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Excellence in Policing

Insights from data science: Understanding demand and vulnerability

Greater Manchester Police

Crime & Well-being Big Data Centre, Manchester Metropolitan University

Structure of the session

- Overview of aims, approach and individual projects.

- Data collection and integration.

- Case studies of projects.
  - Mental Ill Health
  - Domestic Abuse
  - Missing Persons
  - Knife Crime

- Please make this session interactive...
  - Do these findings match your experience?
  - Has anyone undertaken similar work / research?

Aims

- To ensure that the 'Operational Analytics Partnership' serves to complement and enhance existing GMP demand analysis.

- To deliver research outside the capability and capacity of GMP in-house analytical services – 'Big Data' analytics.

- To improve the understanding of vulnerability (demand and response).

- To found the partnership on a co-production approach – 'better research and impactful strategic and operational products'.

Approach and Projects

- **Co-production approach**: an appreciation of GMP administrative data and existing analyses; GMP (policing and civilian) staff interviews and subject matter expert workshops providing *'expertise by experience'*; an iterative approach – from research design to the interpretation of results.

  - **Project 1: Data collection, rebuild** and **integration, enabling analysis.**

  - **Project 6: Understanding vulnerability – (demand and response)**: Mental Ill-health; Domestic Abuse; and, Missing Persons.

  - **The extent and nature of Knife Crime**

Data collection and integration (1)

- **Data collection, rebuild** and **integration, enabling analysis.**

- **Infrastructure** – ISAs, BDC secure data facility (physical / virtual), vetting of researchers / support staff.

- **Data Collection.**
  - Police - Crimes, Incidents, Incident text narrative, public protection incidents / DASH, Missing from Homes, Duty Status, Airwave / GPS.
  - Socio-economic data / Census, ACORN.
  - Spatial datasets - OS POI / topography.
  - Partner datasets - TfGM inc. mobile phone data.
  - Published datasets.
  - Data Dictionary.

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Data collection and integration (2)

- **Data Rebuild** and **Integration.**
  - Relational database(s).
  - Spatial / Temporal / Categorical referencing.
  - Integration across datasets.
  - Integration with other datasets.
  - Development of research dataset(s).

- **Research Datasets Enabling Analysis.**
  - Overarching dataset.
  - Theme specific datasets.
  - Scale of data requires data science techniques.

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Mental Ill-health (1)

- Wider Policy literature and GMP officers / staff perceive that between **20% and 40% of police time is spent** dealing with Mental Ill-health incidents.

- But, **only 2%** of incidents in GMP are flagged as Mental Ill-health.

- Developed a **novel automated text mining computational approach** to quantify and qualify mental ill-health demand utilising a six year dataset (Jan 2012 to Sept 2017 – 5.4m records) of incident logs and deployment (Airwave) data (Oct 16 to Sept 17).

- Incidents coded by researchers and police officer.

Mental Ill-health (2)

- **9-10% of all incidents** entail Mental Ill-health.

- Utilising the text mining dataset identified different spatial and temporal patterns, enhancing our understanding of vulnerability.

- Text mining of keywords identified the qualities of Mental Ill-health incidents (i.e. the types, (limited) characteristics), other agency involvement and conclusions.

- **20% of deployed resource** is associated with Mental Ill-health.

Mental Ill-health (3)

- An underestimate? Not a statutory responsibility, lack of training and back office costs.

- Systemic Failure - Approximately 1 in 5 logs identified as mental ill-health related include a closing code in the text.

- Operational implications: Changing recording practices (automated alert system), capability and partnership working.

Domestic Abuse (1)

- Domestic abuse as a proportion of all calls for service (in Greater Manchester) **has increased** between 2011 and 2017 from 6% to 8%.

- The police deploy the 'Domestic Abuse, Stalking, Harassment and Honour Based Violence (DASH)' assessment tool (27 questions) to identify risk and prioritise resource allocation. But, there is **no guidance as to how to interpret responses** to DASH questions nor **evidence of its efficacy** as a risk assessment tool.

- Developed a **machine learning and deep learning** (i.e. artificial neural networks) classification model to evaluate DASH and to identify key questions.

Domestic Abuse (2)

- 380,000 DASH assessments completed over six years.

- Data linkage – integrating PPI / DASH, Incident, Crimes data to develop a **victim and episode dataset** to understand: victim types; 'dyad' relationships; location / time and escalation of risk.

- Informed by co-production approach including stakeholder workshops.

- Responses to DASH are **not interpreted in a consistent manner** in the risk assessment process.

- Reliance upon DASH **varies by victim characteristics, location and time.**

Domestic Abuse (3)

- Not all questions are of equal importance and **key questions hold a greater influence on risk categorisation** and outcomes.

- Research raises concerns regarding the **efficacy and efficiency** of DASH.

- DASH is lengthy and there are **redundant questions leading to significant Waste / 'Costs' to GMP** (approx. 190 police officers per year).

- Operational implications: Develop refined DASH assessment for gender / family groups; shorten DASH to support faster prioritisation, linking responses to risk classification.

Missing Persons

- **Increasing demand** – of which (83%) is being driven those repeatedly missing from home (esp. under 18s).

- Most people (around 80%) are **found / turn up within 1 day** and the majority (approx. 98%) are **found safe**.

- **Particular groups have an elevated risk** (e.g., first time missing teenage girls / when patterns are out of the norm!).

- **Approx. 6% of deployed resource** – doesn't capture back office functions.

- Operational implications: Need to improve data capture / rethink risk assessment – not fit for purpose! Key issue: Risk aversion vs. reducing demand on service.

Next Steps: DASH and Missing Persons

- **Redesign assessment tools** and their **application** – to improve their effectiveness in determining risk and to deliver efficiencies through creating savings in the time required to answer them.

- To this end:
  - There is the need to revise the set of DASH questions in a more intelligent way;
  - Some DASH questions need to be pre-populated with answers;
  - Need to link the patterns of questions with outcomes;
  - Remove duplication (paper and computer); and
 - Make better use of technologies (iOPS / mobile technology) to enable this.

Knife Crime : Research Questions and Approach

- **RQ1: What is the current extent of, and longer-term extent in, knife crime?**

- **RQ2: What is the nature of knife crime and is this changing?**

- Developed a novel automated context-based text mining computational approach to quantify and qualify knife crime / officer verification.

- Approximately 1.6m crime records, spanning January 2013 to mid-December 2018.

- MO text (plus: Instruments, Means and Weapons fields) as opposed to assessment of weapon field (traditional ADR counting mechanism).

The Extent of Knife Crime in GM
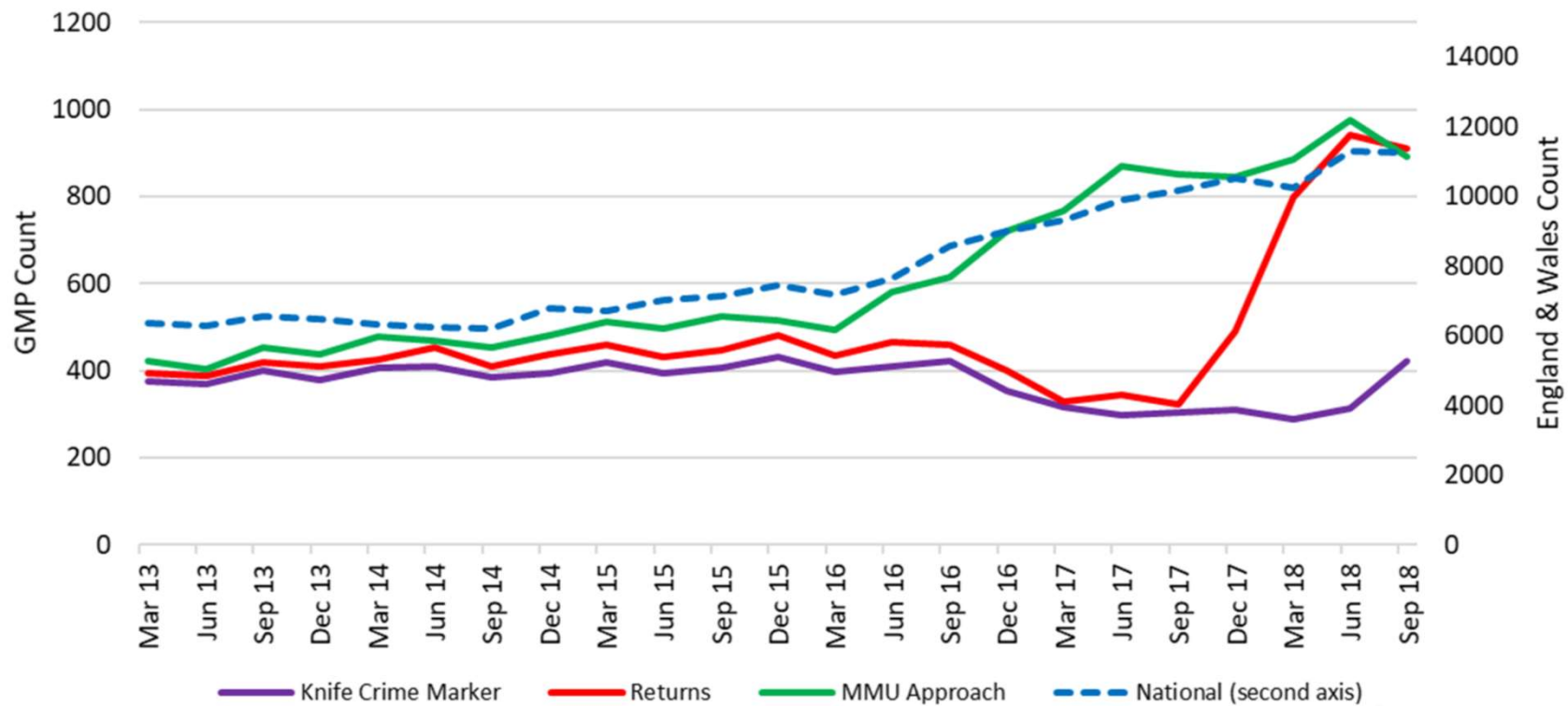
RQ1: Conclusions and Implications

- Why did knife crime reporting diverge from the national trend in 2016? (implication of mobile devices, etc. – important lessons to be learnt).

- When corrected the extent of Knife Crime in GM reflects the national trend.

- The research confirms the validity of the post December 2017 changes to GMP knife crime recording practices.

- Automated text mining algorithms can be used to back-fill GMP data on knife crime

- A context-based text mining algorithm can be deployed – going forward – to meet GMP knife crime reporting requirements.

- The efficacy of the algorithm can be improved via improved recording practices (MO text) and (potentially) via reference to incident text logs and other datasets.
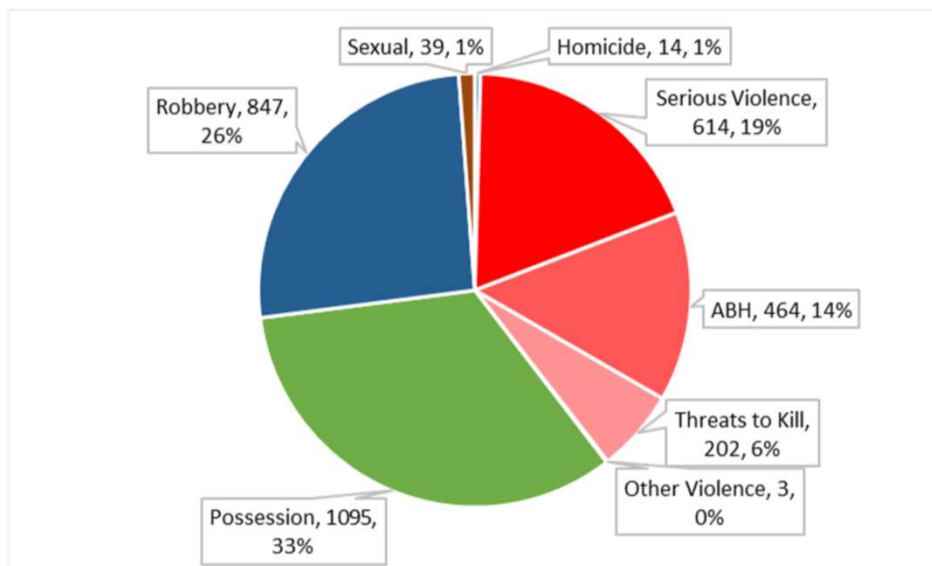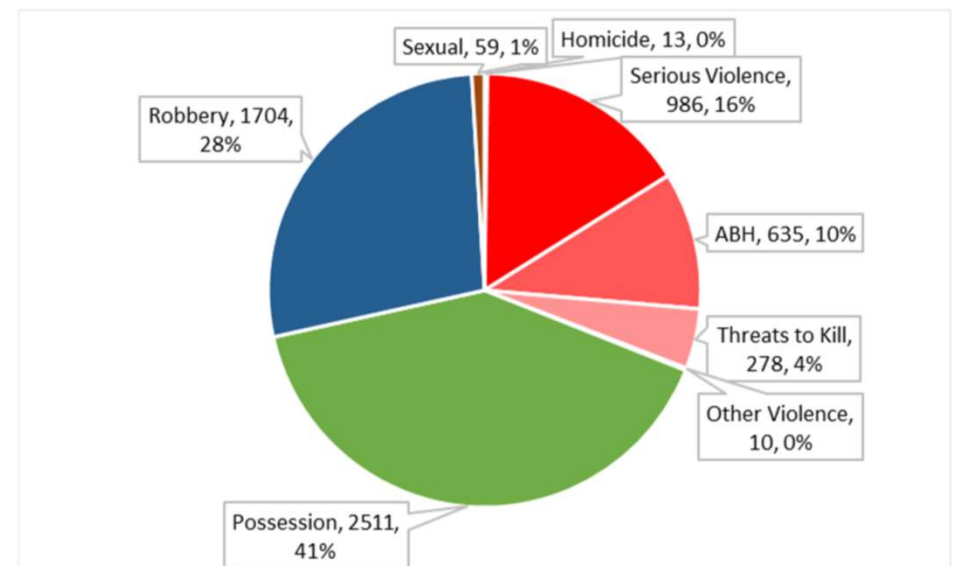
RQ2: The Nature of Knife Crime

- Offence types:
  - ADR only covers specific groups (Some Violence, Robbery & Sexual Offences).
  - To understand the extent of knife crime it is sensible to consider all offences including: Homicides and Possession offences.
  - This allows for a more nuanced investigation incorporating: Use, Threat and Possession (plus Robbery / Sexual Offences where it is more difficult to determine use / threat).

Types of Knife Crime Offences

12mths to Nov. 2015 (n=3,278)

Sexual, 39, 1%
Homicide, 14, 1%
Serious Violence, 614, 19%
Robbery, 847, 26%
ABH, 464, 14%
Threats to Kill, 202, 6%
Other Violence, 3, 0%
Possession, 1095, 33%

12mths to Nov. 2018 (n=6,196)

Sexual, 59, 1%
Homicide, 13, 0%
Serious Violence, 986, 16%
Robbery, 1704, 28%
ABH, 635, 10%
Threats to Kill, 278, 4%
Other Violence, 10, 0%
Possession, 2511, 41%

- Knife crime offences almost doubled between 2015 and 2018. However, the proportion of violence offences have fallen (40% to 30%), with a corresponding increase in the proportion of possession offences (33% to 41%).

Known Offenders

- Offenders are predominately male (88%), with the 15-19 age group accounting for 22% of offenders.

- The proportion of the 15-19 age group has increased from 20% to 25% over the last three years.

- Across GM a disproportionate proportion of young offenders (15-19) are BAME*.

- Over two thirds (67%) of offenders live in the 20% most deprived communities.

- OCG: 98% Male, 35% 15-19; 62% 10-24.

- 86% of offenders have offended on only one occasion.

Note*: Ethnicity Utilising Officer Classification on Custody Record.

Population Pyramid of all Known Offenders (all years)
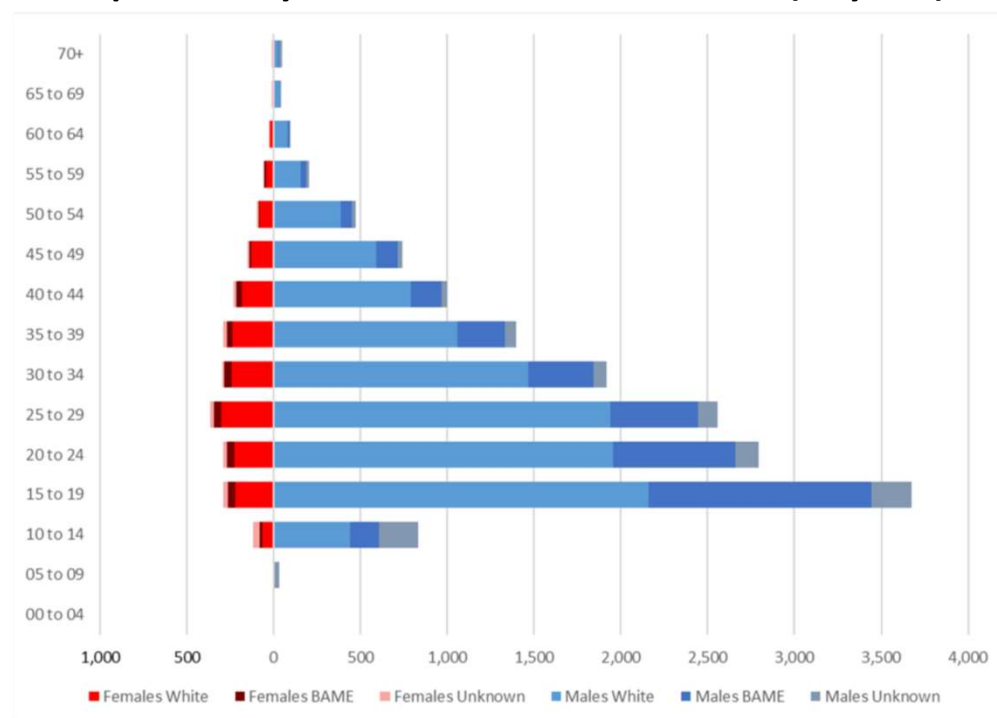
RQ2: Conclusions

- More of the same by type, however:
  - Disproportionate increases in robbery and possession offences.
  - Lower increases in violence offences.
  - Domestic abuse (at least a third of 'violence / possession / sexual related offences').
  - This is not an increase in organised crime – there is not a disproportionate increase in OCG flags – these have remained approx. 10% over time.
  - Homicide very similar over time.

- More of the same by location, however:
  - A concentration of crime in Manchester local authority (with city centre hotspots), which is also increasing faster than other LAs.
  - More crimes are taking place in open public spaces (street etc.).
  - Three-fifths of KC occurs in the most deprived areas (1/5th) – this ratio has also stayed constant over time.
  - Increases in offences at Prisons and Schools.

RQ2: Conclusions

- The severity of offences (2015 -) is not necessarily increasing.

- The count of 'Sanction outcomes' is similar over time. However the proportion of sanction outcomes is falling. This is a positive story (police budgets)?

- Age – Increases in younger age groups (esp. 15 – 19), different distributions for Possessions, Robbery and Violence.

- Ethnicity – higher proportions of BAME (especially for Robbery).

Challenges and benefits of approach

- Key Challenges
  - New ways of working (agile).
  - Capacity / joined-up nature of organisations.
  - Data and Data Quality.
  - Language / translation.
  - Knowledge mobilisation.

- Benefits (and Emergent Priorities)
  - Co-production approach has led to better research and impactful strategic and operational products.
  - Better recording and measurement.
  - Better evidence of the problem.
  - Better policing (policy and practice).
  - Making better use of data – to address priorities and partnership.

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Questions?

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Key Insights

- Location
  - Offences occurring outside in public places increased by 126% in three years. (Robbery of personal property 173% increase; Possession of weapons, 134% increase; Violence, 76% increase
  - Increases in Schools (108%) and Prisons.
  - Knife crime occurs disproportionately in the most deprived areas (41% in top decile, 60% in top quintile).
  - Hotspots concentrating in particular areas.

- Seasonal and temporal distribution varies by type.

- Overall, 10% of knife crimes are flagged as OCG. – these proportions have remained consistent over time.

- The count of 'Sanction outcomes' have remained stable over time. However the proportion of sanctioned outcomes is falling. This is a positive story (police budgets)?
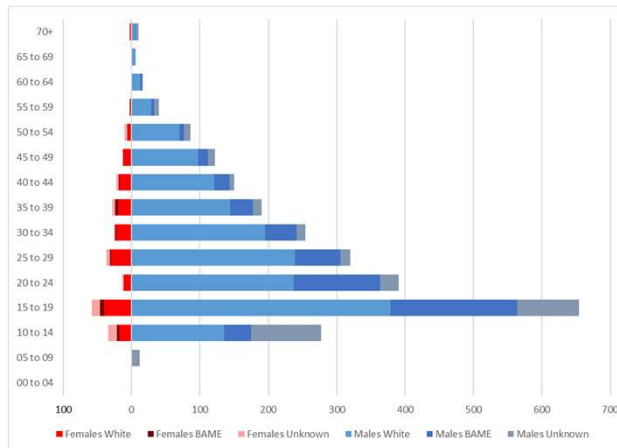
Known Offenders (2)

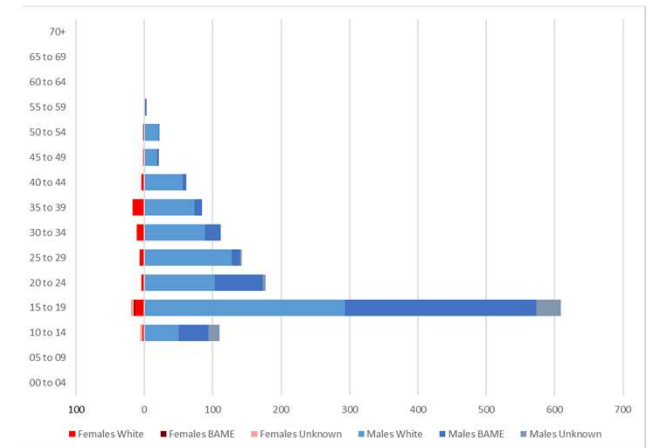- Known Offenders between Dec 16 and Nov 18 (last two years)
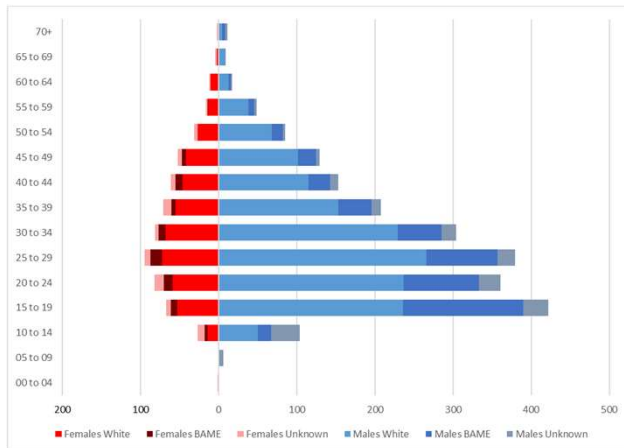
Use (Violence)

79% Male, 17% 15-19, 37% 10-24

Possession (exc. Prisons)

91% Male, 26% 15-19, 51% 10-24

Robbery

95% Male, 44% 15-19, 65% 10-24

*Ethnicity Utilising Officer Classification on Custody Record

Victims

- Victims are predominately male (74%), with the 15-19 age group accounting for 22% of victims.

- The proportion of 15-19 victims has increased from 20% to 25% over the last three years.

- 60% of victims live in the 20% most deprived communities.

Population Pyramid of all Victims