Crime concentration in Perth CBD: a comparison of officer predicted hot spots, data derived hot spots and officer GPS patrol data

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ABSTRACT
In an applied criminology context, recent meta-analyses and randomized control trials have demonstrated the benefits of targeting police patrols at hot spots or concentrations of street level crime and disorder. This study asked a group of 79 police officers from Perth to make a prediction, based on their experience, of where hot spots of crime would occur in the near future. Officer-defined hot spots were then compared with hot spots derived from police crime data over the preceding 24 month period. Finally, officer patrol time was tracked using a GPS-enabled smart phone and overlayed against both types of hot spot. This analysis indicates that police officers should be supported with hot spot mapping tools which identify data derived micro-places with persistent issues. Analysis also reveals officers patrol both their own and data-derived hot spots regularly; however, they only stay for a matter of a few minutes. These short stays are contrary to best evidence, which dictates officer patrols in hot spots should last for approximately 15 minutes in order to create both initial and residual deterrence.

1. Introduction
There now exists a compelling and ever-growing body of literature which supports hot spots policing as an effective strategy for preventing crimes and citizen calls for service. However, less is known about the differences in officer perceptions of hot spots, formed as a result of their experience in policing an area, compared with those hot spots identified thorough geo-spatial analysis. It is fair to say that officers generally focus on short-term crime problem places, identified over the course of a few months or even hours. This level of targeting is necessary to provide communities with visibility and reassurance and is the reality of reactive policing. This paper looks at a policing area which, at the time, did not routinely map or provide information to officers on micro hot spots of crime, defined as a place where officers can see the public and the public can see the police. This provided a unique opportunity to examine officer perceptions, using their professional judgement, of hot spots in Perth.
and compare these with data-derived hot spots. In a similar study conducted in Belfast, Northern Ireland\(^4\) researchers concluded that data analysis was as good as, if not better than, professional judgement in predicting where hot spots occur, and as a result where patrol effort is focused.

This research asked some key questions about crime in Perth Central Business District (CBD) with the aim of informing future police strategy around the use of available patrol time. This started with answering the question, ‘is there a concentration of crime in places in Perth?’ and moves logically through a description of officer-identified hot spots, how they compare with data-derived hot spots, and how much frequency and duration of patrol actually occurred in both types of hot spot and area. Finally, we comment on possible policy implications and limitations to this analysis.

2. Methodology

In March 2018, 79 officers were provided with two A1 maps of Perth CBD to draw on. First, they were asked to consider public generated crimes and calls for service, which we defined as street level crime (SLC - acquisitive crimes such as; burglary, robbery, theft, theft from and of motor vehicles, damage, disorder, arson, etc.) and, without any further parameters or instruction, asked to draw freehand where these crimes occurred. These areas tended to be large and were later defined as hot areas. Second, officers were given a definition of a micro hot spot (see above) and provided a small circular template representing 100 m in diameter. Officers were asked to draw where, in their experience, SLC concentrated. There was no upper or lower limit to the number of hot areas or hot spots officers could draw. Map images were then imported into a geographic information system (GIS) and georeferenced. The officer hotspots were digitized in the GIS, resulting in digital polygon files (ESRI shapefiles). It was then mathematically possible to determine overlaps between sets of hot areas (polygons), or the hotspots drawn by different officers.

Half of the officers involved in drawing maps were attached to dedicated bicycle patrol teams, and were all provided with a personal issue smart phone, with a GPS tracking app enabled. The other officers used a pool of ten police vehicles to patrol Perth. These vehicles were all issued with a dedicated smart phone in the same way as bike officers. Phones were issued for a ten-week period between March and May 2018, directly after officers were asked for their hot area and hot spot predictions.

Between July 2015 and May 2018, there were approximately 100,000 crimes defined as SLC, characterized as high volume, visible or public actions that might reasonably be deterred by overt police patrols. All offences generated directly by police activity (‘detected’ offences such as drug possession, breaches of legal orders, and offences against police officers) were classified as non-street level offences. Hot spots were derived from the crime data using a range of techniques, including Kernel Density Estimation (using an 8 km × 6 km area divided into 75 m × 75 m grid squares), Spatial and Temporal Analysis of Crime (STAC) ellipses, and the Getis-Ord Gi* algorithm. This analysis was used to identify both hot areas and hot spots where crime has concentrated during this three-year period in Perth CBD.
3. Results

3.1. Crime concentration

We can conclude, from our analysis, that Perth does indeed have a concentration of crime in places. Using the 75 m × 75 m grid square method, overlaying our study area, and the smoothed/gi* statistic, we can report that 1.8% of cells contain 40% of crime (99% C.I), 2.4% of cells contain 45% of crime (95% C.I) and 2.9% of cells contain 48% of crime (90% C.I). This new evidence of crime concentration in Perth conforms to Weisburd’s law of concentration of crime in places and the bandwidths seen in American cities.

3.2. Officer agreement on crime concentration

Analysis of digitized and overlayed officer hand-drawn hot areas revealed some variance in agreement between officers on where crime was concentrated. More than two-thirds of officers had a 30–40% agreement rate in identification of hot areas. There were only five officers with an agreement rate more than 39% and three officers with an agreement rate of less than 15%. Although this might seem surprising, each officer has developed his or her own perception of areas in Perth, based on a range of different incidents they have attended. Put simply, it might be that we remember the pain of those incidents and recall these with relative ease – even if they have not occurred in a place that has been a persistent issue over a longer period of time.

3.3. Officer predicted versus data derived crime concentration comparison

Initial analysis of the data revealed there were four hot areas with a radius of 200 m, and nine hot spots with a radius of 50 m. These were identified using STAC – developed by the Illinois Criminal Justice Information Authority – and compared with grids created by gi* statistic (using only the 99% confidence level). Officers’ digitized maps were then plotted over gi* grid areas to compare the degree of similarity between data derived and user derived hotspots. We can conclude that officer’s agreement rate in identifying hot areas was just 15%, this fell dramatically when comparing hot spots, to only 4%.

3.4. Percentage of officer time spent in hot areas and hot spots

Using 1.7 million GPS pings created by tracking officers during the ten-week period between March and May 2018, we were able to measure the percentage of officer time spent out of the station, inside their own or their colleagues identified hot areas or hot spots. Officers spend roughly the same percentage of patrol time in their own and their colleague’s hot areas. However, officers’ favour spending more time in their own identified hot spots than they do in their colleagues identified hot spots. In addition, while officers entered these locations quite frequently, they did not linger in them. The average visit to a hot spot location lasted less than 2 minutes, despite evidence that longer stays produce optimal crime reductions.
3.5. Limitations

As with any exercise in tracking using technology, there was a disparity in the number of GPS pings created by each officer. Some of this is explainable with tasking and abstractions of officers during the ten-week tracking phase. However, it was also clear that there were officers who were reluctant to be tracked and also issues with phone battery life and GPS settings. There was a daily feedback ritual during the tracking phase, but despite these daily corrections many officers continued to have inconsistent levels of GPS pings.

4. Conclusions

We can say, for the first time, that Perth has places within its CBD that have their own criminal careers, places where the levels of crime have remained stable across a period of 2–3 years. These areas account for approximately half of all street level crimes and provide a starting point for a targeted patrol strategy to be implemented to prevent crimes in these hot spots and hot areas. This analysis also demonstrates that officers’ perception of where these hot spots and hot areas occur are influenced by their own experiences of policing Perth. In order to support officer decision making and consistency in where officers patrol, and for how long, we recommend that a hot spot mapping tool is developed to enhance already existing briefing products so there is also a focus on preventing crime in longer term problem areas. In addition to this, officers are already patrolling hot spots of SLC in Perth, but for nowhere near the length of time required to create initial and residual deterrence. We also recommend that officer patrols be tracked, and the information fed back to frontline supervisors to ensure the optimal amount of visible patrol time is conducted.

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