Improving the explanatory content of problem profiles using hypothesis testing

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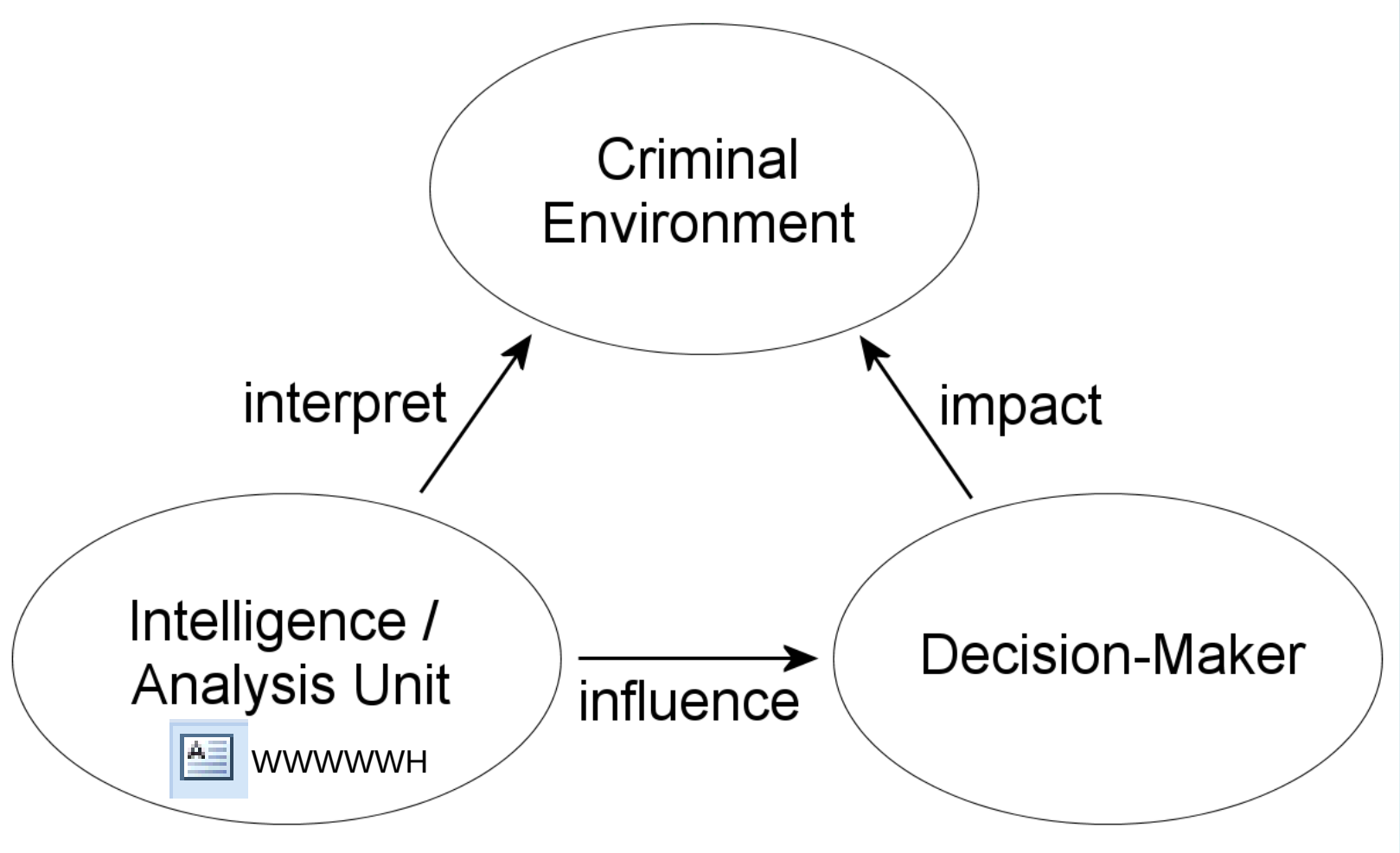
Overview

- The role of analysis
- Using hypothesis testing to move from the descriptive to the explanatory
  - Problem profile structure
  - Example:
    - Residential burglary in Oldham
- Practical considerations
- Resources

The role of analysis (Ratcliffe's 3i Model)



Incorporating hypothesis testing into analysis

- Frame direction and content of analysis using hypothesis testing

  Hypothesis:
  - A true (or false) statement that provides a plausible reason to explain the problem
  - Testing it results in coming to some conclusions
  - Identifies the data that are required and analysis to conduct
  - Retains focus on the analysis to conduct
- The key stakeholders of the problem should be the ones who come up with the hypotheses
- Focus is on examining Why
  - Using whichever WWWWH (4Ws1H) are most suitable for the hypothesis that is being tested
- Makes it easier to identify how to respond

  Good analysis = clearer understanding of the problem = easier to identify what will work

Incorporating hypothesis testing into analysis

Problem profile structure

- Overview – clearly defining the problem
  - Magnitude/scale of the problem
  - Trends (increase)
  - Define the problem quite specifically

    From: *"Violent crime is going up"*

    To: *"Assaults and ASB are going up, most noticeably in the town centre"*

  Share overview with stakeholders, getting them to propose hypotheses
- Reasons for the problem
  - Hypotheses (3-5 max)
- Analysis
  - Each section based on testing each hypothesis
- Conclusions/interpretation
  - Explaining why the problem exists
  - Recognising that the problem is made of several different, unique qualities

Example: Explaining the BDW increase in Oldham

Overview: burglary dwelling in Oldham

- Nov 2010 - February 2011
  - 18% increase (91 more burglaries)
- Increase concentrated
  - Q2 Oldham East: 65%

Figure 1. Oldham burglary dwelling trends – March 2008 – February 2011.

	Nov09-Feb10	Jul-Oct10	Nov10-Feb11	Change: Nov09 to Feb10 – same period prev year	Change: Nov09 to Feb10 - prev 4 mnths
Q1	125	142	147	↑18% 22	4% 5
Q2	71	81	134	↑89% 63	↑65% 53
Q3	71	76	90	↑27% 19	↑18% 14
Q4	81	70	89	↑10% 8	↑27% 19
Q5	86	103	80	↓7% -5	↓22% -23
Q6	58	43	66	↑14% 8	↑53% 23

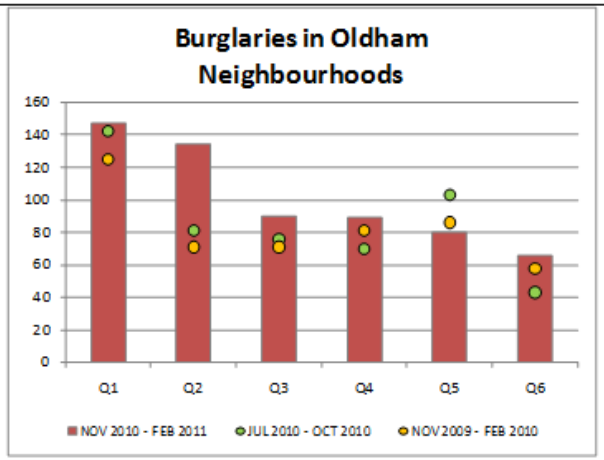


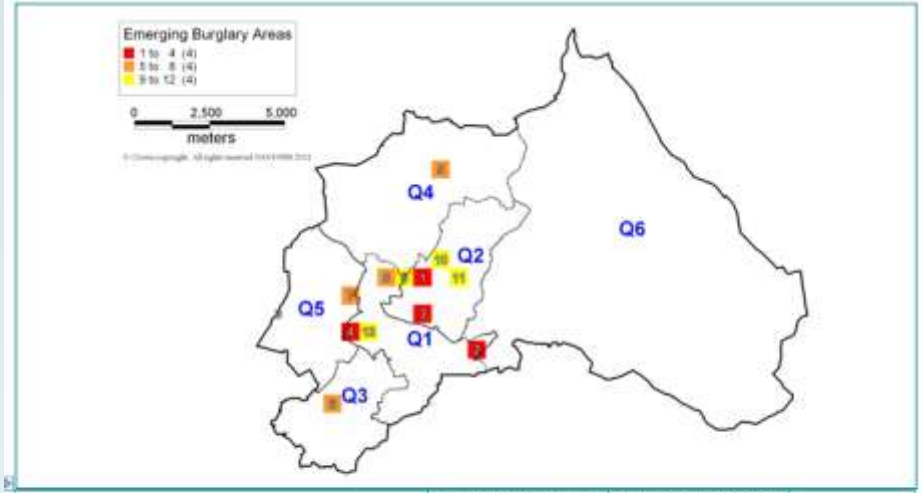
Figure 2. Burglary dwellings in Oldham for Nov 10 to Feb 11 compared to previous periods.

Example: Explaining the BDW increase in Oldham

Overview: burglary dwelling in Oldham

- Emerging problem areas
  (Using Dispersion Calculator)
  - 12 out of 462 areas (grid cells) were mainly responsible for the increase
    i.e. 18% increase in just these 12 areas

- *Why do you think there has been this increase in burglary dwelling in Oldham?*



Locality of grid cell	Burglary dwelling Jul – Oct 2010	Burglary dwelling Nov 10 – Feb 11	Increase
1. West of Shaw Road, Q2	1	14	13
2. Holts Estate, Q1	4	15	11
3. Greengate Street, Q2	0	9	9
4. West of Block Lane, Q1	4	12	8
5. Small Brook Estate, Q5	3	10	7
6. Higher Memorial Park, Q3	9	15	6
7. Middleton Road, Q1	1	7	6
8. Mitchell Street, Q1	5	11	6
9. Oldham Edge, Q1 / Q2	9	15	6
10. Around Stoneleigh Park, Q2	2	8	6
11. Littlemoor Lane, Q2	9	15	6
12. Newport Street, Q1	2	7	5
Total	**49**	**138**	**89**

Figure 4. Areas in Oldham that have contributed most to the recent burglary dwelling increase, listed in rank order of their contribution.

Example: Explaining the BDW increase in Oldham

- **Hypothesis 1 (More Offenders):** The increase in burglary is attributable to an increase in burglary offenders living in these areas as a direct result of an increase in prison releases
- **Hypothesis 2 (Less Effective Cocooning):** The increase in burglary is attributable to a decrease in the effectiveness of “cocooning” in these areas, leading to a higher level of repeat and near-repeat victimisation
- **Hypothesis 3 (Targeting Jewellery):** The increase in burglary has been driven by an increase in gold jewellery thefts, particularly in Asian neighbourhoods, as a result of an increased market for second hand jewellery in the “cash for gold” retail outlets
- **Hypothesis 4 (Darker Evenings):** The increase in burglary is attributable to an increased opportunity for burglars to offend in the early evening due to the extended hours of darkness over the winter

Example: Explaining the BDW increase in Oldham

Hypothesis 1 (More Offenders): *The increase in burglary is attributable to an increase in burglary offenders living in these areas as a direct result of an increase in prison releases*

- Comparing Nov10-Feb11 to previous 4 month period:
  - 6% increase [7 more] in the number of known BDW offenders
- No evidence to suggest increase in groups of offenders working together
  - 17% increase in lone offenders linked to BDW
  - Lone offenders accounted for over half of the BDW offences that were linked to a known offender

Example: Explaining the BDW increase in Oldham

Hypothesis 1 (More Offenders): *The increase in burglary is attributable to an increase in burglary offenders living in these areas as a direct result of an increase in prison releases*

- Prison releases
  - Increased by 52%. However:
    - Only one of these prisoner releases was linked to a BDW that was committed between Nov10-Feb11 (Spotlight Programme closely monitors prison releases)
    - Only 5 offences were linked to 4 offenders who had been released from prison between Jul-Oct 2010
  - If recent prison releases were considered to be responsible for the recent increase in BDW, it is expected that many more would have been linked to BDWs that were committed during the Nov 2010 – Feb 2011 period

Example: Explaining the BDW increase in Oldham

Hypothesis 1 (More Offenders): *The increase in burglary is attributable to an increase in burglary offenders living in these areas as a direct result of an increase in prison releases*

- Top 9 offenders linked to BDW between Nov10-Feb11, 5 were from another division
- Most prolific known offender was linked to 15 offences, 11 of which were Taken Into Consideration
- 6 of the top 9 offenders were **not** subject to PPO scheme or Spotlight programme
  - These 6 offenders are known to have committed at least 26 burglaries between Nov10-Feb11

SRN	BDW	Spotlight or PPO	Comment
600308	15	Y	11xTIC/4xCharge
2559	9	N	G Div Offender
784639	4	N	G Div Offender
347073	4	N	G Div Offender
400688	4	Y	4xCharge
301964	3	N	1xTIC/2xCharge
576780	3	N	2xCharge/1xNFA
488851	3	Y	P Div Offender
547044	3	N	A Div Offender

Figure 7. Most prolific known offenders in Oldham, Nov 10 – Feb 11, by PPO and Spotlight status.

Example: Explaining the BDW increase in Oldham

Hypothesis 1 (More Offenders): *The increase in burglary is attributable to an increase in burglary offenders living in these areas as a direct result of an increase in prison releases*

- **Oldham offenders**: 71% of BDWs committed between Nov10 -Feb11 and linked to an offender, were committed by offenders who live in Oldham
- Q1E5, Q3S5 and Q2L5 had the highest SCI values
  - In these areas, more offenders tend to offend very locally than elsewhere
  - Q3S5 and Q2L5 experienced largest increase in the number of BDW offenders known to live in these areas
- Beats covering town centre and that border neighbouring divisions had the lowest SCIs i.e. BDWs in these areas tend to be committed by offenders travelling into the area

Beat	Number of known BDW offenders Nov10-Feb11	Change in offenders: Nov10-Feb11 to Jul-Oct10	Number of BDW offenders known to live in this beat and who offended in this beat Nov10-Feb11	Number of BDW linked to an offender	**Self Containment Index**
Q1E5	8	-11% (1 less)	4	8	**50**
Q1F5	0	(Reduction of 6)	0	5	0
Q1G5	6	0%	0	3	0
Q1H5	18	20% (3 more)	7	23	30
Q2J1	2	100% (1 more)	0	0	NA
Q2J5	9	-25% (3 less)	4	12	33
Q2K5	11	57% (4 more)	2	12	17
Q2L5	17	143% (10 more)	14	34	**41**
Q3Q5	1	-50% (1 less)	0	4	0
Q3R5	2	100% (1 more)	1	8	13
Q3S5	11	175% (7 more)	6	12	**50**
Q4T5	3	50% (1 more)	0	6	0
Q4U5	1	0%	1	6	17
Q4V5	0	(Reduction of 2)	0	6	0
Q4W5	1	(Increase of 1)	0	6	0
Q5M5	1	-67% (2 less)	0	3	0
Q5N5	1	-89% (8 less)	0	5	0
Q5P5	1	-67% (2 less	0	6	0
Q6Y5	0	(Reduction of 2)	0	14	0
Q6X5	0	0%	0	2	0
Q6Z5	0	(Reduction of 2)	0	3	0
Oldham	93	-1%(1 less)	-	-	-
From outside Oldham	27	8% (2 more)	-	-	-
Unknown address	7	600% (6 more)	-	-	-

Figure 8. Change in resident offender known to have committed BDW, and the Self Containment Index.

Example: Explaining the BDW increase in Oldham

Hypothesis 1 (More Offenders): *The increase in burglary is attributable to an increase in burglary offenders living in these areas as a direct result of an increase in prison releases*

Summary and interpretation

- November 2010 to February 2011: small increase in the number of known burglary offenders, but a large increase in the number of prison releases
  - As only one of the prison releases was linked to a burglary during this period, unlikely that increase in prison releases, and increase in known offenders was solely attributable to the recent increase in BDWs in Oldham
  - However, Q2 : increases in known offenders was highest; likely that an increase in offenders played a part in the increase in BDWs
    - Supported by the SCI score for Q2L5: offenders stay local
- 6 of the 9 most prolific offenders were neither PPOs nor on Spotlight
  - Suggests some attention/updating/scrutiny of active, prolific offenders may be required

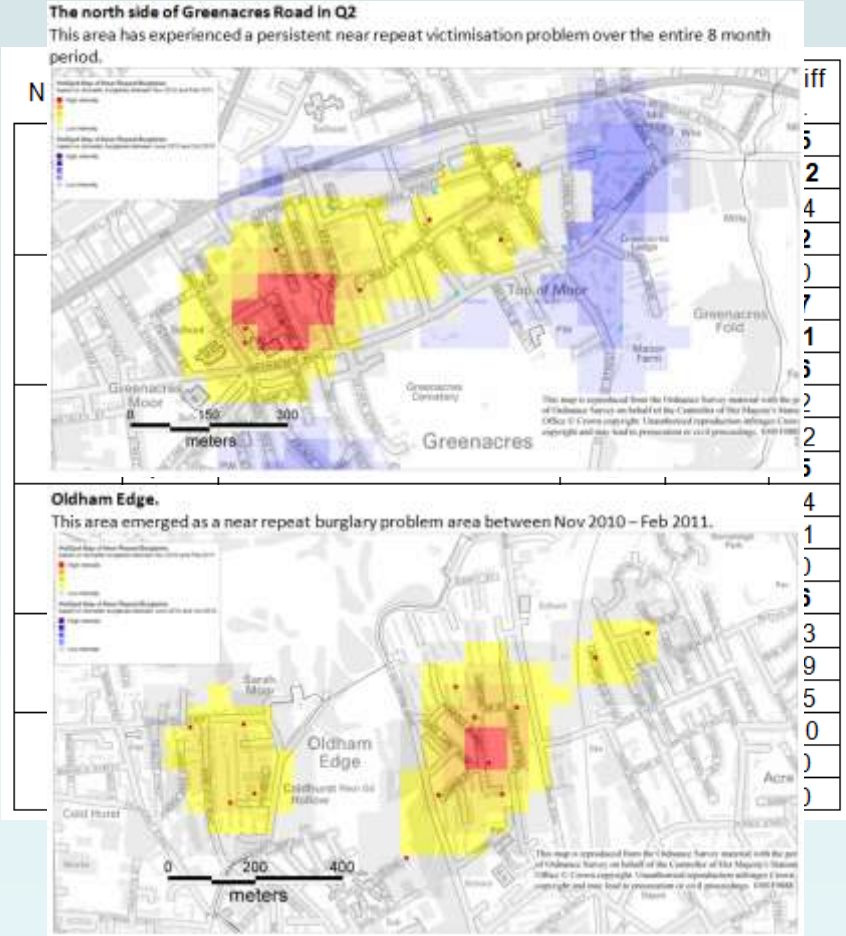
Example: Explaining the BDW increase in Oldham

Hypothesis 2 (Less effective cocooning): *The increase in burglary is attributable to a decrease in the effectiveness of "cocooning" in these areas, leading to a higher level of repeat and near-repeat victimisation*

- Repeat victimisation:
  - Jul-Oct 2010: 3.1% of BDW were repeats
  - Nov10-Feb11: 1.2%
- Near repeat victimisation:

  Jul-Oct 2010:
  - 7.2% of BDWs were near repeats
  - Evidence of near RV within 2 days, between 200 to 300m from an initial burglary

  Nov 2010-Feb 2011:
  - 9%
  - Evidence of near RV within 2 days, and within 200 metres around an initial event



Example: Explaining the BDW increase in Oldham

Hypothesis 2 (Less effective cocooning): *The increase in burglary is attributable to a decrease in the effectiveness of "cocooning" in these areas, leading to a higher level of repeat and near-repeat victimisation*

Summary and interpretation

- RV not an issue in Oldham
  - RV reduced
  - Only 1 in 100 properties burgled were subsequently burgled again
  - The active work of the Crime Reduction Team to minimise burglary repeats should continue
- Near RV levels have increased
  - Increase in heightened risk of further burglaries occurring within 200m and within 2 days
  - Increase in near RV is responsible for approximately 20% (an additional 17 offences) of the recent increase
  - If near RV was reduced to the levels experienced in July – October 2010, this could contribute towards a 4% reduction in BDWs.
- Near RV was concentrated around certain communities, most notably in Q1 and Q2 (two areas that had experienced biggest burglary increase)

Example: Explaining the BDW increase in Oldham

Hypothesis 3 (Targeting jewellery): *The increase in burglary has been driven by an increase in gold jewellery thefts, particularly in Asian neighbourhoods, as a result of an increased market for second hand jewellery in the "cash for gold" retail outlets.*

- Jul-Oct 2010: 58 burglaries where jewellery was stolen (11% of all burglaries)
- Nov 2010-Feb 2011: 81 burglaries where jewellery was stolen (13%)
- Jewellery remains popular item to steal; gold may be targeted by burglars
- Increase in burglaries where jewellery was taken accounts for 15% of the total increase in burglary
- Targeting of Asians: no evidence to support this
- No hotspots of jewellery theft

Summary and interpretation:

- Some evidence to suggest jewellery becoming more common target in burglaries, but overall increase is quite small
- No evidence to suggest any particular ethnic group or geographic area
  - Rather, areas where there has been increase in jewellery burglaries are areas which have experienced an increase in burglary generally

Example: Explaining the BDW increase in Oldham

Hypothesis 4 (Darker evenings): *The increase in burglary is attributable to an increased opportunity for burglars to offend in the early evening due to the extended hours of darkness over the winter*

Time of day 15:00 – 20:59:

- BDW increased by 98% in Nov 2010–Feb 2011 compared to the same period in Jul – Oct 2010
  - Increase is equivalent to approx 100 more burglaries
  - Equates to 18% increase in BDW seen in Oldham
- Other hours of day: remained comparable to the summer period
- Pattern has been evident in each of the previous 3 years

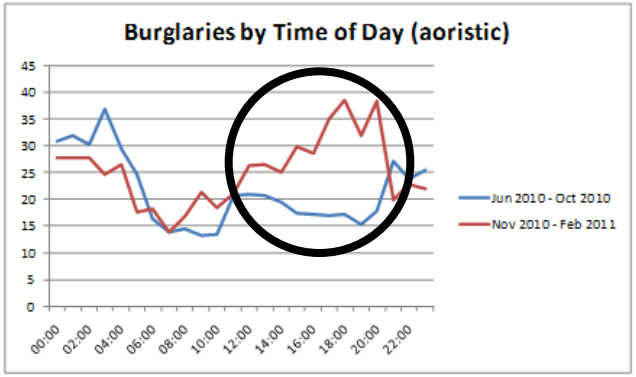
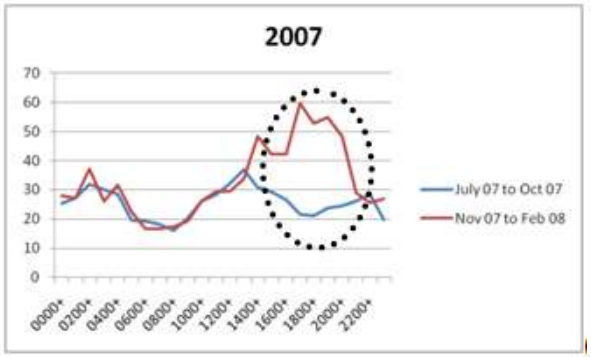
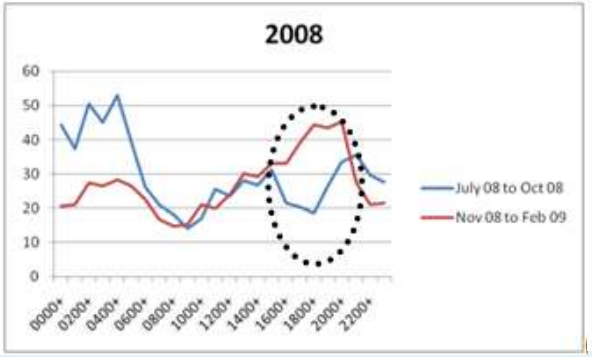
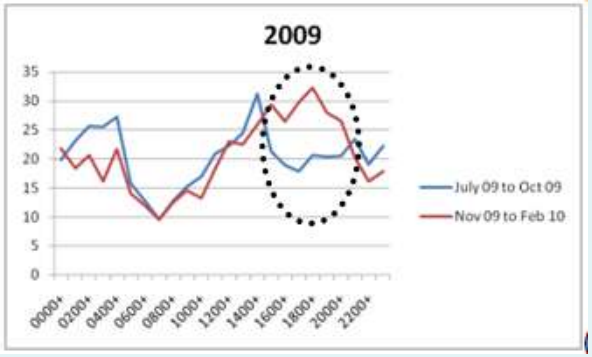


Figure 11. Time of day when buglaries were committed in Oldham, comparing Nov 2010- Feb 2011 to Jul – Oct 2010







Example: Explaining the BDW increase in Oldham

Hypothesis 4 (Darker evenings): *The increase in burglary is attributable to an increased opportunity for burglars to offend in the early evening due to the extended hours of darkness over the winter*

Summary and interpretation

- Entire increase of 18% in burglaries is equivalent to increase in burglaries between 15:00 – 21:00 during the November 2010 – February 2011 period
- Likely that offenders taking opportunity of darker evenings to commit more burglaries during the winter months i.e. effectively extending their 'hours of business'
- Pattern has repeated in each of the previous three years
  - Therefore highly likely that it will happen again this winter
- The areas affected most by increase are same areas that experienced an increase in near RV - Q1 and Q2
  - Means we can design a response that tackles both issues at the same time

Example: Explaining the BDW increase in Oldham

Conclusions

- Burglary dwelling increased by 18% between November 2010 to February 2011
  - Most of this increase can be attributed to an increase in offending during the mid-afternoon to mid-evening hours
  - Problem has persisted since at least 2007, and is highly likely to be repeated in the Winter of 2011/12
  - This pattern was most evident in Q1 and Q2
- Little evidence to suggest that the increase in burglaries was solely attributable to an increase in offenders in Oldham
  - Increase in offenders was most apparent in Q2, where offenders tend to offend locally
  - Nearly three-quarters of all burglaries committed in Oldham were committed by offenders who live in Oldham
- 6 of the 9 most prolific known burglars over the winter were neither PPOs nor on Spotlight
  - A review of the existing process for monitoring active and prolific burglary offenders would be useful to ensure that the best people for current disruption and management are identified.
- Repeat victimisation levels in Oldham are incredibly low, however levels of near RV increased
  - Increase in near RV is equivalent to 4% increase in BDWs in Oldham; highest in Q1 and Q2
- Little evidence to suggest that the price of gold jewellery and the purported greater ease in how it can be sold is behind the recent increase in burglaries

Practical considerations

- Approach does not provide all the answers!
  - Explains several of the main causes
  - Product richer in explanatory substance
- ‘Overview’ alongside local knowledge usually provides enough for stakeholders to offer reasons
  - But useful to hold meeting to discuss Overview
- Need to articulate reasons into testable, specific hypotheses
- Qualification process filters out the inplausible ...!
- Encouraging key stakeholders/decision-makers to suggest hypotheses improves commissioning
  - Actually results in some dialog!
  - And better involves them in interpretation of analysis results
- Involving number of different agencies leads to richer range of hypotheses
- Problem profile more fit for purpose
  - Easier to identify how to respond, and who is best placed to respond

Summary

- Need to move on from producing descriptive, general material, that says very little, and usually what is already known!
- Need to improve the understanding of the problem
- Hypothesis testing approach naturally leads to coming to some explanatory conclusions
  - Does not explain everything, but tests what are initially seen to be the main reasons
  - Myth busting
  - Combines well with problem solving principles
    - Identifies the specifics of problem
- Need to improve interpretation

Thankyou

Resources

- Paper due in Policing: Journal of Policy and Practice March 2012 *'Improving the explanatory content of analysis products using hypothesis testing'*
- Guidance and practice advice to be available by December 2011
- Slides on website next week

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