WMP Briefing Paper

Optimum Patrols Simulation

Ethics Committee (13 September 2023)

This project is at the proposal stage and is presented to the committee 'in principle' so that any immediate concerns can be raised.

The finer details of the methodology, exact data to be used and mode of communicating the results will not be determined until after the exploratory data analysis (EDA) phase has been undertaken.

Once the analyses have been completed the project will be presented to the Committee again so that the data used, methodology, findings, intention for deployment and communication plans can be examined in more detail.

Legal opinion has been sought and the Data Protection Impact Assessment (DPIA) is being reviewed by the Force Data Protection Officer (DPO).

Tasking

This project was requested by Inspector Kym Jones in November 2022.

The aim of the project is to optimise high visibility patrol activity in precise geographical locations across several crime types in order to support the Force priority to deliver a service that works for local people.

Purpose

The purpose of the analysis is to develop a methodology which enables West Midlands Police (WMP) to design patrol strategies based on the optimum use of police resources and focused on reducing a number of key crime types, namely Serious Youth Violence (SYV)[1], burglary, robbery and theft of motor vehicle (TOMV).

The methodology will identify how patrols may be optimised (over time and space) such that the reduction in harm / number of crimes arising from the presence of high visibility patrols is maximised.

The output will be a Business Insight (Qlik) dashboard for local intelligence analysts and policing managers. It will inform recommendations about where to deploy neighbourhood policing teams and decisions will be made through the monthly Local Tasking and Delivery Boards (LTDBs).

Context

The WMP vision is to be recognised as a police service that is big enough to cope with everything that is asked of us, while showing we are small enough to care about the things that really matter to people. One of the Force's key strategic priorities is to build a service that works for local people. To achieve this, the Force has recently changed its operating model so that policing is delivered through new Local Policing Areas (LPAs)[2]. In

[1] under age 25, non-domestic abuse

[2] There are seven LPAs co-terminus with the local authority areas.

order to provide a local, visible police service this project aims to maximise the deployment of local resources by aligning the activity of neighbourhood teams to the highest occurring locations and times of four key offence types. This project does not affect those resources allocated to respond to emergency calls and is not designed to be used as a live-time resource allocation tool.

Currently, intelligence analysts make recommendations to LPAs about which crime types to focus on in the next four-week period. They use historic information to suggest the likely locations and times when offending may occur, so that patrol plans can be developed. *Figure 1* is an example of the hot spots and timings for specific crime types in a 30-day period which would need to be considered at LTDB when resourcing decisions are made.

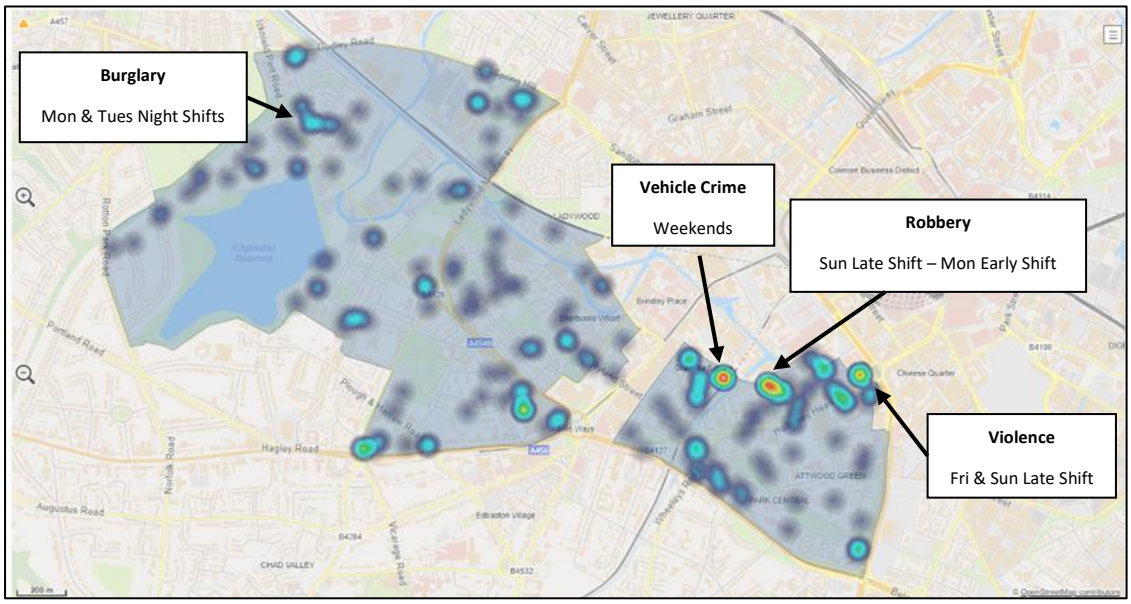

Figure 1: Example crime map for a 30-day period in Ladywood Neighbourhood *(data for illustration purposes only)*

Th Data Analytics Lab (DAL) has developed robust statistical methodologies which can now be used to enhance the information available to intelligence analysts and decision makers:

- Since April 2022, the DAL has been providing a forecast of the likely locations for knife crime (where used causing injury) for the next four-week period. During the beta testing phase the weighted average prediction error (WAPE) for knife crime has averaged 18% lower than the traditional hotspot approach available to intelligence analysts. The model places greater emphasis on reducing the probability of deployment to areas where a crime is less likely. The methodology used to develop this predictive tool has been presented to the Committee for scrutiny on a number of occasions.[3]
- The Crime Seasonality Planner includes a time series forecast for most crime types for each LPA. The methodology was presented to the Committee in July 2022.[4]
- Between October 2022 and April 2023, the DAL and Guardian Team undertook a randomised control trial (RCT) to evaluate the effectiveness of high visibility police patrols on levels of violent crime in identified hot spots. The analysis of the impact of the RCT on levels of violent crime is submitted to the Committee in this September meeting.

This Optimum Patrols Simulation project is intended to synthesise these developments in order to strengthen the analysis that can be provided to the LPAs as they make decisions about when and where to deploy their neighbourhood resources.

[3] See *Evaluation of the predictive tools for short term forecasting of Knife Crime (used causing injury) and Serious Violence* submitted to Committee in February 2023. https://www.westmidlands-pcc.gov.uk/ethics-committee/ethics-committee-reports-and-minutes/

[4] See *Crime Seasonality Planner* submitted to the Committee in July 2022. https://www.westmidlands-pcc.gov.uk/ethics-committee/ethics-committee-reports-and-minutes/

Intended activity resulting from the project

The intention is that local intelligence analysts and policing managers would have a tool which would assist in making resourcing decisions.

This is not designed to be a 'live time' resourcing tool, but one which would feed into the monthly tasking processes in the same way as the Knife Crime predictive tool has been used.

It would not be used to make decisions about deploying officers whose role it is to respond to emergencies, but is intended to develop patrol plans for neighbourhood resources whose role is to engage with local communities and to be visible in the right places, at the right times to prevent crime occurring.

The information would be used in conjunction with other information sources such as the current intelligence picture, information from offender managers and from local partners.

It is anticipated that the hot spots will be refreshed on a monthly basis, with the patrol simulation being refreshed weekly – but this will be assessed as the project develops.

Ethical Considerations

The tool would be tested against existing tasking processes and evaluated for its effectiveness in reducing opportunities for offending.

The performance of the results, both in terms of crime levels and staffing would be monitored.

The activity undertaken by officers would be the usual neighbourhood policing activities – the tool is not designed to determine what the policing activity should be, but to ensure that officers are more likely to be patrolling in the right place and at the right time when more harmful offences are likely to occur.

Data

Data to be used:

- Crime data from Connect
- ControlWorks incident data
- Oracle Fusion HR data

Level of analysis:

☑ Individual
Individuals aggregated?
☑ Yes
☐ No
☐ Specific Area:
☐ Output Areas
☐ Super Output Areas - Lower
☐ Super Output Areas - Mid
☐ Wards
☐ Districts
☑ West Midlands
☑ Other - point data for crime to generate hot spot areas

Reliability of data:

An extensive exploratory data analysis (EDA) phase will be undertaken to examine the extent of any data quality issues.

Sample or entirety: Entirety

Type of analysis:

☐ Exploratory
☐ Explanatory
☐ Predictive
☑ Optimisation

Proposed methodology:

The following methodology is proposed:

1. Identify the hot spots for each of the crime types (SVY, burglary, robbery and TOMV) in terms of both locations and times of day. Relative harm will also be calculated for each hotspot using the Cambridge Crime Harm Index (CCHI)[5], so that a violent crime hot spot will be shown as generating more harm than a vehicle crime hot spot if the count of offences is the same
2. HR and resourcing data will be used to calculate the likely number of neighbourhood officers available to conduct these patrols on each shift.
3. Develop a simulation process capable of directing the movement of available officers to target the hot spots at the appropriate times.
4. Develop and apply a function which takes account of the likely reduction in volume of offences and the resulting harm, when a patrol has occurred.
5. Develop a mechanism to run simulations to find the optimal patrol, so that an available resource would be directed to a more 'harmful' hot spot in the first instance.

[5] https://www.crim.cam.ac.uk/research/thecambridgecrimeharmindex

Will the project eventually be automated: ☑Yes ☐ No
Means of evaluation: Feedback from users

ALGO-CARE considerations

As this project is at the proposal stage and is presented to the committee 'in principle' in order that any immediate concerns can be raised, the finer details of the methodology will not be determined until after the EDA. Once the analyses have been completed the projects will be presented to the Committee again so that findings and methodology can be examined in more detail.

Advisory	
If applicable, are the outputs from the algorithm to be used in an advisory capacity?	The output in the form of a Business Insight dashboard would be advisory and would feed into recommendations made by intelligence analysts, in conjunction with other sources of information.
Does a human officer retain decision-making discretion?	Yes, decisions about patrol plans for neighbourhood teams would be made via the LTDB process.
Lawful	
What is the policing purpose justifying the use of the algorithm (means and ends)?	The policing purpose is to assist LPA commanders to make the best use of their neighbourhood resources by ensuring they can have an impact on reducing the key crime types of SYV, burglary, robbery and TOMV.
Is the potential interference with the privacy of individuals necessary and proportionate for legitimate policing purposes?	Whilst data regarding individuals will be processed, this would be to produce aggregated data (counts of crimes over certain time periods and in various locations) as the basic unit of analysis would be crimes and their location. Similarly, information relating to officers will be processed and aggregated to predict likely deployable neighbourhood resource at any given shift on an LPA. Therefore, there would essentially be no interference with the privacy of individuals.
In what way will the tool improve the current system and is this demonstrable?	The current process is for intelligence analysts to review historic data and make suggestions for future patrol locations. Currently, there are no means of formally assessing the optimal approach to patrolling. The ability to develop such complex simulations requires the data, tools and expertise of the DAL.

Are the data processed by the algorithm lawfully obtained, processed and retained, according to a genuine necessity with a rational connection to a policing aim?	The data are from WMP systems and collected to enable their normal day-to-day operations.
Is the operation of the tool compliant with national guidance?	The analyses proposed would accord with the Government Digital Service Data Ethics Framework 2020[6]
Granularity	
Does the algorithm make suggestions at a sufficient level of detail given its purpose and the nature of the data processed?	The aim of the project is to identify crime hot spots and to align policing activity in the most efficient way. The analysis will provide information at a level which enables these hot spots and available resource to be determined.
Are data categorised to avoid broad-brush grouping and results and therefore issues of potential bias?	Using aggregated counts would best suit the aims of the project, but would not involve any other form of categorisation (other than an assessment of harm)
Do the potential benefits outweigh any data quality uncertainties or gaps?	The project will include an extensive EDA element and this should highlight areas of heightened uncertainty in the data or where particular gaps exist. Should any such issues be identified, these would be addressed as a part of the project. Given the benefits of reducing neighbourhood crimes it is not expected that any data quality issues would be of such a magnitude as to warrant not undertaking the project.
Is the provenance and quality of the data sufficiently sound?	The data will be those that are gathered during the day-to-day work of WMP and will enable analyses of the type envisioned for this project.
If applicable, how often are the data to be refreshed?	To be determined as the project is developed. Likely that the crime hot spots will be refreshed on a monthly basis and that the resourcing data will be refreshed more frequently.
If the tool takes a precautionary approach in setting trade-offs, what are the justifications for the approach taken?	Not applicable

[6] https://www.gov.uk/government/publications/data-ethics-framework

Ownership	
Who owns the algorithm and the data analysed?	WMP would own the analyses and data.
Does WMP need rights to access, use and amend the source code and data?	No
Are there any contractual or other restrictions which might limit accountability or evaluation?	No
How is the operation of the algorithm kept secure?	The analyses developed would be kept wholly within the secure WMP computing environment.
Challenge	
What are the post-implementation oversight and audit mechanisms, e.g. to identify any bias?	Feedback received from users coupled with analysis as to resource patrolling patterns would be assessed.
If the algorithm is to inform criminal justice disposals, how are individuals notified of its use?	Not applicable.
Accuracy	
Does the specification of the algorithm match the policing aim and decision policy?	The model would aim to produce information to aid decision making within WMP which would be in line with its aims and policies.
Can the accuracy of the algorithm be validated periodically?	Not applicable.
Can the percentage of false positives / negatives be justified?	Not applicable.

How was the method chosen as opposed to other available methods?	Currently the broad approach has been identified due to the nature of the business question and the data available.
What are the (potential) consequences of inaccurate forecasts?	Not applicable.
Does this represent an acceptable risk?	Not applicable.
How are the results checked for accuracy and how is historic accuracy fed back into the algorithm for the future?	Not applicable.
How would inaccurate or out-of-date data affect the result?	Generally inaccurate or out-of-date data could detrimentally decisions re: deployment, etc.
Responsible	
Would the operation of the algorithm be considered fair?	Not applicable.
Is the use of the algorithm transparent (taking account of the context of its use), accountable and placed under review?	A technical paper will be provided once the project has been developed.
Would it be considered to be used in the public interest and to be ethical?	Using neighbourhood resources effectively to contribute to the reduction of key crime types would be in the public interest.
Explainable	
Is information available about the algorithm / decision-making rules and the impact of each feature?	Such information would be produced for any model arising from this project.

Appendix 1: Glossary of Terms

WMP / Law Enforcement Terminology	
CCHI	Cambridge Crime Harm Index
DPIA	Data Protection Impact Assessment
DPO	Data Protection Officer
LPA	Local Policing Area
LTDB	Local Tasking and Delivery Boards
HR	Human Resources
SME	Subject Matter Expert
SYV	Serious Youth Violence
TOMV	Theft of Motor Vehicle
WMP	West Midlands Police

Data Science Terminology	
ALGO-CARE	All projects have used the ALGO-CARE to consider ethical implications: Advisory, Lawful, Granularity, Ownership, Challenge, Accuracy, Responsible, Explainable
EDA	Exploratory Data Analysis
WAPE	weighted average prediction error