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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?



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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'.



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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.

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

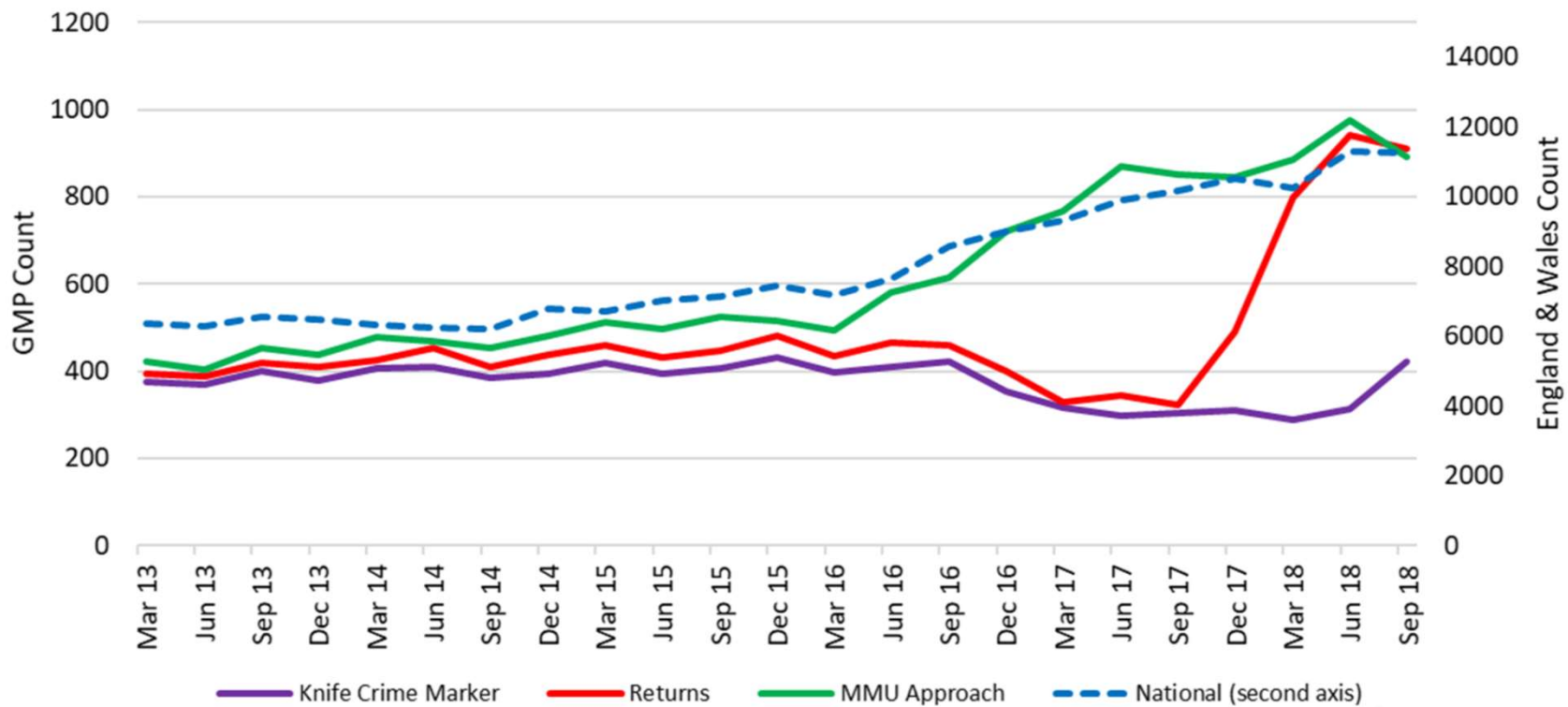
- RQ1: What is the current extent of, and longer-term extent in, knife crime?
- RQ2: What is the nature of knife crime and is this changing?
- Developed a novel automated context-based text mining computational approach to quantify and qualify knife crime / officer verification.
- Approximately 1.6m 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).



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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.



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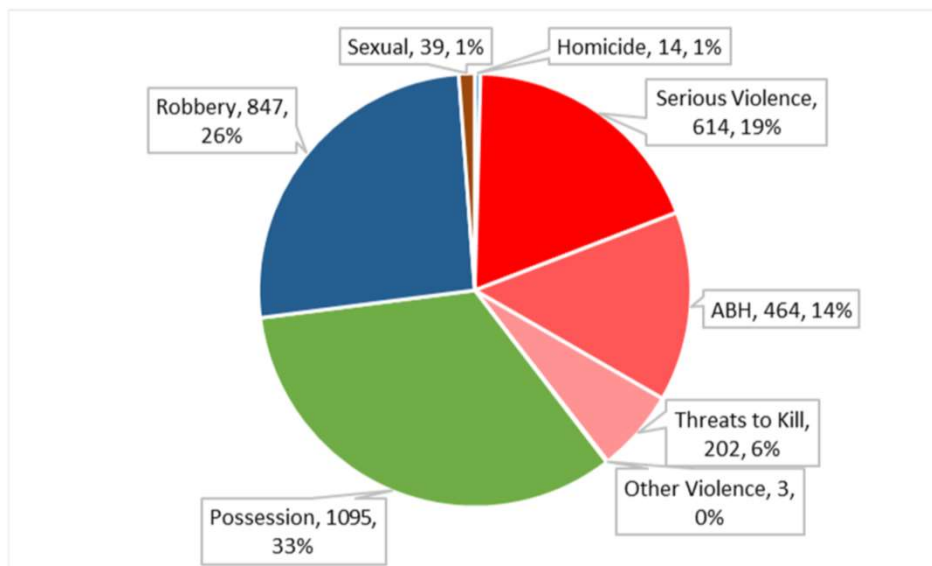


RQ2: The Nature of Knife Crime

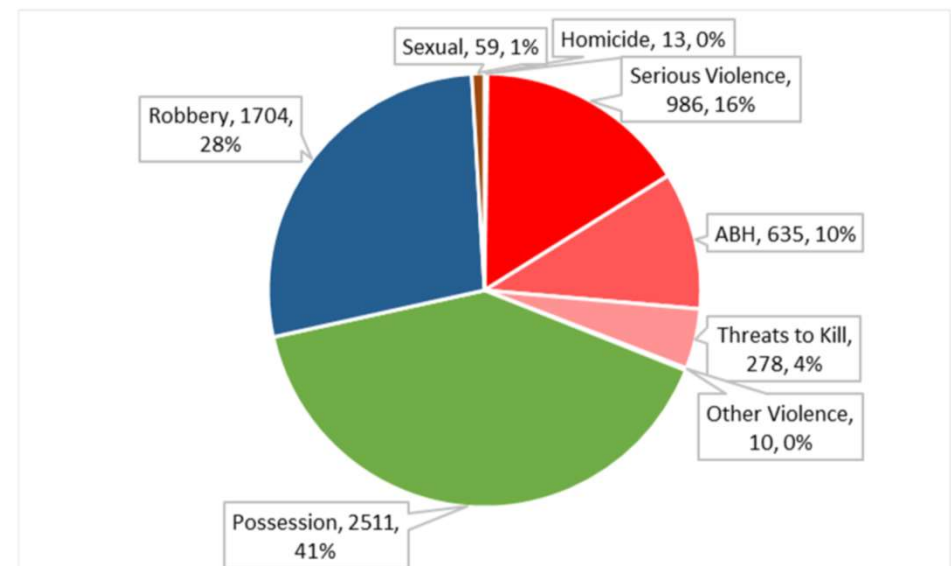
- Offence types:
 - ADR only covers specific groups (Some Violence, Robbery & Sexual Offences).
 - To understand the extent of knife crime it is sensible to consider all offences including: Homicides and Possession offences.
 - This allows for a more nuanced investigation incorporating: Use, Threat and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



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



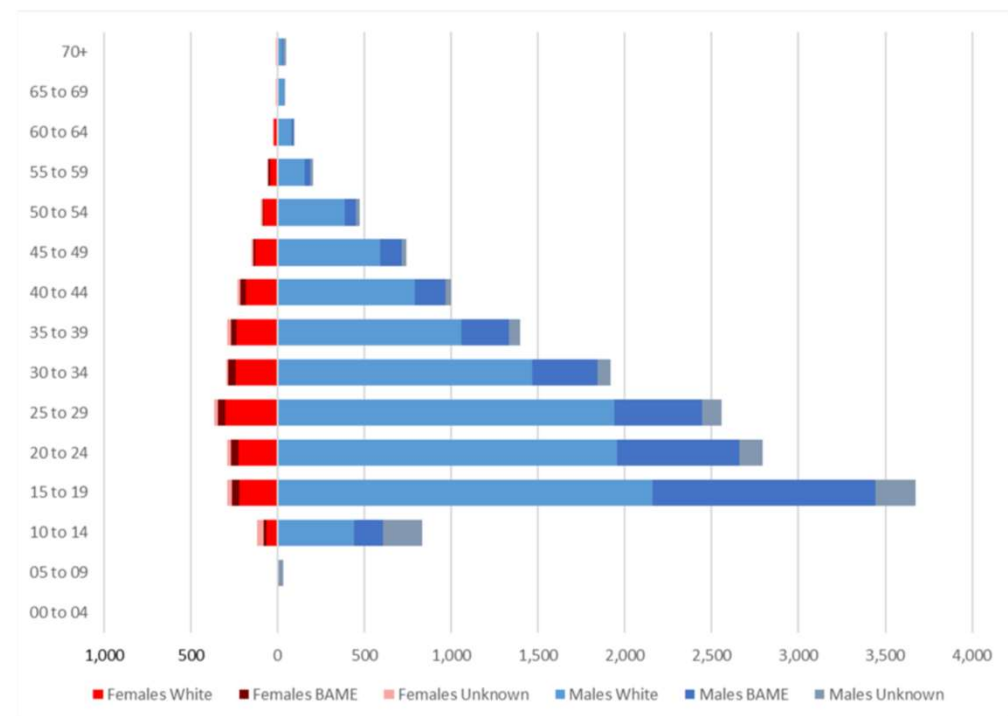
- Knife crime offences almost doubled between 2015 and 2018. However, the proportion of violence offences have fallen (40% to 30%), with a corresponding increase in the proportion of possession offences (33% to 41%).

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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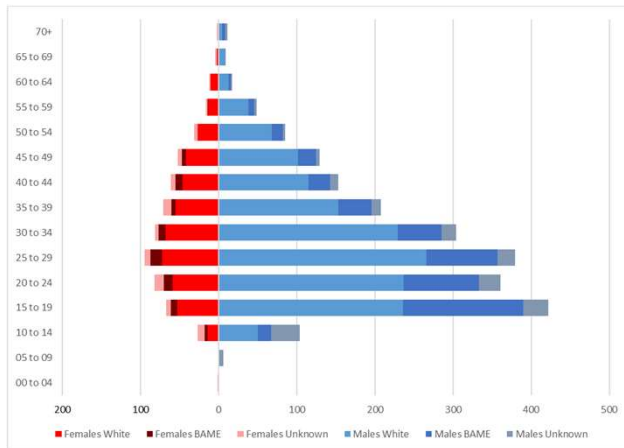


Key Insights

- 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)?

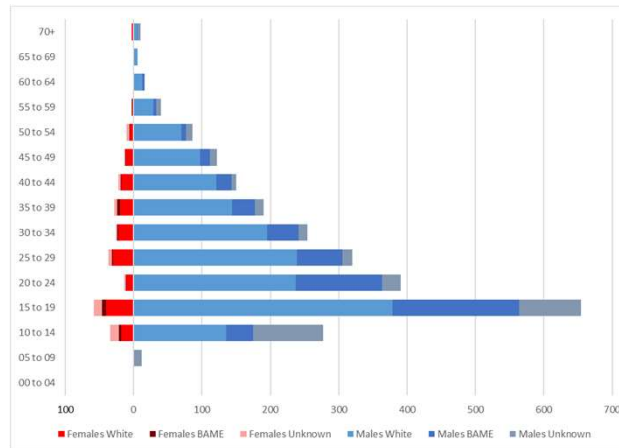
Known Offenders (2)

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



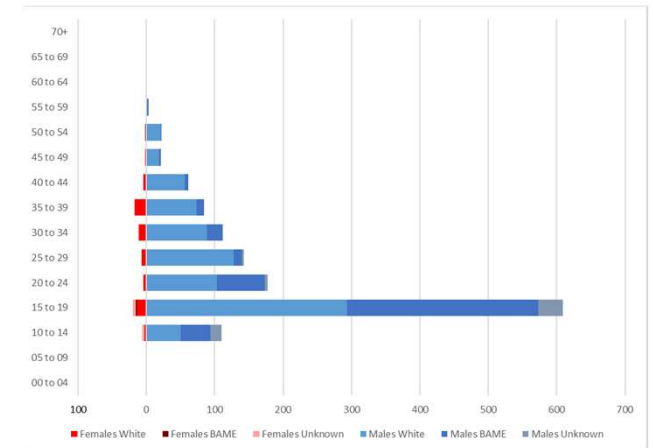
Use (Violence)

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



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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

