Paper:
Correia, S. (2019). Responding to victimisation in a digital world: a case study of fraud and computer misuse reported in Wales. *Crime Science, 8*(1)
http://dx.doi.org/10.1186/s40163-019-0099-7

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Responding to victimisation in a digital world: a case study of fraud and computer misuse reported in Wales

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Abstract
This paper presents the early results of a study exploring computer misuse and fraud victimisation in Wales, United Kingdom (UK). The results presented here describe the quality of the data available to local forces, the characteristics and heterogeneity of the victims who report incidents and the nature of the police response at a local level. The significance of these results is considered within the enforcement and victimisation policy context that surrounds computer misuse and fraud. It is argued that while Action Fraud data provides a rich source of data with respect to victims’ needs, specific improvements in data collection and processing could aid local forces in the delivery (or facilitation) of a more victim-focused response. Alongside this, the results highlight how an adequate police response must take victim heterogeneity into account, both at national and local levels. Finally, better understandings of vulnerability (both theoretically informed and empirically tested) are necessary, on which to build an adequate victim-response to these crime types.

Keywords: Cybercrime, Fraud, Computer misuse, Policing, Victimisation, Repeat victims, Vulnerability, Online crime

Introduction
Experiences of computer misuse (CM) and fraud victimisation have increasingly occupied the public sphere. Their significance was highlighted in the United Kingdom (UK) from 2017, as these crimes integrated the yearly crime estimates produced by the Office for National Statistics (ONS). Recent estimates indicate that there were 3.25 million incidents of fraud and 1.24 million incidents of CM\(^1\) in the year ending March 2018 (ONS 2018a), increasing the grand total from 6.01 to 10.57 million estimated crimes (Ibid.). Alongside these figures stands the considerable investment government has committed to cyber security—£1.9 billion by 2021 (HM Government 2016).\(^2\) Finally, the threat and harm posed by these crime types have also attracted attention. Cases such as the 2007 cyber-attack on Estonia and the Stuxnet worm aimed at Iran stand as examples of large national infrastructure attacks. Recently, 2017 was characterised by ransom ware attacks including WannaCry, which disrupted organisations across the world, including UK hospitals. Since, data-breaches have made successive headlines, with millions of personal data records lost. However, it has been suggested that the mass media’s attention often focuses on ideal victims and perpetrators (Christie 1986) and fails to properly scrutinise ‘official’ narratives, primarily put forward by criminal justice institutions and large business victims (Jarvis et al. 2015; Levi 2006, 2008). As such, better and empirically grounded understandings of these crime types are necessary.

At the same time, the process by which victims report CM and fraud and the ways in which victim services are delivered have changed significantly in the UK. Firstly, the reporting of cybercrime and fraud has improved with the introduction of the national reporting centre, Action Fraud (AF). Its introduction mirrored the equivalent in

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\(^1\) Including computer virus and unauthorised access to personal information.

\(^2\) Up from £860 million in the previous 5-year term. To illustrate the enormity of this investment, this sum would be sufficient to give every individual in the UK over £6000 over the same period.
the USA and Canada and had been recommended by The Fraud Review (2006) and academic experts (Button et al. 2009a; Levi and Burrows 2008). Additionally, victim support services have been considerably decentralised from their previous model (Hall 2018). These services became (or reverted to) local delivery, with the addition of competitive bidding for service providers wishing to deliver those services, funded through the Office of the Police and Crime Commissioners (PCCs) (Ibid.). These changes have taken place in the context of a computer crime and fraud policing strategy which, following the counter-terrorism ‘CONTEST’ model, is divided into ‘4 Ps’: ‘Pursue’ offenders through prosecution and disruption, ‘Prepare’ to mitigate against the impact of incidents, ‘Protect’ individuals, organisations and systems against being victimised and ‘Prevent’ people from engaging in crime (City of London Police 2015b; HM Government 2013, 2018). The ‘Protect’ strand is the one that is more clearly linked to a victim-focused response. Here, discussions with stakeholders revealed a policy of local delivery supported by national resources such as the NFIB. The responsibility of ‘volume’ crime prevention (i.e. that which is not considered ‘serious organised crime’) falls to local police forces, following prioritisation by PCCs and Chief Constables (City of London Police 2015a). Third sector organisations such as Victim Support are meant to lead on addressing victim impact and reducing repeat victimisation (Draft NPFS 2015a, b). In addition, at the local level Police and Crime Reduction Plans often strategically focus ‘Protect’ activity on ‘vulnerable’ victims (e.g. Dyfed Powys PCC 2017; Gwent PCC 2017; North Wales PCC 2017; South Wales PCC 2017). Thus, this area of crime control requires the interaction of UK law enforcement agencies across three levels: the National Fraud Intelligence Bureau (NFIB) determines what is investigated, the Regional Organised Crime Units (ROCU)s support strategic delivery and large-scale investigations and the local forces investigate and deliver victim-response ‘on the ground’.

In this context, this paper seeks to critically engage with challenges of responding the computer misuse and fraud victimisation by considering three questions: (1) How can data collection be improved to best enable local forces to meet victim needs? (2) How heterogeneous are victims who report CM and fraud in Wales? And (3) How is law enforcement responding to these crimes at a local level? It does so by drawing on the early results of the quantitative element of a larger mixed-methods study, utilising a sample of crimes reported via AF, for a period of 2 years (1st of October 2014 to the 30th of September 2016), within the four Welsh police forces. In answering these questions, this paper also concludes by pointing to avenues for future research. This paper focuses on fraud and CM for two reasons. Firstly, except for some important contributions (Buchanan and Whitty 2014; Button et al. 2009b, 2014; Whitty 2015) there remains limited academic study of victimisation in this area. Secondly, the initial scoping research indicated that the overall impact of these crimes on victims, especially in terms of their volume and associated costs, as well as the vulnerability of victims were priorities in public discourse and academic literature (Anderson et al. 2013; Blakeborough and Correia 2018; Buchanan and Whitty 2014; Button et al. 2009b, 2014; Home Office 2018b; McGuire and Dowling 2013; Whitty 2015).

Finally, what is meant by computer misuse and fraud in this paper should be clarified and the author’s avoidance of the term ‘cybercrime’ explained. ‘Cybercrime’ is used to refer to a diverse range of illegal activity which occurs primarily within an electronic environment, enabled by the Internet (Yar 2006). Given the wide scope of the term however, it is useful to break ‘cybercrime’ down further into sub-categories. As such, the author started this enquiry by drawing on several existing typologies (particularly Home Office 2018a, b; Levi et al. 2017; Levi and Burrows 2008; McGuire and Dowling 2013; Yar 2006), to identify what types of (cyber) crime may be of interest (see Fig. 1). However, ‘cybercrime’ is a contested term and its usefulness may be questioned altogether (Grabosky and Smith 1998), especially where the aim is to understand victims’ perspective and the extent to which victim policy is adequate and effectively implemented. Crucially for this study, the boundaries between “cyber” and “traditional” crime were found to be blurred. In line with previous research (Levi et al. 2017), it became apparent that the author’s attempt at coding data according to an on/offline dichotomy was impossible. Furthermore, the Modus Operandi (MO) of a crime should not substantially change the principles that inform victim response. As such, this article will not exclusively consider crimes with a “cyber” element, but instead cases of victimisation associated with crimes of fraud and computer misuse, as defined by the Fraud Act 2006 and the Computer Misuse

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5 This was not surprising with respect to fraud as many Modus Operandi (MO) have been found to straddle the on/offline divide (e.g. Button et al. 2012; Gini et al. 2017; Levi 2017; Levi et al. 2017).
Act 1990 respectively, whether they have on/offline elements or both.6

Methods
This paper reports on a sub-set of early results from a study based on $N = 17,049$ computer misuse (CM) and fraud reports, made by victims within the Welsh police forces (Dyfed/Powys, Gwent, North Wales and South Wales), via the UK’s national reporting centre Action Fraud (AF). The data relating to all crimes7 reported over a 2-year period between the 1st October 2014 and the 30th September 2016 were returned to the respective forces who agreed to share this with the researcher via the Southern Wales Regional and Organised Crime Unit (ROCU), a partner organisation in this project. While it was possible to access the full population of AF victim reports at the time the data was collected, insights from crime reports collected prior to October 2014 were considered less reliable due to the transition into the AF reporting system. As such, all records available at the point of data collection from October 2014 were collected.

To undertake this research, the author underwent a process of security vetting, enabling her to access, clean and anonymise the data within the ROCU’s secure environment. The anonymised dataset was then further analysed at Swansea University, whose Ethics Board reviewed and approved the project prior to its commencement. Given the project’s aim to improve the response to victims of CM and fraud, a strong public-interest rationale justified the use of this administrative dataset. Nonetheless, as the original dataset identified victims of crime, the handling of this sensitive information carried the risk of loss of anonymity and subsequent harm to participants. As such, a strict protocol for data access, anonymisation, storage and reporting was followed in order ensure these risks were mitigated.

A data-driven mixed methods methodology was employed. Mixed-methods is understood as “the type of research in which a researcher... combines elements of qualitative and quantitative research approaches... for the purposes of breadth and depth of understanding and corroboration” (Johnson et al. 2007, p. 123). AF reports contained both quantitative and qualitative data, each suited to different methods of analysis and to answer different research questions. As such, a mixed-methods approach was appropriate and a sequential explanatory design used (Creswell et al. 2003; Ivankova et al. 2006). This paper reports on the first stage in this sequence, where structured data from the AF database was quantitatively analysed, to explore reported incidents and police response.

A descriptive statistical analysis of the dataset was undertaken at first instance, including an exploration and testing of variables’ distribution and measures of central tendency. This enabled a better understanding of the quality of the data and the characteristics of the population of reporting victims. Subsequently, several theoretically informed statistical hypotheses were tested using inferential frequentist methods. Given that the dataset contained a variety of categorical (e.g. gender), interval

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6 At the time of writing, Home Office Counting Rules define 15 fraud categories relevant to individual and business victims (containing a further 24 sub-categories between them) and three computer misuse categories (with a further seven sub-categories between them). In total, this amounts to eight unique categories of computer misuse offences and 41 unique fraud categories. Given that working with 49 categories would be impractical and of limited statistical use, the crime categories in the original dataset was combined and re-coded into nine fraud categories and two computer misuse categories as specified in Table 1.

7 ‘Crimes’ include all cases reported and recorded as crimes by Action Fraud, following the Home Office Counting Rules.
| Analytical category | Original dataset category                                                                 |
|---------------------|------------------------------------------------------------------------------------------|
| Consumer fraud      | Online shopping and auctions                                                              |
|                     | Consumer phone fraud                                                                      |
|                     | Other consumer and retail fraud                                                           |
|                     | Computer software service fraud                                                           |
|                     | Ticket fraud                                                                              |
|                     | Charity fraud                                                                             |
|                     | Insurance broker fraud                                                                    |
|                     | Door to door sales and bogus tradesmen                                                    |
| Advance-fee fraud   | *419* advance fee fraud                                                                   |
|                     | Lottery scams                                                                            |
|                     | Counterfeit cheques, bankers drafts and employment opportunities                         |
|                     | Dating scam                                                                              |
|                     | Fraud recovery                                                                            |
|                     | Inheritance fraud                                                                        |
|                     | Rental fraud                                                                             |
|                     | Other advance fee fraud                                                                   |
|                     | Lender loan fraud                                                                        |
| Investment fraud    | Pension fraud committed on pensioners                                                     |
|                     | Pension liberation fraud                                                                  |
|                     | Share/bond sales or boiler room fraud                                                     |
|                     | Pyramid or ponzi schemes                                                                  |
|                     | Prime bank guarantees                                                                     |
|                     | Time shares and holiday club fraud                                                        |
|                     | Other financial investment                                                                |
| Card and banking fraud | Fraud by false representation cheque, plastic card and online bank accounts (not PSP) |
| Services fraud      | Application fraud (excluding mortgages)                                                  |
|                     | Telecom industry fraud (misuse of contracts)                                              |
|                     | Mandate fraud                                                                            |
|                     | Fraudulent applications for grants from charities                                          |
|                     | Mortgage related fraud                                                                    |
|                     | Insurance related fraud                                                                   |
|                     | Dishonestly retaining a wrongful credit                                                    |
|                     | Pension fraud by pensioner (or their estates)                                             |
| Retail fraud        | Retail fraud                                                                             |
| Business compromise | Business trading fraud                                                                    |
|                     | Corporate employee fraud                                                                  |
|                     | False accounting                                                                         |
|                     | Corporate procurement fraud                                                               |
|                     | Bankruptcy and insolvency                                                                 |
| Public fraud        | Fraudulent applications for grants from government funded organisations                   |
|                     | DVLA driving licence application fraud                                                     |
|                     | HM revenue and customs fraud (HMRC)                                                       |
|                     | Department of works and pensions (DWP) fraud                                              |
| Other fraud         | Fraud not covered elsewhere                                                               |
|                     | Other regulatory fraud                                                                    |
|                     | Fraud by failing to disclose information                                                   |
|                     | Fraud by abuse of position of trust                                                       |
(e.g. number of repeats) and ratio data (e.g. loss and age), statistical tests were carried as appropriate. In this paper results relating to Pearson Chi squared tests ($\chi^2$) are reported to identity significant differences between sub-groups of victims. The odds ratio and Cramér's $V$ are reported where appropriate as measures of effect size. Finally, where $\chi^2$ was found to provide limited insight, generalised linear models (GLMs) were used to aid visualisation and interpretation of results. GLMs replicate or replace many of the traditional statistical tests, while allowing the researcher to focus on interpretation of models through a standard (visual) method (Field et al. 2012; Fox 2003; Fox and Weisberg 2011; Hutcheson and Schafer 2012; Hutcheson and Sofroniou 1999).

There are several limitations when using police recorded crime (PRC) for statistical analysis, and some are particular to CM and fraud (Flatley 2013; Levi and Burrows 2008). PRC only captures crime which was reported to and recorded by the police. As such, it provides an insight into reporting/recording rather than crime patterns or victimisation risk. This limitation is especially relevant with respect to the crime types under consideration as they are comparatively under-reported. It is estimated that only 14.5% of CM and fraud experienced by individuals were reported to the police in the year ending September 2018 (ONS 2019, Tables A1 and A4). In comparison, 55.9% of thefts were reported to the police in the same period (ibid.). In addition, concerns have been raised over the process of “criming”, i.e. attributing a crime label to a reported incident in accordance with the UK’s Home Office Counting Rules (HOCR) (Home Office 2015). Issues regarding compliance with HOCR and recording practices led to PRC losing its status as approved national statistics in 2014 (UKSA 2014). Finally, high levels of ‘attrition’ have been reported in the recording of fraud and CM (Scholes 2018) and, as with administrative data more broadly, AF data was collected for the administration of justice and is thus not optimised for the purposes for which it was analysed here.

Nonetheless, AF data remains useful where the focus of the enquiry is the CJS response towards victims. While enquiry is limited to reported crime, it is also the case that responding to victim needs must start with those who come forward to report. Previous research has shown that trust in the police and a belief that the police can do something about the issue are important factors influencing whether victims report crime (MacDonald 2001; Skogan 1984; Zawitz et al. 1993). As such, an adequate police response is a factor in driving reporting behaviour. Previous research has also indicated that the victims’ perception of the seriousness of the crime, is the most important factor leading to a decision to report crime (Skogan 1984; Tarling and Morris 2010). Similarly, a cost–benefit analysis or the opportunity-costs for the victim involved in reporting also constitute factors in decisions to report crime (Goudriaan 2006; Skogan 1984). In fact, the seriousness of the crime and/or a cost–benefit rationale were given as prominent reasons for not reporting to AF—although lack awareness of the service was the most common reason cited for not reporting.  

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**Table 1 (continued)**

| Analytical category | Original dataset category | NFIB code |
|---------------------|---------------------------|-----------|
| Hacking             | Hacking-server            | NFIB52A   |
|                     | Hacking-personal          | NFIB52B   |
|                     | Hacking of social media and email | NFIB52C   |
|                     | Hacking PBX/dial through  | NFIB52D   |
|                     | Hacking (extortion)       | NFIB52E   |
| Malware, virus and (D)DOS | Computer Virus\Malware\Spyware | NFIB50A   |
|                     | Denial of Service attack  | NFIB51A   |
|                     | Denial of Service attack (extortion) | NFIB51B   |

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8 Calculation based on a total number of fraud and computer misuse offences estimated at 4,477,000 for the UK population in the year ending September 2018 (Table A1), against the number of such offences reported to the police for the same period at 650,051 (Table A4). The count including reports from industry bodies was used as some cases captured in the CSEW are unlikely to be recorded by Action Fraud, as a result of the application of Home Office Counting Rules.

9 Calculation based on a total number of thefts offences estimated at 3,574,000 for the UK population in the year ending September 2018 (Table A1), against the number of theft offences reported to the police for the same period at 1,998,876 (Table A4).

10 The removal of the designation of “national statistics” from police recorded crime can therefore be interpreted to mean that police recorded crime—which includes the crime data supplied by police forces and Action Fraud (now run by a private provider for the National Fraud Investigative Bureau) to the Home Office—does not meet identified user needs; are not produced, managed and disseminated to high standards; and its limitations not well explained.

11 While ONS provided respondents with a wider selection of reasons (ONS 2017, Table 2), these were combined for ease of analysis by this researcher into “never heard of Action Fraud” (66%), “cost–benefit rationale” (19%), “crime reported elsewhere” (14%), “private matter” (8%), “other” (8%) and “don’t know” (1%).
Finally, per the Victims’ Code, the seriousness and impact of the crime, victim characteristics such as living with a disability and circumstances such as being a repeat victim require an enhanced response from criminal justice agencies (MOJ 2015). The code extends to all victims of crime, the ‘right’ to be assessed according to such ‘vulnerability’ criteria. As such, one would expect to be able to identify within AF data significant detail to enable an adequate prioritisation and response to victims’ needs, as well as discharge victims’ service and procedural rights (Hall 2018).

As such, this paper will consider the quality of AF data in terms of two quality dimensions set out within the European Statistical System (Eurostat 2017; ONS 2018b): (1) relevance and (2) accuracy and reliability. Relevance is the degree to which data meet the users existing and emerging needs. Accuracy and reliability concern whether the sourced data is accurately recorded and reliably reflect the reality they seek to capture. While PRC does not currently carry the quality seal of UK ‘official’ statistics, these principles remain are useful in considering the quality of AF data.

### Results and discussion

#### Data quality

Issues affecting the accuracy and reliability of AF data include data ‘missingness’ as well as errors in processing, measurement and coding. The level of missing data in salient AF variables was high and is summarised in Table 2. Missingness was highly variable in the original variables, but also in the variables derived/encoded by the author, due to lack of detail and inconsistencies in some records. For example, several variables were coded based on the free-text incident description. However, some descriptions were missing and the level of detail variable. In addition, 664 duplicates were found within the dataset, indicating some processing error before the data was shared with the local forces. Finally, the author’s manual coding exercise identified some inconsistencies with respect to the original AF coding, particularly in the attribution of crime type category to incidents e.g. a ‘Denial of Service attack’ (DOS) recorded where ‘Hacking’ would have been a more appropriate category.

### Victim heterogeneity

Significant differences were found with respect to crime types reported across victim characteristics, but the effect sizes were generally small. Differences in the crime types reported across victim groups are highlighted in Fig. 2. Among individual victims, a significant difference was found with respect to crime types reported across gender ($\chi^2 (7) = 73.57, p < 0.01$). However, in this case Cramer’s $V (0.075)$ indicates that the effect size is small. Nonetheless, the standardized residuals suggest that the difference is driven by females being significantly more likely to report Advance fee fraud (p < 0.01) and males significantly more likely to report Investment fraud (p < 0.01). Based on the odds ratio, the odds of a victim of Advance fee fraud being female are 1.24 times higher, while the odds of a victim of Investment fraud being male are 2.35 times higher. In terms of ethnicity, a significant difference was found between crime categories reported by victims identified as White and Other ($\chi^2 (7) = 18.17, p = 0.001, \text{Cramer's } V = 0.05$). The standardized residuals revealed that this was driven by the White ethnic group reporting significantly more advance fee fraud while their actions fraud.

| Table 2 Distribution of loss (including loss = £0) |
|-----------------|--------|--------|--------|-------|--------|
| Type | N | Mean | sd | Median | Max |
|---------------|-----|------|-----|-------|------|
| All           | 11,874 | 25,875.2 | 15,849.4 | 155 | 1,000,000,000 |
| Buss.         | 1812 | 19,529.31 | 399,860.5 | 195 | 16,784,966 |
| Ind.          | 9239 | 3723.1 | 60,012.27 | 150 | 5,000,000 |

N: sample size; sd: standard deviation; max: maximum value

Action Fraud data shared with local forces could be much improved in terms of its ‘fitness’ to be used to conduct victim vulnerability assessments. Extra fields which may enable local forces to develop a better picture of local victims’ needs include the type of victim (e.g. individual, business, charity or public sector organisation), gender, whether there is an on-line element to the incident, victim’s gender, whether the victim has accessibility needs or is a repeat victim. The author could derive some of this information from the dataset through a combination of automated and manual linkage and coding. However, this was a resource-intensive exercise which local forces may be unable to carry out. Finally, in discussions with stakeholders it transpired that some of this information is collected centrally by AF/NFIB but is not shared with local forces. Even within the arguably limited terms within which ‘vulnerability’ is defined in the Victims’ Code (MOJ 2015),12 the data collected by AF and shared with local police forces appears insufficient to conduct a victim vulnerability assessment.

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13 Cramér’s $V$ varies from 0 to 1, with a 1 indicting a perfect association.
conversely, the Other group reported significantly less. Finally, a derived variable for age category grouping age data into UK Census categories was created and a significant association between victim’s age category and the crime types they reported ($\chi^2 (84) = 525.63, p < 0.001^{14}$). However, the detail of what drives a significant $\chi^2$ result becomes difficult to interpret where multiple categories result in large contingency tables. As such, the age category was re-coded into a new age variable split over four categories according to the age values for the first quartile, median (52) and third quartiles and a GLM predicting the logit of the probability of age category based on the crime reported was run in R statistics. The overall model significantly reduced residual deviance ($\chi^2 (21) = 375.1, p < 0.0001$) and the model’s effect display (Fig. 3) clearly demonstrates that victims reporting Investment and Advance fee fraud are more likely to be older, whereas those reporting Hacking, service fraud and Malware/DDOS/Virus more likely to be younger victims. This result is confirmed in the table summarising the statistical parameters (Table 3).

With respect to reported financial loss, Table 4 shows that loss data is highly spread, highlighting considerable differences between victims. A considerable number of reports (2682 or 21%) indicated a reported loss of £0. This observation should be interpreted with caution for two reasons. Firstly, there was a considerable amount of missing data with respect to loss (30%). Secondly, where the victim has declared an estimation of loss at the time of reporting, this may not reflect longer term and/or indirect losses. On one hand these factors may result in an under-estimation of no-loss reports as the researcher noted that many no-loss reports were recorded as “missing data” in the loss variable (as opposed to “£0”). On the other, there may be some instances where the victim reports the crime before the (total) loss is known to them. Nonetheless, this sample is indicative that a considerable proportion of reports made relate to ‘unsuccessful’ frauds or hacks.\(^{16}\) The impact of financial loss being relative to the means of the victim, prioritising cases where there is some loss may help focus a victim response. Currently, only cases reporting losses over £100,000 should be automatically picked up for further action at NFIB (Scholes 2018, p. 6). However, this amount is far beyond a typical loss being reported by individuals (or even businesses) and research has previously shown that cybercrime and fraud may result in victim-impacts beyond financial loss. These may include feelings of stress, physical or mental health problems, strain on relationships and worsening personal credit rating, among others (Button et al. 2012). As such, to adequately prioritise cases for a

\(^{14}\) There were two cells with minimum expected frequencies below 5 and the minimum expected frequency overall was 4.4. However, as previously noted, with a larger contingency table it is acceptable to have up to 20% of expected frequencies below 5, given that no expected frequencies are below 1 (Field et al. 2012, p. 818).

\(^{15}\) At the same time, the researcher also found instances where a loss amount was recorded by Action Fraud within free-text field for the incident description, but this was not recorded in the appropriate numerical variable. Issues of data accuracy and usefulness are returned to in the conclusion to this paper.

\(^{16}\) Although according to the Fraud Act 2006 the offence of fraud is complete when a false representation is made, regardless of its outcome.
victim-focused response, the reporting system may also need to capture victim-impacts beyond financial loss.

Finally, victim heterogeneity was found in terms of the level of repeat victimisation within the sampled data. In order to assess repeat victimisation, two new variables were computed from the original dataset prior to anonymisation: ‘repeat premises’ is a count of the number of repeat reports from the same premises by matching victims’ first line of address and postcode (including all victims), ‘repeat victim’ is a count of how many reports from the same individual (excluding corporations) could be found by matching on victim’s name, date of birth and address.\(^{17}\) Overall, 30% of business reports were associated with repeat premises and 10% of individual reports emanated from repeat victims. In addition, as indicated in Tables 5 and 6, there was some variation in the number of times a business/individual repeatedly reported.

Police demand and response

Of all the reports received from victims within the four Welsh police forces for the period under study (N = 17,049), most crimes were reported by victims within the jurisdiction of South Wales police force (41%). This is unsurprising as this is the area with the largest population as well as the most internet access. Of the reports received, 19% were ‘actioned’ in some way (N = 3225), as indicated by having been recorded as referred to a police force, a partner agency, classified with an outcome or progressed in some way on the AF dataset. In approximately 5% of all cases, the force by whom the case of actioned is known. Table 3 provides a summary of the various categories of outcome identified in this dataset. Of the 19% of cases that were actioned, most were referred for enforcement-type actions. In contrast, fewer cases were actioned to address victim support needs as indicated by the lower percentage of cases referred to a partner agency (1%) and victim care (0.25%).

On one level, this is in line with the policy priorities set by the UK government in the National Cyber Security Strategy 2016–2021 (HM Government 2016) and the Serious and Organised Crime Strategy (HM Government 2013, 2018). Both these strategies emphasise investigation of organised and persistent offenders and the protection of national critical infrastructure, while having less of a focus on victim support and what is referred to as high volume and/or low sophistication crime. In fact, the way in which Action Fraud reports are prioritised and selected for manual review by the NFIB for possible dissemination inherently favours investigation over other outcomes such as victim services or intelligence (Scholes 2018). At this crucial stage of the victim journey, AF reports are collected in the NFIB’s “Known Fraud” database, whereby a

\(^{17}\) In order to maximise accuracy, all discrepancies between these two variables were manually checked as differences in spelling could lead to errors in the automated counts.
computer programme selects cases for review and dissemination based on the existence of potential lines of enquiry (Ibid.). Victim vulnerability is not assessed centrally in the same way. However, if victim-response is left for local forces to lead on, they would benefit from more guidance and better quality data (Table 7).

Conclusion
This paper considered the quality of the data which UK law enforcement agencies gather from victims of computer misuse and fraud offences, with respect to their information needs to provide an adequate victim response. Furthermore, it considered the heterogeneity of the victims who report and the level of police response. The analysis presented draws on the early results from a mixed-methods sequential study based on a sample of crime reports made within the four Welsh police forces to Action Fraud (AF), the UK’s national reporting centre.

It is argued that AF data provides a rich data source to identify victim needs. At the same time, specific improvements in data collection and processing could aid local forces in the delivery of a victim-focused response, thereby properly addressing the government’s priorities as set out in the Victims Charter. As it stands, the data collected by AF and shared with local police forces appears insufficient to conduct a victim vulnerability assessment. In addition, quality issues and under-reporting will negatively impact on the strategic insight that can be drawn from this data.

While no large differences were found with respect to the types of crimes reported across demographic characteristics, there was some heterogeneity in terms of the

| Age category | Parameter (crime category) | Estimate (β) | Standard error | Wald statistic | Odds-ratio |
|--------------|----------------------------|--------------|----------------|---------------|------------|
| 37–52        | (Intercept)                | −0.09        | 0.06           | −1.4          | 0.92       |
| Card and banking | −0.24                    | 0.14         | −1.8           | 0.79          |
| Consumer fraud     | 0.14                      | 0.08         | 1.9            | 1.15          |
| Hacking         | 0.02                      | 0.12         | 0.16           | 1.02          |
| Investment fraud  | 0.98                      | 0.98         | 3.2            | 2.7           |
| Malware virus DDOS | −0.09                    | −0.09        | −0.59          | 0.91          |
| Other fraud     | −0.01                     | −0.01        | −0.12          | 0.99          |
| Services fraud  | −0.04                     | −0.04        | −0.26          | 0.96          |
| 53–66          | (Intercept)                | 0.18         | 0.06           | 3.0           | 1.20       |
| Card and banking | −0.73                    | 0.14         | −5.2           | 0.48          |
| Consumer fraud     | −0.16                     | 0.07         | −2.2           | 0.85          |
| Hacking         | −0.80                     | 0.13         | −6.06          | 0.45          |
| Investment fraud  | 1.31                      | 0.28         | 4.6            | 3.7           |
| Malware virus DDOS | −0.32                    | 0.15         | −2.08          | 0.73          |
| Other fraud     | −0.28                     | 0.09         | −3.04          | 0.75          |
| Services fraud  | −0.76                     | 0.18         | −4.23          | 0.47          |
| > 67           | (Intercept)                | 0.43         | 0.06           | 7.6           | 1.54       |
| Card and banking | −1.03                    | 0.14         | −7.3           | 0.36          |
| Consumer fraud     | −0.60                     | 0.07         | −8.6           | 0.55          |
| Hacking         | −1.47                     | 0.15         | −9.98          | 0.23          |
| Investment fraud  | 1.02                      | 0.28         | 3.6            | 2.8           |
| Malware virus DDOS | −1.36                    | 0.19         | −7.21          | 0.26          |
| Other fraud     | −0.45                     | 0.09         | −5.04          | 0.64          |
| Services fraud  | −1.69                     | 0.22         | −7.60          | 0.19          |

Model:
\[
\log \left( \frac{P(Y = j)}{P(Y = j')} \right) = \beta_0 + \beta_1 \text{Crime category(Card and Banking)} + \beta_2 \text{Crime category(Consumer fraud)} + \beta_3 \text{Crime category(Hacking)} + \beta_4 \text{Crime category(Investment fraud)} + \beta_5 \text{Crime category(Malware, Virus and DDOS)} + \beta_6 \text{Crime category(Other fraud)} + \beta_7 \text{Crime category(Services fraud)}
\]

where \(j'\) = reference category (age category = 0–36 years old)
\(\beta_0 = \text{Advance fee fraud} \)
financial losses and level of repeat victimisation. The proportion of no-loss reports suggests that a victim-focused response needs to capture victim-impacts beyond financial loss. In addition, a small number of victims reported repeatedly over the time-period in question. Further research is needed to substantiate the link between repeat victimisation and vulnerability.

The meaning of ‘vulnerability’ also needs to be better understood in relation to victims of CM and fraud. The Code of Practice for Victims of Crime (MOJ 2015) and the crime plans developed by the Police and Crime Commissioners for each of the Welsh police forces (Dyfed Powys PCC 2017; Gwent PCC 2017; North Wales PCC 2017; South Wales PCC 2017) all commit to protecting and responding to the needs of vulnerable victims. However, little is currently done in the way of analysing AF

### Table 4 Original and coded variables according to base, number of unique levels and percentage of missing data (N = 17,049)

| Variable | Base (n) | Levels | Missing (%) |
|----------|----------|--------|-------------|
| Police force | 17,049 | 4 | 0 |
| Reported date | 17,049 | 751 | 0 |
| NFIB category | 17,049 | 55 | 0 |
| Victim partial postcode | 17,049 | 244 | 0 |
| Victim age | 10,846 | 122 | 18 |
| Victim ethnicity | 8,668 | 17 | 35 |
| Financial loss | 11,874 | 1971 | 30 |
| Force disseminated to | 997 | 54 | 94 |
| Partner agency disseminated to | 227 | 7 | 99 |
| Primary purpose (outcome) | 1725 | 12 | 90 |
| Call for service progress | 2228 | 14 | 87 |
| Derived and (re)coded variables | | | |
| Crime category (analytical categories) | 17,047 | 11 | 0.01 |
| Crime group (fraud/CM) | 17,049 | 2 | 0 |
| Any online MO | 15,431 | 2 | 9 |
| Any offline MO | 15,339 | 2 | 10 |
| Mixed MO | 15,339 | 2 | 10 |
| Crime MO group | 15,339 | 3 | 10 |
| Victim type | 15,952 | 3 | 6% |
| Victim gender | 13,011 | 2 | 2% |
| Victim ethnic group | 8,668 | 2 | 35 |
| Repeat victim (individual) | 13,290 | 8 | 0 |
| Repeat victim (premises) | 17,049 | 19 | 0 |
| Business sector | 2428 | 21 | 3% |

* Percentage missing calculated based on reports identified as relating to individual victims, N = 13,290 (businesses, charities and public sector victims excluded)

### Table 5 Number of reports (and %) from the same business premises (N = 2432) and individual households (N = 13,290)

| Number of reports | Businesses premises | % | Households | % |
|-------------------|---------------------|---|------------|---|
| 1 (unique)        | 1710                | 70 | 11,777    | 89 |
| 2                 | 322                 | 13 | 1176       | 9  |
| 3                 | 107                 | 4  | 194        | 2  |
| 4                 | 65                  | 3  | 56         | 0.4 |
| 5–9               | 77                  | 3  | 86         | 0.6 |
| 10–14             | 22                  | 0.9| 1          | 0.0 |
| 15–19             | 17                  | 0.7| 0          | 0  |
| >20               | 112                 | 5  | 0          | 0  |

### Table 6 Number of reports (and %) from the same individual victims (N = 13,290)

| Number of reports | Individuals | % |
|-------------------|-------------|---|
| 1 (unique)        | 11,977      | 90 |
| 2                 | 1012        | 8  |
| 3                 | 179         | 1  |
| 4                 | 37          | 0.3|
| 5                 | 31          | 0.2|
| 6                 | 24          | 0.2|
| 7                 | 6           | 0.0|
| 8                 | 24          | 0.2|

### Table 7 Records of cases actioned, Wales (N = 17,049)

| Recorded action          | Frequency | Percentage of total |
|--------------------------|-----------|---------------------|
| Actioned                 |           |                     |
| Enforcement              | 796       | 5                   |
| Force (misc)             | 14        | 0.08                |
| Intelligence             | 10        | 0.06                |
| Investigation closed     | 531       | 3                   |
| Investigation ongoing    | 1343      | 8                   |
| Partner agency referral  | 227       | 1                   |
| Prevention               | 175       | 0.5                 |
| Transferred to another force | 86    |                     |
| Victim care              | 43        | 0.25                |
| Total                    | 3225      | 19                  |
| Not actioned             |           |                     |
| Filed                    | 329       | 2                   |
| No investigation         | 176       | 1                   |
| NA                       | 13,319    | 78                  |
| Total                    | 13,824    | 81                  |
data for indicators of vulnerability. To achieve this, further research is needed into what these factors and indicators are. Once vulnerability is properly understood with respect to these crime types, it is suggested that applying the latest technology such as machine learning to developing a referral system for victim support services would go some way to putting the victim at the centre of computer crime and fraud policy. This would require however, a higher level of accuracy in the recording of these crime types. Alongside this, it is important to ensure that the various levels of policing and victim support responsibility do not result in a lack of ownership of victim support services.

Abbreviations
AF: Action Fraud; CM: computer misuse; CSEW: Crime Survey for England and Wales; GLM: generalised linear model; MO: Modus Operandi; MOJ: Ministry of Justice (UK); NFIB: National Fraud Intelligencia Bureau; ONS: Office for National Statistics; PCCs: Police and Crime Commissioners; PRC: police recorded crime; ROCU: Regional Organised Crime Unit; UK: United Kingdom.

Authors' contributions
Not applicable as it is a single author publication. The author read and approved the final manuscript.

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Acknowledgements
The author would like to thank everyone at the cyber unit in the Southern Wales Regional Organised Crime Unit (ROCU) for their support in making this project possible. This piece is also indebted to the constructive feedback of Prof. Stuart Macdonald at Swansea University, as well as the extensive feedback of the two independent reviewers. I am very grateful for their time and consideration.

Competing interests
The author declares no competing interests.

Availability of data and materials
The data cannot be shared at present as agreement for this has not been provided by the research partners.

Funding
This research was funded by an Economic and Social Research Council (ESRC) Ph.D. studentship.

Publisher's Note
Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Received: 6 June 2018 Accepted: 6 April 2019
Published online: 24 April 2019

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