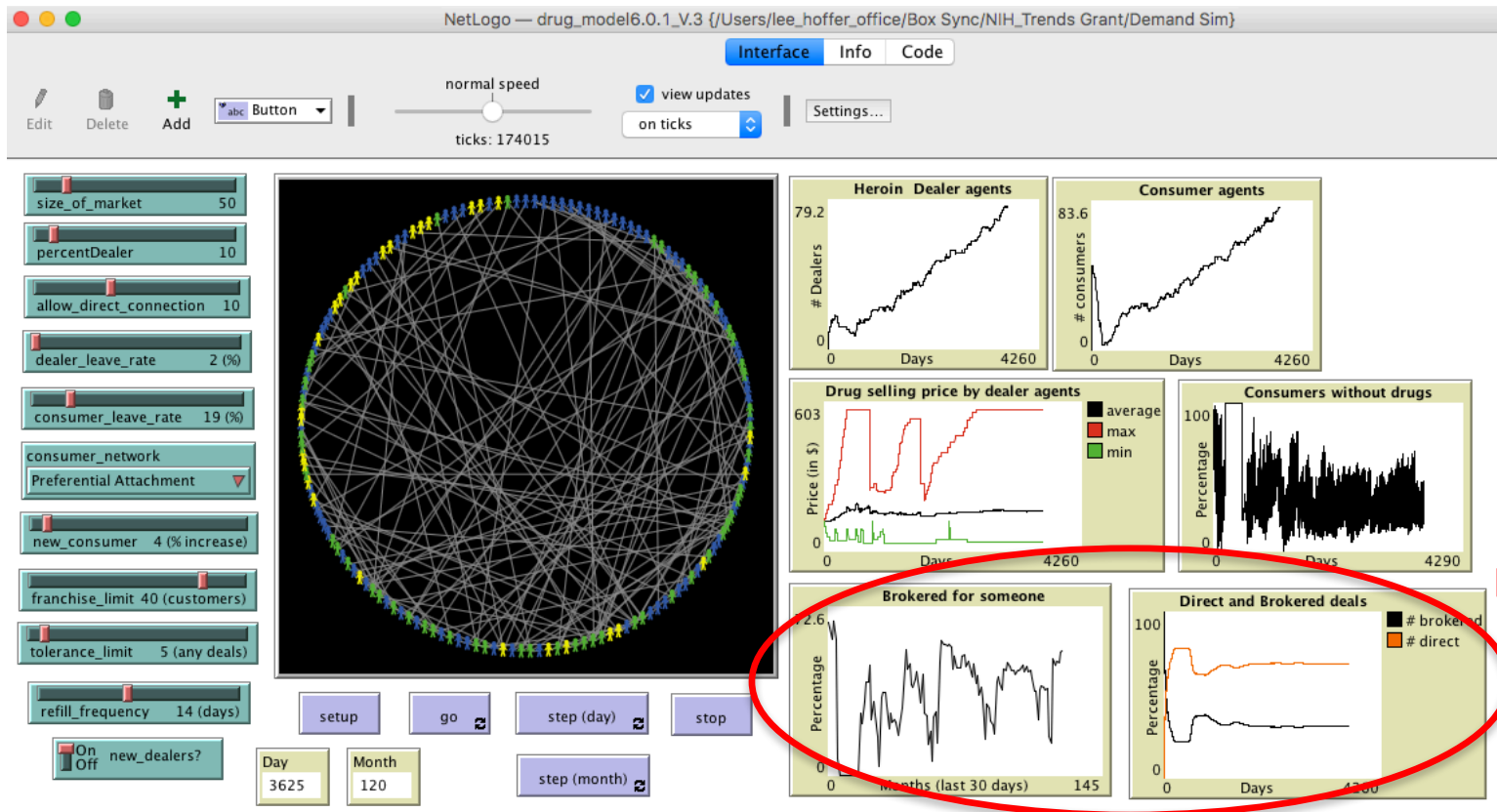
# The ABM: Opioid Demand

# Demand ABM



- ✓ Delineate the ratio between direct vs. brokered transactions for different demand conditions (e.g., +20%)
- ✓ **Step 4:** Identify this ratio among users to indicate level of demand

# Demand ABM



✓ In progress: issues with the “agent” algorithms

# **The Implementation: Ohio SEP Data Network**



# The Project

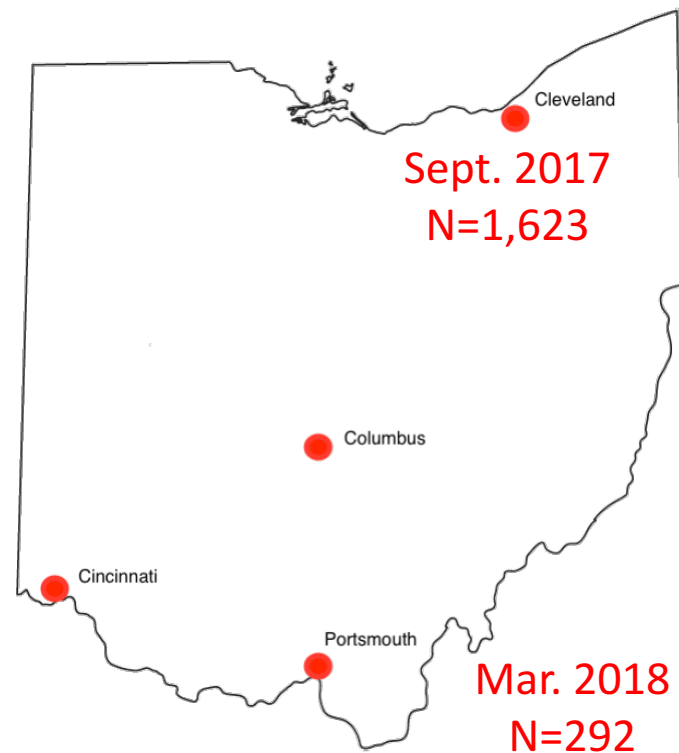
- (2015 – Present) Developing a **statewide** system to monitor syringe exchange activity using **REDCap – web-based survey platform**
- Standardize data collection of client information (for comparisons)

- Utilize this system for:

1. **Program** decision-making
2. **Monitoring** drug use dynamics

(Future)

1. **Collect** data on drug use behaviors  
(direct vs. brokered transaction ratios)



# Conclusion

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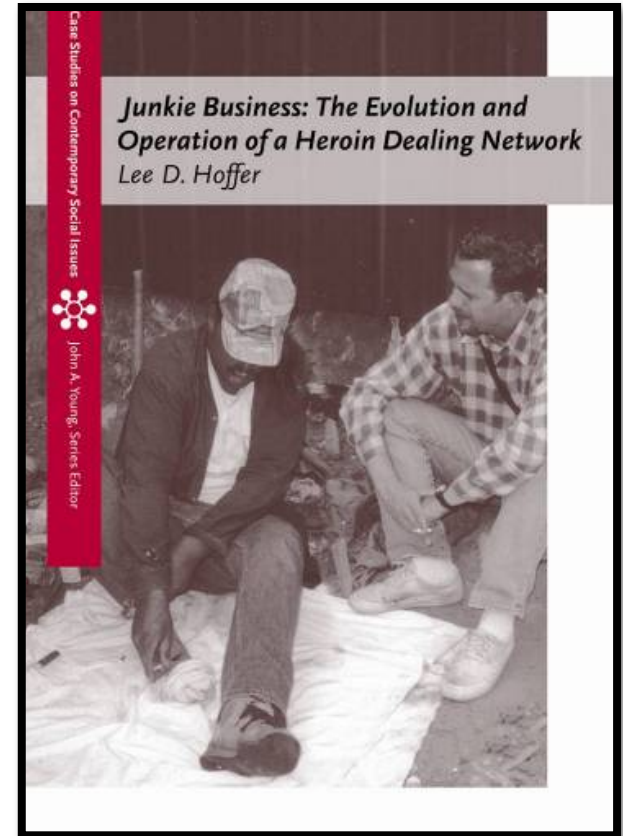
- Impossible to communicate all the ways Mike has influenced my work (ABM & ethnography)
- Mike's discussion of “algorithmic complexity” helped me identify the relationship between CAS (ABM) & ethnography... for application

# Conclusion

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## Foreword by Mike Agar (3 pages)

- “Lee Hoffer has written three books at once.”
- “In the third reading of this same book, he extends the new complexity science to economic markets and organizational behavior.”
- (Illegal drug markets) “There is no ‘boss of all bosses’ directing traffic. It happens spontaneously, on the ground, from the bottom up. Drug distribution is a colony of amoebas, not a marching band.”



(Thomson Wadsworth, 2006)

# Acknowledgments

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**Allison Schlosser**

CWRU Research Team, graduate student

**Kelley Kampman**

CWRU Research Team, graduate student

**Website:** <http://anthropology.case.edu/faculty/lee-hoffer/>

**THANK YOU**