Unlocking data to inform public health policy and practice
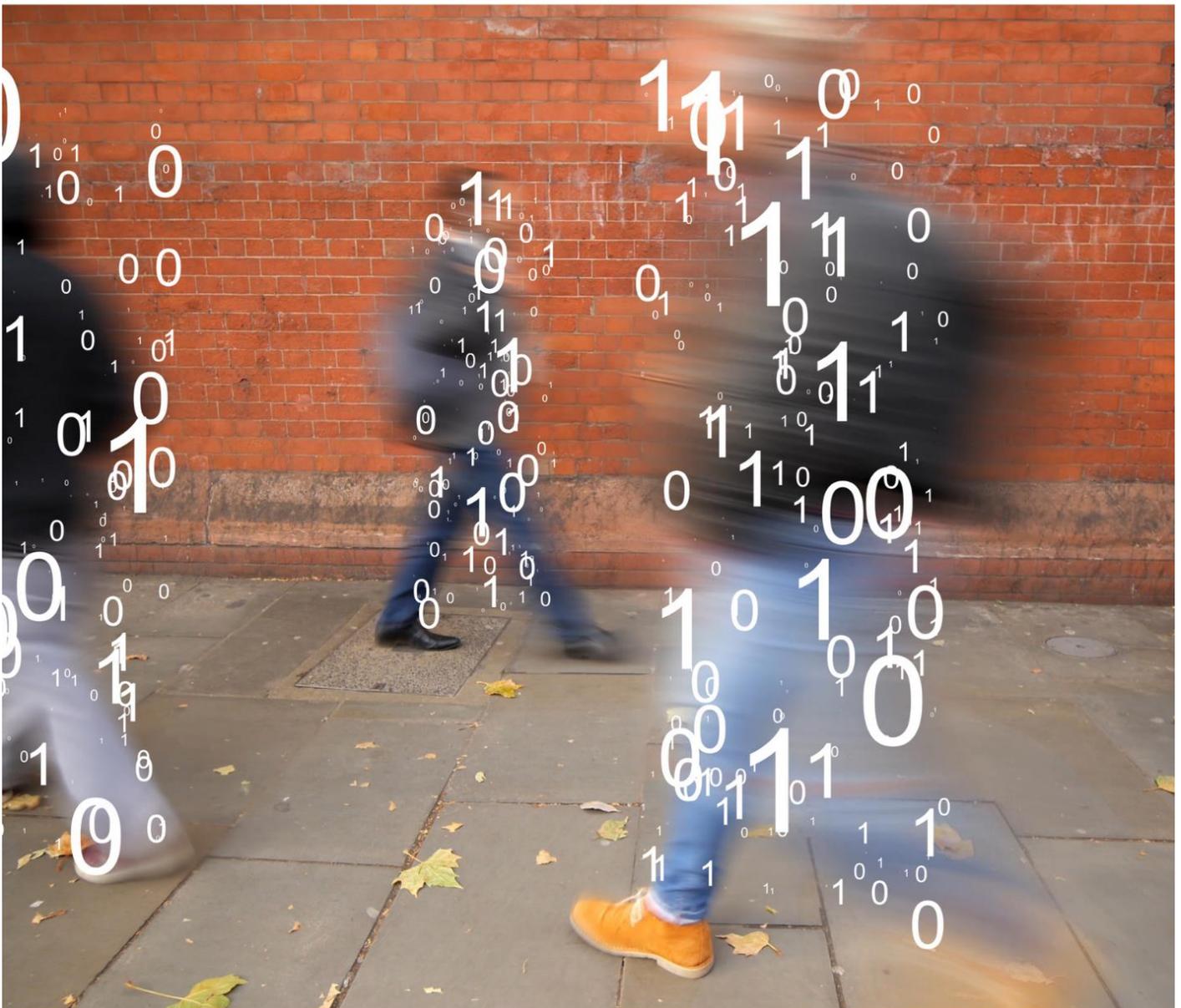
REPORT

Project title: Unlocking data to inform public health policy and practice

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Executive Summary

Aims: To assess the feasibility of linking police data with health data from hospitals, Accident and Emergency (A&E) Departments and General Practitioners (GPs). Linking police data to healthcare data is not straightforward. Firstly, the data in police systems are often in a narrative format that contain highly sensitive and disclosive information. Although text data is rich descriptively, anonymising and analysing these data is challenging. Secondly, police services in different parts of the country use different software systems, which makes harmonising data across all different police forces and other agencies very difficult. Thirdly, linking entire police datasets with healthcare data has not been previously attempted and it is possible that the risks might appear greater than any benefits.

The overarching aim was to assess whether the benefits from linking police and healthcare data outweigh the effort required and any risks involved. The pilot therefore sought to determine, first, whether text mining could be used to code the text data fields in the Domestic Abuse, Stalking and Harassment (DASH) risk assessment on police data systems. Second, what the views and opinions were of police staff on using a single system and on sharing data with other agencies. Finally, to examine what learning was feasible from linking the DASH assessment with health data. The findings were presented at two workshops at which recommendations for next steps were discussed.

Methods and findings: Text mining methods were used to extract data from the "summary of incident" field, the name of the agency that a PPN referred to, or agencies already involved with the family. This work found that these methods would be able to correctly identify 18 agencies, and these could be coded within the IT

department of a police service, enabling textual data to be transformed into a coded format that could be subsequently anonymised and shared. This method could also be used to identify other data of interest.

Interviews with 36 individuals from the four police services in Wales, representatives of the Violence Prevention Unit and Police Liaison Unit, identified that the Niche system was the most used and was highly regarded. Interviewees felt that it would be a positive development if all forces moved to the same system. However, work is still required to ensure that there is a minimum dataset for each area as there is high variability in data quality on the systems. The main barrier prohibiting sharing data is a lack off knowledge on what was possible to share. However, this could be overcome by an unambiguous framework endorsed at a high level of what data should be shared and what data should not be shared.

The exemplar case study linked PPN data with GP and hospital data for 8,709 people. This work identified that those who had with an emergency hospital admission/A&E visit/death within 12 months of their PPN referral were those who already had a history of multiple health records such as had previous emergency hospital admissions before the first PPN visit, had prescriptions for painkillers and antibiotics from the GP in the year before the PPN visit, and the perpetrator was more likely to have a criminal history. Analysis also found that pregnant women in a household of a PPN referral were twice as likely to have a low birth weight baby (preterm or failure to grow) compared to pregnant women in households without a PPN referral (after adjusting for confounders such as mum age, mum smoker, deprivation). Younger victims (aged 0-20) are at higher risk of having an emergency A&E attendance or emergency hospital admission in the year after the PPN.

Recommendations: Workshops with a combined attendance of 100 people including; those from academia, Welsh and English police services, Welsh Government, Home Office, and the third sector concluded that future directions should focus on quick wins and build on showing the benefits of data sharing. There needs to be consultation with the public to ensure public trust in any data sharing proposed. Future work should be undertaken to agree what information should be shared, agree standards for this data and in what format it should be collected and clarity around how data can be shared while meeting data protection regulations.

Conclusions: This work demonstrated the main barriers to sharing are not physical barriers, for example, there is support to use the same data software systems across police forces and to define a minimum dataset for data collection, it is possible to use text mining to extract data and it is possible to link data across agencies and produce findings that can be used to improve service (for example, including a question on previous emergency admission to hospital in the DASH questionnaire could improve identification of high risk individuals). The main barrier to sharing datasets across agencies is a lack of clarity around data governance and what is appropriate to share. Data sharing would require high level support and unambiguous guidelines as to what data can be shared and in what format.

Background (as written in the protocol)

The 1998 Crime and Disorder Act requires police, local government, and the NHS to collaborate on joint crime reduction strategies that includes data sharing to inform targeted responses. Violence has been further prioritised by HM Government in the Violent Crime Strategy [1] and the UK government has allocated funds for the formation of Violence Reduction Units [Violence Prevention Partnerships, VPU in South Wales], in 18 police forces with the explicit purpose of promoting a Whole System Multi-Agency (WSMA) approach [2]. Information sharing is vital as it has been shown that often one agency does not have the whole picture, for example 75% of those attending Emergency Departments with assault related injury are not found in police records due to fear of repercussion [3] This means there is a real move to improve collaborations with the police to promote data sharing [4] and recent research has been undertaken to examine the best way of using police data in order to benefit from the 'big data' investments and more efficient decision making [5]. This work focuses on unlocking data with a focus on police data for the prevention of domestic abuse. In this work domestic abuse is defined as any incident of controlling, coercive or threatening behaviour, violence or abuse between those aged 16 or over who are or have been intimate partners or family members, regardless

of their gender or sexuality. The abuse can encompass but is not limited to the following types of abuse: psychological, physical, sexual, financial, emotional. [6]. According to Home Office Statistics 1 in 4 women has experienced domestic abuse and 1 in 5 sexual assault during their lifetime in the UK [7]. The Crime Survey of England and Wales reported that 20% of women (3.4 million female victims) have experienced some type of sexual assault since the age of 16 [8]. The abuse often gets worse during pregnancy and this puts both the mother and the unborn child at danger and it increases the risk of potential negative foetal and mother outcome including miscarriage, infection, premature birth, and injury or death to the baby [9]. Pregnancy can trigger or increase the risk of domestic abuse [9,10] and for this reason the Antenatal Routine Enquiry into Domestic Abuse was introduced across Wales in 2005 and it is now a requirement that all women are asked about domestic abuse at a safe opportunity during their antenatal and health visiting appointments. The threat of abuse has been exacerbated substantially in the current COVID-19 pandemic situation [11,12]. World Health Organisation has called on multiple organisations including Governments and policy makers, healthcare facilities and providers, humanitarian response organizations, community members and the women who are experiencing abuse to respond to this crisis during the pandemic.

Pilot work and experience: Secure Anonymised Information Linkage (SAIL) databank is a world-leading secured data linkage, management and access system which holds a vast amount of routinely collected population level data from wide range of data providers including the National Health Service (NHS), Welsh Government, Office of National Statistics (ONS) and other social care organisations [13]. SAIL facilitates the secured linkage mechanisms across all the datasets held in the databank by assigning a unique double encrypted linkage key (Anonymous Linking Field (ALF)) to individual records [14]. SAIL has ISO27001 accreditation [15] and already hold datasets on, looked after children, children in receipt of care, maternal and child indicators, community health (e.g. health visitor, vaccination, education, higher education and training, family justice data, health (GP/hospital/A&E/intensive care) and others. Bringing data from the Police together with these datasets would enable the police and public health services to offer more evidence based [16] prevention and identify vulnerable families much earlier. However, the barriers to bringing police data with other data sources are greater than in other fields. The main barriers include:

Barrier 1 - Data type: the data collected by the police is often detailed narrative/qualitative data. This is very rich data but not in a form that can be easily anonymised or coded to extract information.

Barrier 2 - Multiple software systems: each police force has purchased different software systems for collecting the same type of data (e.g. Public Protection Notification Report (PPN) data is collected using a different system in each of the areas of Wales (e.g. Dyfed Powys have a different system from South Wales & Gwent who have collaboration using Niche). In addition, there are different datasets within each area using different software systems were not linked together. The datasets are normally developed locally between the force analytical teams and operational departments setting the parameters for data capture, this occurs as there is no nationally agreed data set to report back on to the Home Office in this area of policing. Even within each area the datasets are not linkable, for example, linking datasets holding data on PPN, Police National Computer, MARAC (Multi-agency Risk Assessment Conference) within the local area is not possible. In addition, some systems are proprietary, such as CCTV data use can require permission from the data software provider to access and decode the data. This can make data sharing even more complicated.

Barrier 3 - Security of data: The police culture around data protection is understandably developed as a result of them holding highly sensitive sets of personal data [special category data] which is subject to 'sensitive processing' requirements. The restrictions imposed by the handling of sensitive category data mean that there must be a lawful basis (under article 6 of UK GDPR) and a separate condition for processing under Article 9. As a result, there is not a general culture of sharing databases with others outside the force [17]. There is a specific practice of sharing information of individual cases within the MASH (Multiagency Safe Guarding Hub) environment as the lawfulness of sharing information in order to safeguard in child or adult protection is better understood. However, the research suggests that outside of the MASH there is little experience or knowledge of what benefits there would be if datasets were linked with other agency datasets

or the products that could be developed. Therefore, the generalised approach adopted within 'policing' towards data sharing has been formed from a perspective of being risk averse in order to maintain public confidence by not breach data protection legislation, and maintaining the integrity of personal data held by police. Although it is accepted that there are risks in sharing sensitive data held by police due to a limited in-depth knowledge of data protection legislation within operational policing there has been a reluctance to explore the tangible benefits that could be achieved within the scope of what can be lawfully shared under the legislation to enhance safeguarding for adults and children.

Study aims, objectives and research question

This work aims to pilot real world solutions and learn by doing. The work is to maximise the use of data to facilitate cross sector working including public health, police, education, social services, courts, charities and local authorities, by promoting preventive approaches through understanding the pathway people take through different agency systems by looking at the 'linked' data.

Research question 1 – Can text mining methods be used to extract and code information such as if a person was referred for a specific type of intervention e.g. Police Watch or not? Therefore, enabling rich text information to give coded flagged information which can be integrated with other data sources.

Research question 2 – What changes are required to harmonise different software systems in collecting data for the same purpose? Is it feasible for different forces to use the same single system (e.g. NICHE for PPN's enabling comparisons across forces and with other agencies) or is it possible to select data for harmonisation in a core minimum dataset? For example, in the Multi agency Safeguarding Hub (MASH) covering the Cwm Taf area they use a software product called MHUB which has been developed for each agency to add their updates to each case and all have access. However, this solution still requires each agency to add updates to the system and does not combine existing datasets. This means there is duplication of effort and only specific cases are shared, and there is room for data error in the manual transfer & input of information between the programmes.

Research question 3 – Can an exemplar case study illustrate the benefits of sharing data among agencies in a safe, secure environment with staff who are trained in data security. This work will link PPN data for households containing pregnant women, with data including the maternal and child indicator data, health data (GP/hospital – for mental health/medication), substance abuse dataset, education. This work will show how linked data can help profile families who may be at a higher risk of harm occurring in a better way for police and public health support and intervention to be targeted.

**Methods and results from each work package.**

Work package 1: Text mining police data.

This work package took the incident summary, text written by the investigating officer, from the DASH (domestic abuse, stalking and harassment) risk identification and assessment model. This field text mined to identify which agencies were mentioned (referred to or involved) in the incident and coded them. A secondary aim was to develop an automated process that extracted the agency information from the text field of the summary of the incidence field.

The methods used were: Stage 1, Pre-processing including tokenization (breaking the text into sentences and words), removing stop words, lemmatization (identifying the base form of the word, e.g. good is the base form of better) and stemming (identifying the root word, e.g. fail is the root for failure, failing, failed) ; Stage 2, Frequency analysis of word (e.g. in our dataset harm is mentioned >1000 times and arrest is mentioned >400 times and domestic is mentioned >200 times) followed by manual review, with an expert review of the words

to ensure none are missed and only relevant words are considered; Stage 3, Cooccurrence analysis to identify words that are associated together (e.g. mental & health, domestic & abuse & unit), identify word pairs that should be coded together, synonyms (e.g. domestic abuse unit and domestic violence services should be coded as the same agency), link to the data and code all the pair words (see Figure 1 for key agencies identified in the text).

Figure 1: Key agencies identified and coded in the text.
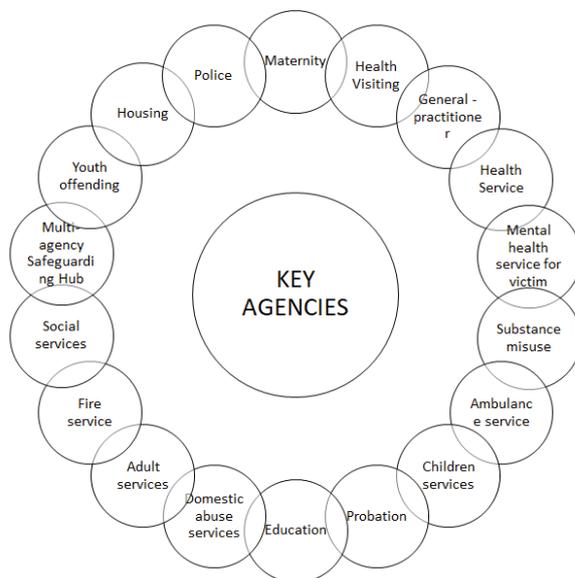
The most frequently mentioned concepts were the *domestic abuse services*, followed by *mental health services.*

The use of text mining to code text data means this information can now be easily anonymised and so shared with other agencies or linked with other data for further research. The automated methods used in text mining gave a substantial reduction in time (weeks compared to 3 months of manual reading and coding data), with the facility to refresh the data within a few hours. The text mining can also be run by analysts in police IT departments, and it can be automated and updated to fit the words and definitions used in specific departments. In summary, this work has shown it is feasible and reliable to use text mining to extract data for sharing from text fields captured in police data.

Work package 2: Interviews with police and domestic violence service providers
Semi-structured interviews were conducted with the four police service areas across Wales to determine any barriers or facilitators to sharing data within the police and other organisations.

In total, 34 interviews were conducted with 36 interviewees between 6th July and 4th November 2021. There were 29 individuals from the four police forces, for each of the four forces we interviewed; 2 Response Officers, 2 Domestic Abuse officers, 2 analysts and a Detective Inspector within Public Protection. In addition, interviews (n= 7) were also held with representatives from the Welsh Government, South Wales Police Headquarters, the Police Liaison Unit and the Violence Prevention Unit.

The method used semi-structured interviews covering 21 questions (see the appendix for the questions used). The interviews were conducted by JE using Teams video, with the exception of one that was conducted over the telephone. They were recorded and transcribed by Underline Transcription. The interviews aimed to gain the views and experiences of staff on using police data systems and data collection within their various roles and service areas.

Codebook thematic analysis was used to generate themes from open-ended questions. Thematic analysis identifies and describes patterns across data. 'Codebook' approaches use a structured coding framework to

develop and document the analysis. Analysis involved six phases: 1) data familiarisation and notes, 2) systematic data coding, 3) generating initial themes from coded and collated data, 4) developing and reviewing themes, 5) refining, defining, and naming themes, and 6) writing the report. All data were independently analysed by HJ, who then discussed the findings with JE to ensure consensus. This was to ensure that important concepts within the data were not ignored, and to achieve a richer understanding of the data through multiple perspectives.

Two key themes and seven sub-themes were developed from the qualitative data: (1) opinions on the systems used in the police for Public Protection, and (2) opinions on data sharing.

Opinions on systems used for PPN: Different forces use different systems and this was *"not ideal"*. However, there was high regard for Niche, "*it is user friendly*" *"a very good intelligence tool".* However, even when different forces used the same system (Niche) they used it differently, "*the level of detail that people put in varies widely". "I like the fact that anything and everything is all recorded in the one database. I don't like the fact that anybody and everybody can add data to it because it's not being managed as well as I would like".* The idea of moving every force to use one system was very well supported even among those who did not currently use the Niche system "*it would be better if people used the same system, even it means changing systems to something else".* However, this would not be the complete answer as "*there is not one single instance of Niche" "I would really appreciate it if all the Niche systems could talk to each other".* So there also needs to be a standard way of using Niche as currently there are large differences in the quality of inputting of the data ``it *is only as good as the information that's imputed".*

Opinions on sharing data: the main barriers to sharing were data protection "*a sort of fear of disclosing information that you shouldn't be*" and knowing whether information can be shared "*there is a hesitancy to share for fear of getting into trouble".* A solution to this was suggested as "*I think the Welsh Government need to step in and develop a framework that applies across the public sector or anyone who deals with information and it is not ambiguous because at the moment there are too many people interpreting Data Protection Legislation in too many different ways".* It was felt that sharing should be the '*default position*" and *"high level buy in from chief officers, or chief execs, and you know you've got their support in doing so, that nervousness would be removed and that would remove the massive barrier".* It was felt that sharing was the way forward "*we aim to go down the evidence based route for lots of aspects of policing, to work better with partners, to save costs, and move resources to the right place*".

In summary, the main barriers to sharing concerned the different data management systems that did not communicate with one another well and uncertainty about what is feasible and allowable to share. However, this can be overcome with bringing in a single system among police forces (recommended Niche) and recommendations of minimum level of data that should be entered to give consistency in data quality. In addition, a top-down recommendation to share data and an unambiguous framework of what should be shared and what should not be shared would facilitate data sharing with other agencies. One participant said *"move to a solution based focus, make it far more simple, because from a policing perspective, we've got the 1998 crime and disorder act, which says, if you're looking to prevent crime and disorder taking place, you've got every right to share information*"

Work package 3: Exemplar case study linking PPN data with GP & hospital data and linkage of data.

Data was linked to examine predictors of attendance at A&E or an emergency hospital admission or death in the 12 months after a PPN visit by the police between 2015 and 2020.

Result: Among the 8,709 participants who had a PPN visit, 3,544 (40.7%) had an A&E admission, 1,182 (13.6%) had an emergency hospital admission and 48 (0.6%) died within 12 months following the PPN. The most important factors determining a higher rate of subsequent emergency medical admission include the number of emergency admissions in the three years before the PPN (e.g. previous emergency admission and higher number of admission give higher risk of subsequent admission after the PPN), subsequent PPN visit (the higher number of additional PPN visits the higher the risk of an emergency admission or death), younger age (e.g aged 0-20 years with age 30-70 years lowest risk), a previous criminal history of the perpetrator, incident referred to MARAC, and victim has a prior history (in the last year) in their GP records of prescriptions for antidepressants, pain killers and antibiotics. For example, 66% of those with one or more previous emergency admissions and two or more PPN visits have an emergency admission or death within the year. This compares to 13% of those who did not have a previous PPN visit, no future PPNs and perpetrator has no recorded criminal history. Factors that were predictive using just data available in the DASH tool included; multiple PPNs (40% higher risk), injury at the scene (40% higher risk), pregnant women (30% higher risk), risk assessment high (30% higher risk). Factors (using only data in the DASH tool) that were associated with a lower risk of an emergency admission were the conflict was over a child, the victim is a mother and the victim threated suicide.

This work also looked at factors associated with low birth weight infants (e.g. preterm or failure to grow), in this dataset, of women who did not have a PPN, 8% had a low birth weight baby, of women who had 2 or more PPNs, 21.2% had a low birth weight baby. Adjusting for maternal age, maternal smoking, deprivation, mum alcohol consumption, pregnancy interval and other confounding factors, a PPN visit is associated with a 2x higher risk of a low birth weight baby if there is a pregnant women in the house.

In summary, this work suggests that the people who end up with an emergency admission in the year after a PPN are people with multiple records in different agency datasets (e.g. have had a previous emergency admission, have multiple visits by the police, visit their GP for painkillers/antibiotics). If a child is involved the outcome appears better for the mother (perhaps due to more support), pregnant women and their infant are at higher risk of a poor outcome (low birth weight baby and emergency admission of mother), younger people are at higher risk (e.g. those aged 0-20) of an emergency admission. If previous hospital admission was included in the DASH assessment it might identify at risk people.

Workshop of learning and recommendations for the future

Two workshops were held, one face to face and one online. The combined attendance at these workshops totalled 100, including attendees from all four police forces in Wales, police forces from Wales and England (e.g. Manchester, Derbyshire, Humberside, etc.) the Home Office, researchers working in crime, patient and public representatives, members of charities such as NSPCC, Barnardos and representatives from Welsh Government.

The workshop presented findings and then ran consultation groups, the groups were asked to write down their recommendations, views and thoughts of future directions of this work. The comments were analysed using qualitative analysis to link each quote to a theme. Themes identified included; 1. Suggestions of where linkage should be used, 2. Recommendations to facilitate linkage in the future 3. Problems identified with doing linkage going forward.

In terms of suggestions where linkage should be used there were many ideas for individual questions, for example, it was felt one direction for the future should be sharing information regarding hotspots (e.g. violent crime data from A&E being plotted on maps to share with police (What is the Cardiff Violence Prevention Model? |Violence Prevention|Injury Center|CDC) which are currently invisible to the police. Data should be used to understand what happens after the police have issued a PPN, "*can we follow up those referred e.g. to mental health services, do they access the service, does it help?*", and to understand the background to the victims and offenders and the family unit, so a more trauma informed approach can be taken. In addition,

sharing to see how different agencies record the same situation "[in] *most cases of mental health, police and paramedics turn up on scene [it would be] interesting to compare what is recorded by paramedics and police at the scene"*

The potential of text mining to unlock '*masses of text data"* was greatly supported, for example to flag when words associated with the 8 stages of homicide (e.g. jealous controlling behaviour) are mentioned in cases, for further review. In addition, it was felt that future work should focus on "*police and mental health services to work more collaboratively".*

In terms of recommendations to facilitate linkage it was suggested to link in with the MoJ Data First Programme (Ministry of Justice: Data First - GOV.UK (www.gov.uk)). It was suggested that the "*Association of Police Officers Cymru used to have a lead for data, so if that lead still exists, it would be good to use them to get high level ACPO Cymru support for linking data for all 4 forces to SAIL*". It was suggested that future work should focus on "*giving examples of how data sharing can improve costs. Saving to public purse/saving lives".* It was felt that consultation with the public is needed to ensure public trust in the sharing and that next steps should include working with those who have lived experience of domestic violence, substance abuse and police involvement and to obtain the population view on data sharing. It was felt that the findings and recommendations need to be presented at executive level to sell the potential and possibilities of scaling up the capability to Welsh Government, Local authority, Police and Crime Commissioners, Public Service Boards. It was felt that there should be some standardisation and harmonisation in how core data is collected such as ethnicity so that data can be compared across agencies and there should be standardisation of what can and can't be shared. Future work should "*agree what information is to be shared, agree information standards for this data, in what format will it be collected in local IT systems, agree standards for sharing this data e.g FIHR (* Fast Healthcare Interoperability Resources).
Suggestions were that the next steps should be focused on quick wins across two or three organisations and build on that, for example focusing on the frequent service users (e.g. patterns of service contact to identify methods of effective triage).

In terms of problems with sharing, some officers felt that there was substantial sharing of data and that multi agency data is shared in MASH and at strategy meetings and that this is really a training issue that officers who were interviewed don't seem to be aware of what happens after an incident. In addition, there was a concern around previous data scandals and how they are handled and a loss of public trust. This was especially a concern that vulnerable individuals might not present to other services if they thought their data would be shared with the police but it was queried *"do we have any indication of how real this risk would be*?" There needed to be measures in place to ensure there is no misuse of data. In addition, although some felt text mining was a very good way of unlocking data others felt it came with concerns around bias of AI and sensitivity around processing and data governance. This was *"significant issues relating to confidentiality, data privacy impact assessments, lawful bias for sharing (GDPR) and information governance issues that need to be resolved*". There was a concern that data could be used for performance/compliance management by agencies. Some reported that they did not feel it was possible to combine and compare data "*I am not convinced of the benefit of this process due to the different ways in which teams process PPNs".*

In summary, it was felt the direction was either to 1. Bring all data together to a single operational data system, which is operational, dynamic, real-time and identifiable, which would be the province of the Wales Accord on the Sharing of Personal Information or 2. Create a platform where data from existing force systems is brought together in a harmonised way to onwardly share with a trusted third party, for research and evaluation.

However, either of these methods would need much more evaluation of the benefits and problems, consultation with the public/service users and exemplary case studies.

Conclusions and Recommendations:

Sharing police data for public health benefit is feasible and many of the problems originally identified as barriers can be overcome. There is strong support among those working in the police forces in Wales to move to use the same software system across all forces (e.g. Niche) and to define a minimum dataset for data collection so that variability in how data is collected is reduced. In addition, it is possible to use text mining to extract information from text fields and this can be done easily and rapidly to enable sharing of anonymised coded information. Finally, it is possible to link data across agencies and produce findings that can be used to understand predictors of adverse outcomes (e.g. emergency hospital admission, low birth weight baby) and to produce findings with linked anonymised data that can improve services e.g including a question on previous emergency admission to hospital in the DASH questionnaire, could improve identification of high risk individuals.

This study suggests that the main barrier to sharing datasets across agencies is a lack of clarity around data governance and what is appropriate to share. Data sharing would require high level support and unambiguous guidelines as to what data can be shared and in what format. If data sharing of whole datasets from the police from all Wales is to move forward, then there would need to be high level buy-in and clear guidelines as to what is expected to be shared and what should not be shared. In addition, it was recommended that the public and service users are involved in discussions of how data is shared in a publicly acceptable way.

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