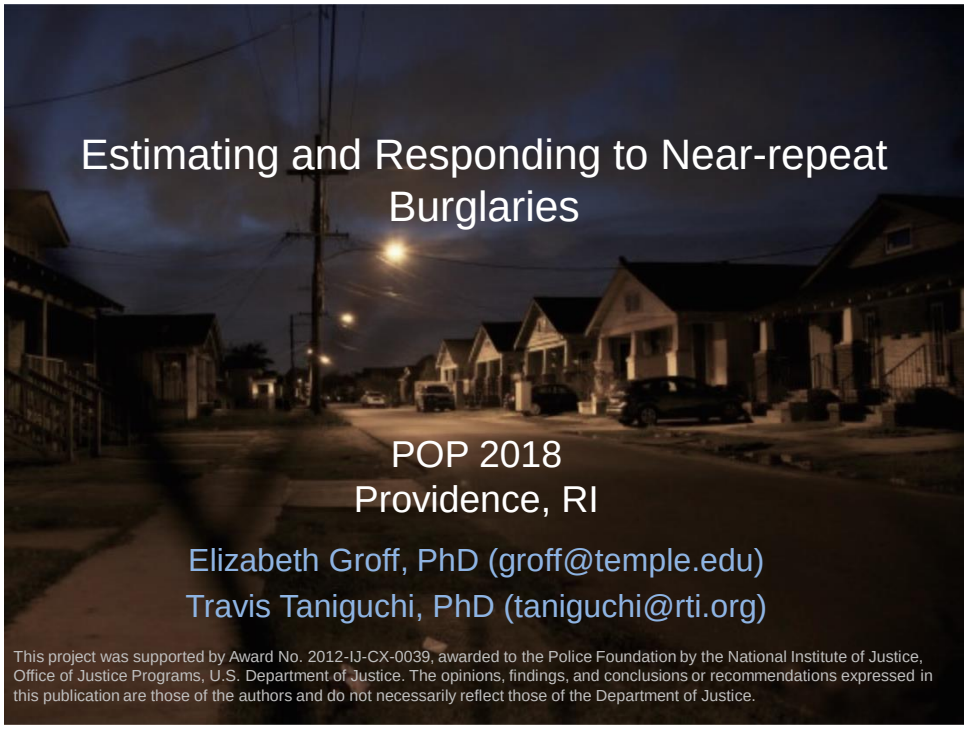

Estimating and Responding to Near-repeat Burglaries

POP 2018
Providence, RI

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Agenda

Part 1: A primer on near repeat patterns

- Definitions and terms
- Existing knowledge
- Importance of considering crime prevention potential

Part 2: NR Crime Prevention Potential Calculator

Part 3: Example analysis in Philadelphia

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Part 1: Background

What is the near repeat pattern of burglary and why should I care?

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Part 1: Repeat and near repeat burglary

- Repeat burglary phenomenon
  - Same house victimized multiple times
- Near repeat burglary phenomenon
  - Burglary increases risk for houses nearby
  - Space-time window varies
- Instigator/Originator event
  - First burglary
- Repeat event
  - Subsequent burglary within space-time window

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Part 1: Near repeat burglary patterns

- Burglary occurrence associated with increased risk for neighbors
- Risk decays over time and space
- Size/duration of space-time high risk window varies

What do we know about near repeat burglary patterns?

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Part 1: Size of high risk window

- Early studies international (UK, Australia)
  - Distance: 200 – 400 meters (656 - 1,328 feet)
  - Time: 2 – 4 weeks
- US studies increased since 2014
  - Distance: 100 – 244 meters (328 – 800 feet)
  - Time: 14 days or less
  - Baltimore County, MD; Houston, TX; Indianapolis, IN; Jacksonville, FL; Long Beach, CA; Newark, NJ; Pompano Beach, FL; Redlands, CA
- Must take quick action
- Size of area is reasonable

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Part 1: Where do near repeats occur?

- Urban backcloth characteristics
- Near repeats more likely if:
  - Housing type and layout are similar
  - Public and other 'at risk' private housing complexes (Moreto et al, 2014)
  - Pawn shops (Moreto et al, 2014)
  - Drug markets (Moreto et al, 2014)
  - Burglar residences (Moreto et al, 2014)
  - Rivers (Piza and Carter, 2017)
  - Railroad tracks (Piza and Carter, 2017)

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Part 1: Where do near repeats occur?

- Socio-economic indicators; micro and meso levels

	Piza and Carter, 2017 (micro)	Nobles et al 2016 (neighborhood)	Zhang et al 2015 (neighborhood)
Concentrated disadvantage	Positive	Positive	
Residential instability	Positive	Positive	
Housing density	Positive		Positive
Racial heterogeneity	Positive	Positive	Positive
Young male population	Positive	Positive	

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Part 1: What works to prevent near repeats?

- Hot spots policing
  - Yes
    - Patrolled during high burglary times – 26% reduction (Fielding and Jones, 2012)
    - Patrolled places with past burglary concentration – 21% reduction (Santos and Santos, 2015a,b)
  - No
    - RCT in Holland (Elffers et al, 2018)
    - Why?
      - Most repeats occurred same day as initiator
      - Relatively few repeats overall

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Part 1: What works to prevent near repeats?

- Non-police centric strategies

	Repeat victimization	Near repeat victimization micro (Neighborhood)	Near repeat victimization (Micro)
Crime prevention information	Yes	Positive	Mixed, positive
Target hardening tools	Yes	Positive	Mixed, positive
Notification of increased risk	Yes	Positive	Mixed, positive
Offer of a security audit	Yes	Positive	Mixed, positive
Uniformed personnel	Yes	Positive	Mixed, positive
References	Anderson, et al 1995; Chenery, Holt, & Pease, 1997; Forrester, Chatterton, Pease, & Brown, 1988	Johnson, et al 2017	Groff and Taniguchi, 2018; Wellsmith and Birks, 2008

Part 1: Does notification increase fear?

Citizens do not report increased concern about crime

(Groff and Taniguchi, 2018; Johnson et al, 2017)

Part 1: What do volunteers think?

Volunteers liked participating

Felt the program improved police-community relations

(Groff and Taniguchi, 2018)

Part 1: Tackling near repeat burglary

- Advantages:
  - Leverages volunteer corps for crime prevention
  - Activates citizens in the co-production of community safety
  - Basis for partnerships with other agencies and nonprofit groups
  - Can be very low cost

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Part 1: Tackling near repeat burglary

- Challenges
  - All burglaries versus actionable burglaries
    - NRC uses all burglaries
    - Intervention focus: Stop pattern versus prevent initiating burglary
  - Delays in reporting burglaries
  - Non reporting of burglaries
- Determining the crime prevention potential of an intervention

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Crime prevention potential

- Number of crimes that could possibly be prevented by an intervention
- Shifts the focus from all crime to actionable crime

Part 1: Investigating the mystery

If NRC found significant space-time clustering, why did relatively few burglaries have follow-ons?

Can we better specify the potential impact of disrupting NR patterns?

Part 1: Measurement differences

- NRC
  - Each pair is classified so individual burglaries might 'count' toward more than one pair
  - Burglaries that occur on the same day as the originator event are not preventable but count as repeats
  - Distance is measured with Euclidean or Manhattan

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Part 1: Value of CPP

- For practitioners
  - Should we undertake this intervention?
  - Was the intervention successful?
  - Is it worth continuing?
  - Measured at micro level

Realistic metric for evaluating program success

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Part 1: A motivating scenario

Consider the scenario

Two cities have 1,000 burglaries a year and implement an intervention to reduce that number…

Agency B

- Burglaries go down by 50
- Chief sees burglary down 5%
- New program shelved because low ROI
- Burglaries in program areas go down by 50, a 50% reduction
- Program expanded because of success

Burglaries go down by 50
Chief sees burglary down 5%

The number of burglaries that were near repeats is calculated as 100

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Part 1: NR-CPP- Example

9 burglaries from January 1st through June 30th

High risk threshold

- 800 feet
- 30 days

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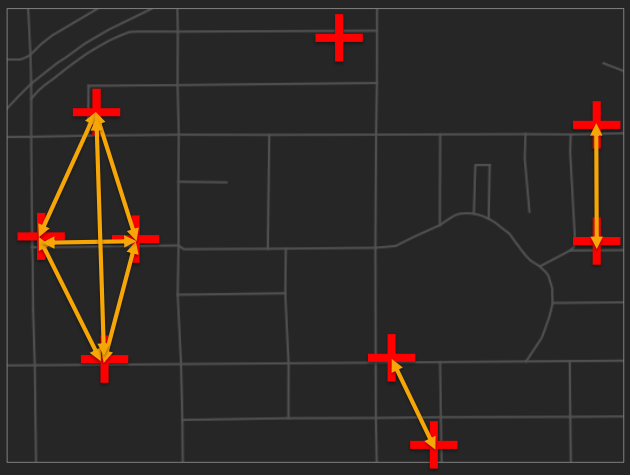
Part 1: NR-CPP- Example

Filter on distance threshold

- Only connections within spatial threshold are shown



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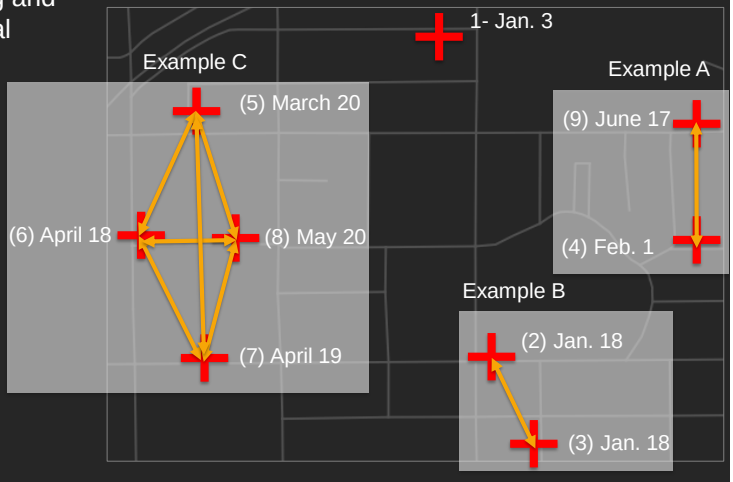
Part 1: NR-CPP- Example

- Consider timing and identify potential pairs



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Part 1: NR-CPP- Example

Example A

Event	Event	Within Distance?	Different Day?	Within Time?	Event Allocated?
4	9	✓	✓	✗	✓

No near repeat events in these examples

Example B

Event	Event	Within Distance?	Different Day?	Within Time?	Event Allocated?
2	3	✓	✗	✓	✓

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Part 1: NR-CPP- Example

Example C

Event	Event	Within Distance?	Different Day?	Within Time?	Event already allocated
5	6	✓	✓	✓	✓
5	8	✓	✓	✗	✓
6	7	✓	✓	✓	✗
6	8	✓	✓	✗	✗
7	8	✓	✓	✗	✓

Two near repeat events in these examples

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Part 1: NR-CPP- Methodology

How can we automate this process?

We build a tool!

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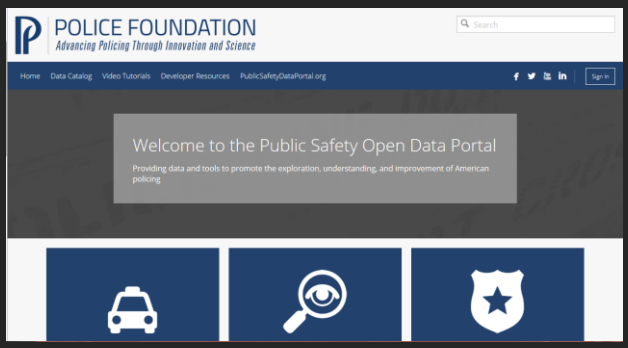
Part 1: NR-CPP- Demonstration

- Examining open source data from seven cities (data.policefoundation.org/)
  - Denver
  - Durham
  - Fayetteville
  - Orlando
  - Philadelphia
  - Santa Rosa
  - Seattle
  - St. Louis



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Part 1: NR-CPP- Results

	Baltimore Co.	Redlands	Denver	Durham	Fayetteville
3 Blocks 4 Weeks	5.89	7.76	14.97	14.30	14.51
	Orlando	Philadelphia	Santa Rosa	Seattle	St. Louis
3 Blocks 4 Weeks	21.49	21.80	12.45	13.98	19.62

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Part 1: NR-CPP- Results

	Baltimore Co.	Redlands	Denver	Durham	Fayetteville
4 Blocks 4 Weeks	8.18	15.24	23.90	21.98	20.53
	Orlando	Philadelphia	Santa Rosa	Seattle	St. Louis
4 Blocks 4 Weeks	30.77	35.84	16.47	26.31	32.97

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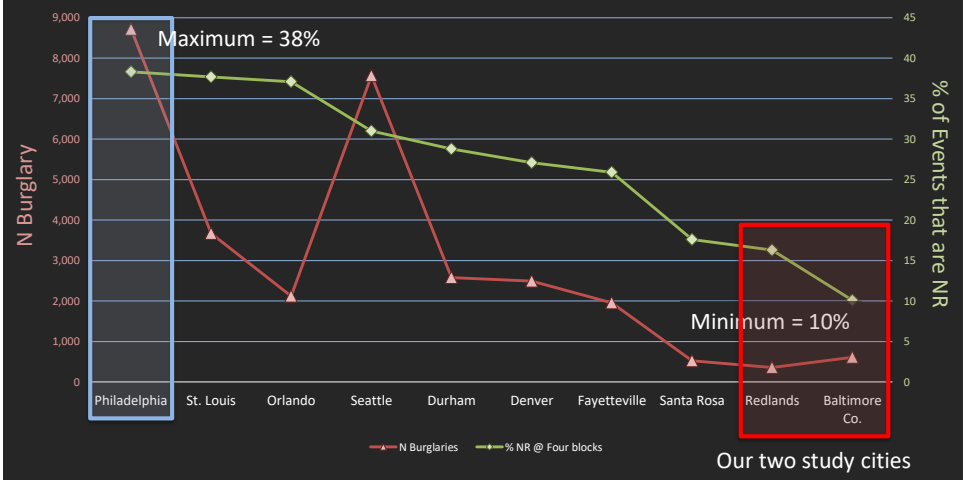
NR-CPP- Variable patterns



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Take away points

- Global NR risk ≠ actionable NR risk
- The CPP of NR varies by city and within cities
- CPP should be integrated into analysis process
  - Calculate CPP prior to designing intervention
  - Drill down the cone of resolution to identify 'where'
- Quantify crime problem
  - Analysis: Should we undertake this intervention?
  - Assessment: Was the intervention successful?

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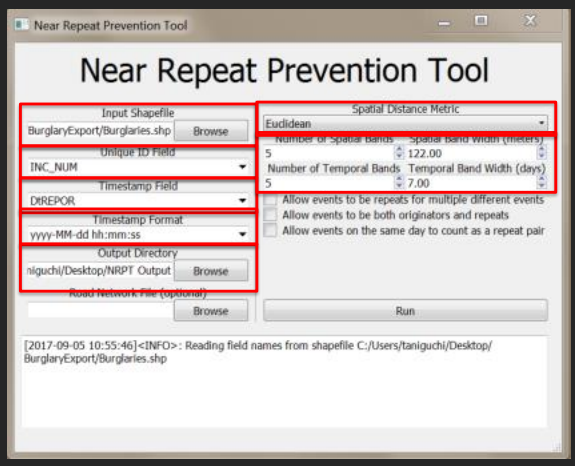
QUESTIONS?

Part 2: Example using NR-CPPC

- All written guides, presentations and software are available at: https://www.policefoundation.org/projects/translating-near-repeat-theory-into-a-geospatial-policing-strategy/
- Scroll down and look for Resources & Tools part of page
- Download software and sample data
- Read user guide

Part 2: NR-CPPC Interface



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Part 2: NR-CPP- Distance

- Leave this field blank AND select ”Network Distance”
  - Program will download and use OpenStreetMap data
- Link to a street file AND select “Network Distance”
  - Program will use your Shapefile
- Leave this field blank AND select other distance metric
  - No street file needed

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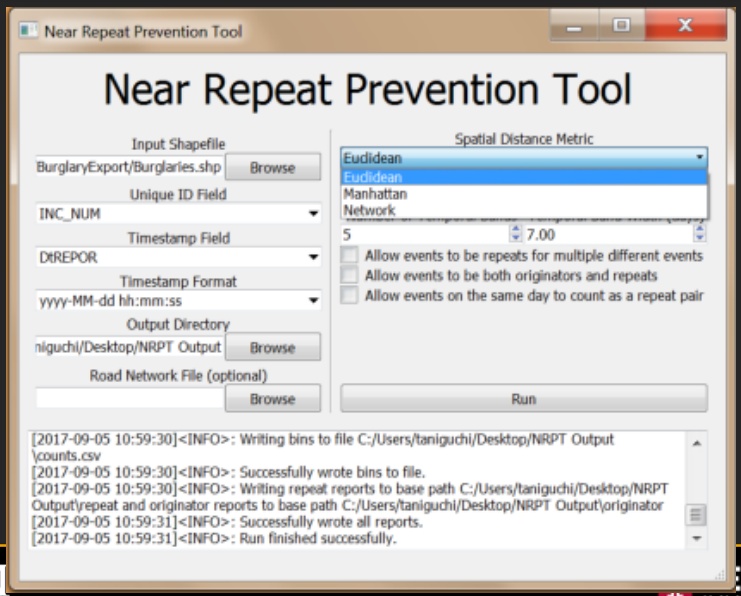
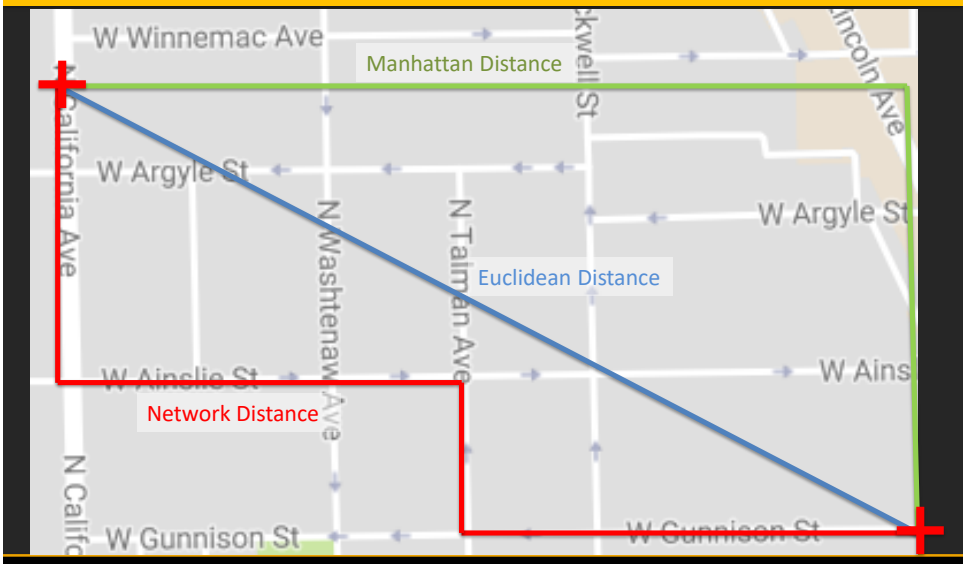
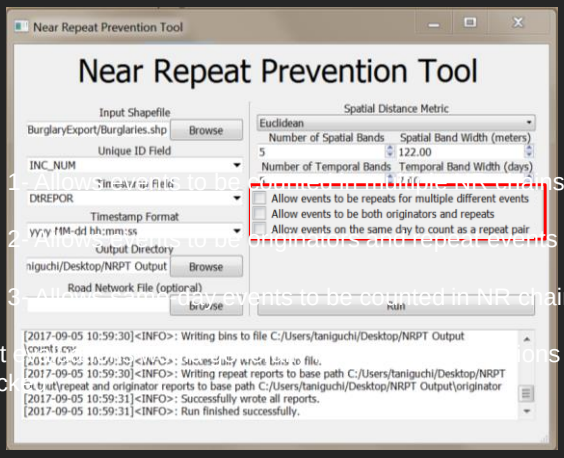
Part 2: NR-CPP- Distance measurement



Part 2: NR-CPP- Distance measures



Part 2: NR-CPPC- Controlling what is counted



Option 1: Allows events to be counted in multiple NR chains

Option 2: Allows events to be originators and repeats

Option 3: Allows events to be counted in NR chains

Robust to options 1 & 2 unchecked

Part 2: NR-CPP- Output files

	A	B	C	D	E
1	spatial_min	spatial_max	temporal_min	temporal_max	count
2	0	122	0	7	24
3	0	122	0	14	42
4	0	122	0	21	58
5	0	122	0	28	78
6	0	244	0	7	55
7	0	244	0	14	107
8	0	244	0	21	162
9	0	244	0	28	218
10	0	366	0	7	99
11	0	366	0	14	195
12	0	366	0	21	291
13	0	366	0	28	397
14	0	488	0	7	145
15	0	488	0	14	296
16	0	488	0	21	440
17	0	488	0	28	600
18	0	610	0	7	183
19	0	610	0	14	376
20	0	610	0	21	575
21	0	610	0	28	803

Program writes out file called count.csv that has:

1. Count of events per space-time bin
2. Spatial min and max
3. Temporal min and max

Part 2: NR-CPP- Output files

	A	B
1	originator_event_ids	repeat_event_id
2	201302000310	201302004383
3	201302003381	201302006451
4	201302002742	201302007175
5	201302011220	201302012119
6	201302011220	201302012715
7	201302011220	201302013609
8	201302009513	201302014014
9	201302010665	201302014294
10	201302011220	201302017427
11	201302017844	201302019577
12	201302019295	201302024054
13	201302017844	201302024446
14	201315034308	201302024989
15	201302026302	201302029601

Program writes out one file for each space-time bin that begin with 'originator'

Each file has the id numbers for all events that were originators and the id numbers for all their associated repeat events

1. Originator_event_ids – may be duplicates
2. Repeat_event_id

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Part 2: NR-CPP- Output files

	A	B	C	D
1	event_id	repeat_event_ids		
2	130000189	130031086|130021664		
3	130000358	130004269		
4	130000679	130003156		
5	130000725	130003438|130002500|130005304		
6	130000816	130010869		
7	130000946	130000725|130003438|130002500		
8	130001105	130020979		
9	130001733	130009745|130009066|130009884		
10	130001884	130004322		
11	130002921	130003987		
12	130002995	130003084|130006023		
13	130003084	130005910|130006199		

Program writes out one file for each space-time bin that begin with 'repeat'

Each file has the id numbers for all events that were originators and the id numbers for all their associated repeat events

1. Event_id – each record is a unique originator id
2. Repeat_event_ids – ids of repeat events separated by pipe

Note: ArcMap reads pipe as NULL

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Part 2: Using output from CPPC

- Number of preventable near repeats
- Proportion of all burglaries that are near repeats
- Geographic concentration in the locations of near repeats

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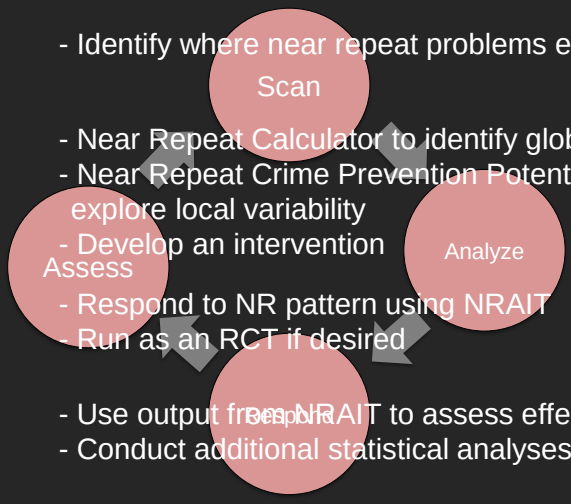
QUESTIONS?

Where to deploy crime prevention resources targeting near repeat burglary?

PHILADELPHIA EXAMPLE

POP/NR Analysis Framework



- Identify where near repeat problems exist

- Near Repeat Calculator to identify global patterns
- Near Repeat Crime Prevention Potential tool to explore local variability
- Develop an intervention

- Respond to NR pattern using NRAIT
- Run as an RCT if desired

- Use output from NRAIT to assess effect
- Conduct additional statistical analyses

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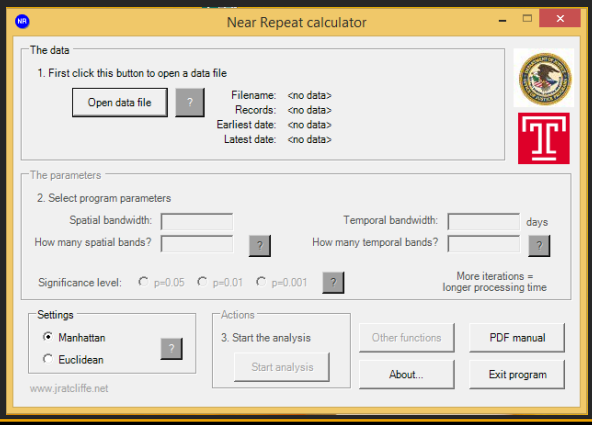
Part 3: Analyzing near repeat crime

1. Calculate global near repeat patterns

Calculating Global Risk

- Near repeat calculator
  - Over what space-time windows does a statistically significant near repeat pattern exist?



Calculating Global Risk- Example

- Baltimore County, MD
  - Significant space-time risk
  - Near repeat pattern exists

	0-7 Days	8-14 Days	15-21 Days	22-28 Days
Same location	5.18	1.58	0.00	8.14
1 to 400 ft.	4.46	1.55	1.24	1.09
401 to 800 ft.	1.64	2.12	1.17	1.30
801 to 1200 ft.	2.17	1.57	1.07	1.31
1201 to 1600 ft.	1.27	1.40	1.31	0.77

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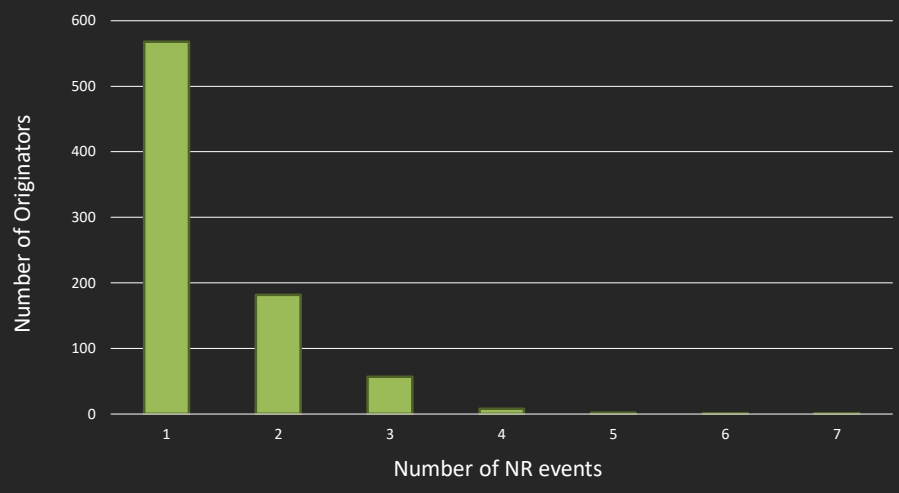
Part 2: Concentration- Philadelphia



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Part 2: Examine burglary across police units

- Total burglary
- Proportion of burglary problem that is involves preventable near repeats

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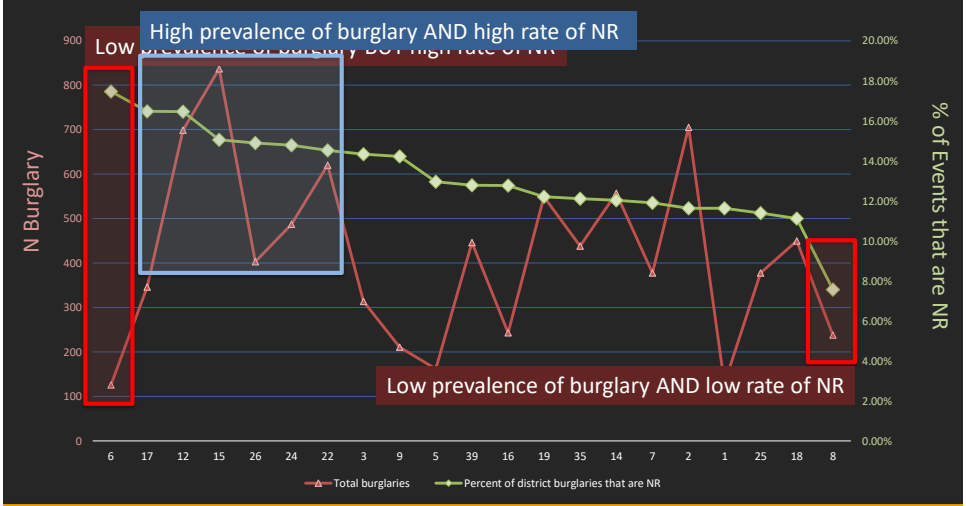
Part 2: Philadelphia, by District



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Part 2: NR-CPP- Mapping

- Add the Excel file into your ArcMap session
- Join the information from NRCPC to your shp file
  - Identify the originators (Originator_ID)
  - Identify the repeats (Repeat_ID)
- Visually display the pattern of each
- Use the hot spot tool to discover where there are concentrations of near repeat events.

These are the areas to focus NR prevention efforts

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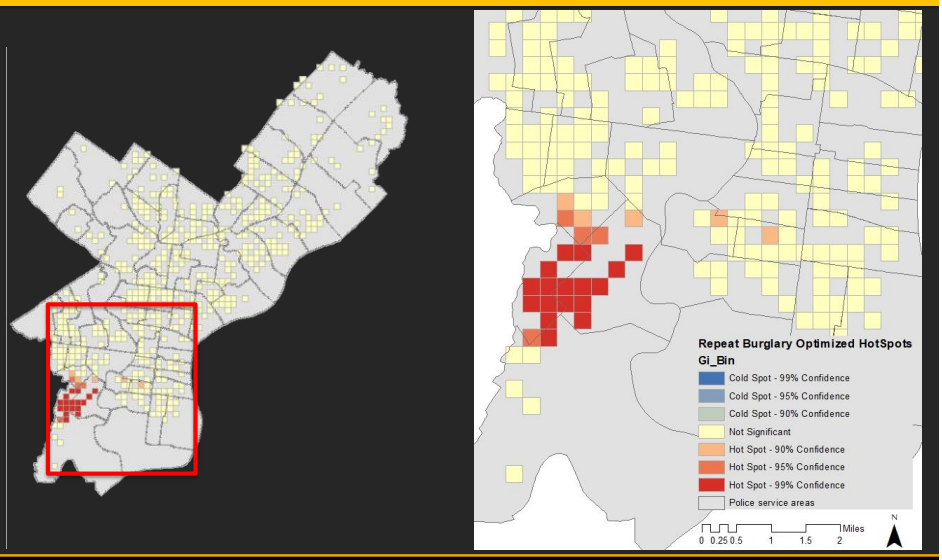
Part 2: NR-CPP- Geographic concentration



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Part 2: Geographic concentration

- Within district variation in near repeat concentration

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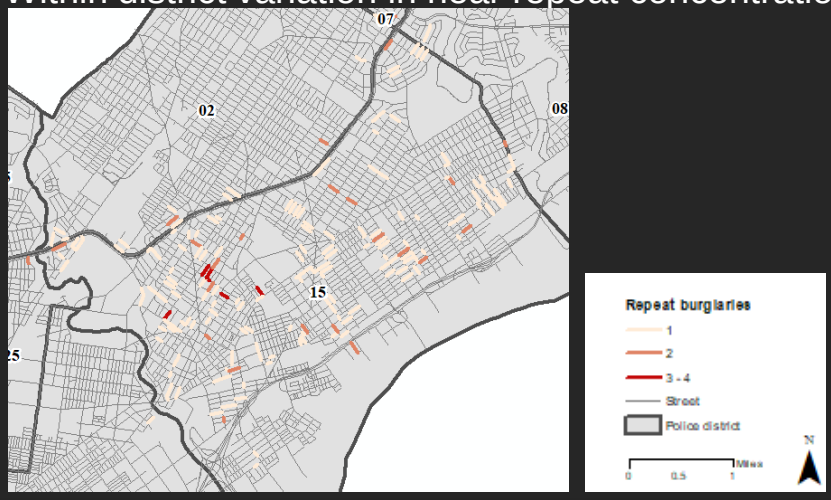
Part 2: Geographic concentration

- Within district variation in near repeat concentration



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QUESTIONS?

Take away points

- Residential burglary CPP varies by city
- CPP should be integrated into analysis process
  - Calculate crime prevention potential prior to designing intervention
  - Examine length of patterns
  - Drill down the cone of resolution to identify 'where'
- Quantify crime problem
  - Should we undertake this intervention?
  - Was the intervention successful?
- May be relevant for other crime types

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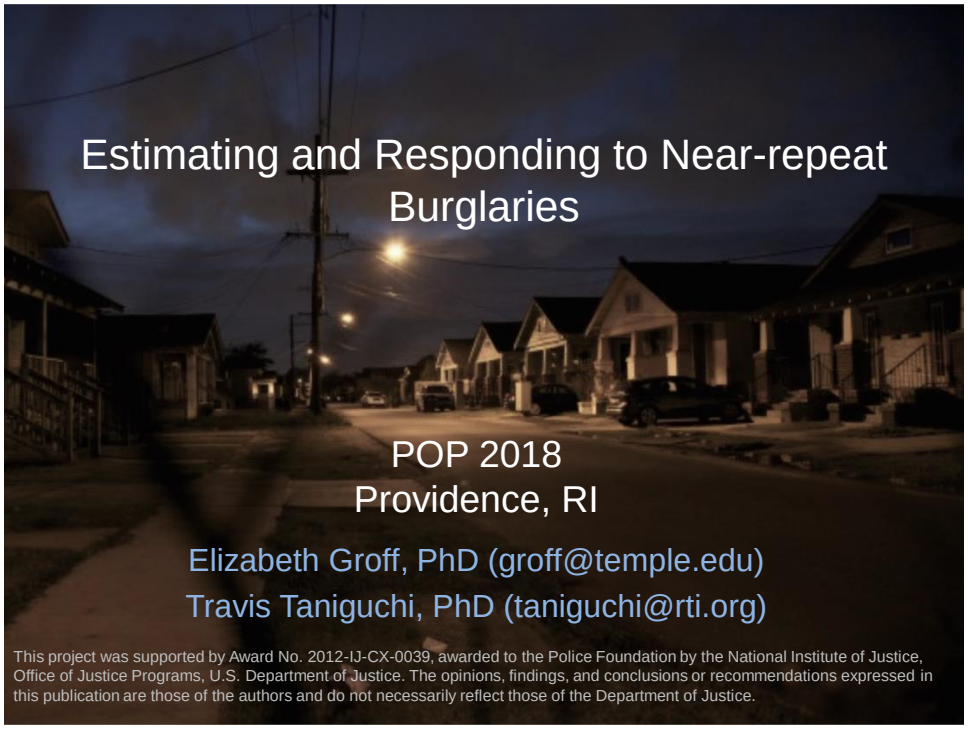

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