Introduction
Forecasting is vital for decision making in uncertain environments (Clarke, 1992). Whilst its methods are widely used in economics, there are also many reasons for wanting to forecast human actions as it had implications in many areas, including predicting serious crimes such as domestic violence. Using forecasting methods, is it possible to predict who poses a threat to their partner in a relationship, and who is likely to reoffend? It is clear to see why it is valuable to predict domestic violence, not only to prevent assault or reassault, but also to enable prevention and rehabilitation resources to be allocated efficiently. Whilst statistics taken from the Crime Survey for England and Wales (CSEW) show that reported domestic violence offences have decreased by 74% from 1993 (1,166,000) to 2012 (308,000), it is still a major concern in today’s society.

Methods of Predicting Domestic Violence Recidivism
The Office of National Statistics claim that women are more likely to be victims of domestic violence than men, with 7.3% of women claiming to have experience of domestic abuse compared to only 5% of men between 2011 and 2012 (based on the 2011/12 CSEW). For this reason, this essay will focus on domestic violence against females.

In prediction research it is important to identify the best predictors of a certain outcome. With regards to domestic violence, men identified as at-risk offenders, measured using characteristics thought to be predictors, are followed-up at various intervals to see if an offence has been committed. Good predictors are only then identified after the outcome has been measured (Hilton & Harris, 2005). However, much research has looked into the prediction of domestic violence recidivism. A prediction made as to whether the offender is likely to reassault would determine the treatment of the offender at the time of arrest or during sentencing.

Empirical predictors linked to general violence recidivism are also seen to predict domestic violence. These include; younger age, previous history of violence and arrest and low socioeconomic status (Aldarondo & Sugarman, 1996; Bennett, Goodman, & Dutton, 2000). Fals-Stewart (2003) collected self and partner reports and discovered that substance abuse (particularly alcohol) was linked to the likelihood of domestic violence that day. It has also been found that offenders are likely to recidivate against the same victim despite
having separated or having restraining orders placed against them. (Buzawa & Buzawa, 2003). These predictors act as guidelines to the type of information that should be collected during risk assessments.

There are two main types of prediction used when forecasting domestic violence; clinical (judgemental) and actuarial (objective) methods. Each will be discussed in turn.

**Clinical Methods**

Clinical risk assessment involves drawing on empirical literature and clinical experience for prediction. It is usually based on intuition, psychiatric symptoms and diagnosis carried out by experts in the field.

One example of a clinical risk assessment is the Domestic Violence Screening Instrument (DVSI; Williams & Houghton, 2004). The Colorado Department of Probation Services (DPS) analysed data from over 9000 domestic violence cases and identified the most common social and behavioural characteristics of offenders with a repeated history of violence. The analysis, alongside a literature review, was then used to determine which items strongly associated with domestic violence and so should have a greater weight when it comes to the score. Content and face validity was then determined by various focus groups including judges, prosecutors, defence attorneys and probation officers. Williams and Houghton (2004) tested 1465 men and found that their score significantly predicted subsequent arrests.

The Spousal Assault Risk Assessment (SARA; Kropp, Hart, Webster & Eaves, 1999) was designed to measure the risk of any violence in family relationships and includes sections on the history of crime, psychological adjustment, domestic violence history and details of the current assault at time of questioning. It was developed by identifying risk factors of domestic violence recidivism found in clinical and empirical literature and then a checklist of these risk factors were composed. Grann and Wedin (2002) tested 88 male offenders to find that the total SARA score predicted recidivism after two and five year follow-ups but not in a shorter time period. They also found that there were only three of the items that significantly related to recidivism on the SARA. However, Kropp and Hart (2000) test 102 domestic violent offenders and found that SARA scores could not distinguish between those who recidivated and those who didn’t. However, whilst this is the most tested and
structured it has not performed as well as other methods. Also, none of these methods have criteria for estimating the degree of risk.

**Actuarial Methods**

Actuarial methods seem to add a further advantage to predicting the occurrence of domestic violence recidivism. They are more focused than clinical methods and are more likely to identify factors actually related to the outcome. Actuarial methods use statistical analysis to formulate a set of items based on the most powerful predictors of domestic violence recidivism; items are only further added when they significantly improve the prediction. For example, if some information is correlated with other strong predictors then it might not be needed to assess risk. These methods not only indicate the proportion of offenders that obtain a certain score, but they also assess the probability that they will reoffend.

The Violence Risk Appraisal Guide (VRAG, Quinsey, Harris, Rice & Cormier, 1998) was developed for the assessment of violent offenders before a trial. When creating the tool a range of information was gathered on 618 men referred for pre-trial assessment, this included demographics, information on the offender’s childhood, clinical and psychiatric history etc. After seven years the men were followed-up and multivariate analysis revealed twelve variables that were independently and significantly related to recidivism.

Another risk assessment tool using this actuarial method is the Ontario Domestic Assault Risk Assessment (ODARA, Hilton, Harris, Rice, Lang, Cormier & Lines, 2004). The aim was to produce a short and simple method to predict recidivism using the information available to police officers during the initial investigation. 589 offenders were questioned on a pool of 54 potential predictors and were followed-up within 5 years. These predictors, including offender characteristics, domestic violence history and relationship characteristics, were subject to multiple stepwise regression analysis, resulting in the appearance of 13 significant and independent predictors of domestic violence recidivism. These included domestic and non-domestic violence history, children in the relationship and substance abuse.

A more recent attempt to create an instrument that predicted domestic violence recidivism was carried out by Berk, He and Sorensen (2005). Their aim was to construct a quick questionnaire that could be administered at the scene that would help police officers
determine the correct action to take. They argued that other risk assessments, such as those already mentioned, are time consuming and difficult to administer at the scene of an incident. Their aim was only to attempt to forecast domestic violence and not to try to explain the behaviour. They administered a screener, containing about 30 questions, to households at the time of a domestic violence incident. These households were then followed up 3 months later to see if a further call had been made to the police. They used a method which combines several classification and regression trees (CART, Breiman, Friedman, Oldhen & Stone, 1984). This method identifies the strongest predictor of the outcome and splits the data depending on the presence or absence of the predictor. This continues until splits in the data can no longer add to the prediction. In this case, four of the items from the original screener were selected because they substantially predict the likelihood of a further call to police. A new call would be predicted if:

1. If the police have been called more than three times to a household.
2. If the police have been called three or fewer times, and
   a. the perpetrator is reported to destroy property when angry, and
   b. the perpetrator is unemployed
3. If the police have been called three or fewer times, and
   a. the perpetrator is reported to destroy property when angry, and
   b. the perpetrator is employed, and
   c. the perpetrator is reported to have threatened to kill the victim or someone else in family in the past.

(Berk et al, 2005, p.371)

An advantage of the technique used by Berk et al (2005) is that they also accounted for the costs of forecasting errors (False Positives (FP) and False Negatives (FN)) in their model.

**Forecasting errors: False Positives and False Negatives**

There are four possible outcomes that can be made when forecasting. A model could correctly predict those who will recidivate (true positive, TP) and those who will not recidivate (true negative, TN). However, there are two errors that may also be made. A
forecast model may wrongly classify someone as a recidivist (FP) or may completely fail to identify a recidivist (FN). This is shown in Figure 1.

<table>
<thead>
<tr>
<th>Real Life</th>
<th>Forecast</th>
</tr>
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<tbody>
<tr>
<td>Recidivist</td>
<td>Recidivist</td>
</tr>
<tr>
<td>Non-Recidivist</td>
<td>False Positive (FP)</td>
</tr>
</tbody>
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Figure 1: Table showing the possible forecasting outcomes.

In order to maximise the accuracy of forecasting it is necessary to eliminate both types of error. However, there is a trade-off between the two errors, such that as the chance of one decreases, the chance of the other increases (this is shown in Figure 2.)

![Figure 2: The trade off between FP and FN, Adapted from Arkes & Mellers (2000)](image)

Unless forecasting is 100% accurate there will always be some overlap between the types of errors and so it must be decided which error is the most harmful. Using a sort of cost-benefit analysis of FP and FN errors it is possible to work out where the point of criterion (d') should go. This is known as signal detection theory (Green & Swets, 1966). When creating their forecast method, Berk et al (2005) believed that false negatives were generally more problematic than false positives, such that it was better to predict a future police call when one wasn’t actually made rather than not responding to a call when there was in fact cause for concern.

However, assessing these costs and benefits is subjective and the precise costs cannot be determined. For example, Halvorsen (2004) argues that no matter what kind of error is
made (FN or FP) an offender may potentially walk free. This is clear in FN's. However, he argues that when a FP is made, an innocent person may be wrongly identified, thus allowing an offender to remain unidentified. Therefore, in some cases, but not all, the two errors may be inextricably linked.

Also as part of signal detection theory (Green & Swets, 1966), Relative Operating Characteristic (ROC) curves can be used to determine the threshold for an event that provides the best trade-off between hit and false alarm rates. The graph plots the true positive rates against the false positive rates to determine the accuracy of a forecast. The area under the ROC curve provides a statistic for the performance of the forecast, an area under the curve (AUC) = 0.5 means the forecast has little or no accurate predictability.

With regards to the risk assessment instruments mentioned previously, each has undergone ROC analysis to determine the accuracy of their forecasts. With regards to clinical methods, Hilton et al (2004) found that the SARA (Kropp et al 1999) predicts domestic violence recidivism with an AUC of 0.64. William and Houghton’s (2004) DVSI showed an AUC of 0.60 which was not found to be significantly different from the SARA. However, when we look at actuarial assessments, Grann and Wedin (2002) carried out a post-release follow up, after a year, on 88 domestic violence offenders using the VRAG (Quinsey et al, 1998) and found that it predicted violence with an AUC of 0.75, this is significantly better than that found using the SARA. It was also found that after a follow-up of five years, the ODARA was able to distinguish between 175 official domestic violence recidivist and 44 non-recidivists with an AUC of 0.77, and with a second sample of 100 offenders, was able to predict recidivism with an AUC of 0.72.

By looking at these, statistics it is clear that actuarial methods outperform clinical methods of prediction.

Problems with Forecasting Domestic Violence

Aside from forecasting errors such as FN's and FP's, there are many other problems that must be considered when forecasting domestic violence. According to Makridakis (1988) humans behaviour is so unpredictable due to two major factors. One major problem that may cause relationships to change is the capriciousness of human behaviour. This involves a person’s ability to change their attitudes and beliefs at their own will. Also, people have the ability to manipulate future events and their future actions. Therefore,
forecasting human behaviour can never truly be accurate. Also the idea that forecasting may lead to self-fulfilling or self-defeating prophecies shows that forecasting may actually have detrimental properties, such that if no forecast were made, these problems wouldn’t have occurred. Forecasting takes information from the past and extrapolates this into the future in order to make predictions, but due to people’s ability to change their behaviour and actions, future patterns may not always follow past patterns.

Other problems include identifying an illusory pattern when in reality one doesn’t exist. This may stem from trying so hard to control the situation, in this case predicting cases of domestic violence. Also, a relationship may in fact be caused by a third factor which causes other factors to follow a certain pattern (Makridakis, 1988). Another problem is that if the forecasting horizon is long, then there is more chance that a change in relationships will be seen. Makridakis (1988) found that a model that is able to predict the past will only predict the future poorly, with a correlation of 0.3. However, this is only when predictions are made one time-point ahead. When predictions are made on a longer forecasting horizon, this correlation decreases. The studies mentioned have included forecasting horizons of three months to seven years and so they are difficult to compare. However, actuarial assessments have been showed to have good predictive ability with a forecasting horizon of up to five years (Grann & Wedin, 2002).

While the studies mentioned so far have looked at domestic violence recidivism and have used only men convicted of previous domestic violence offenses. This could lead to higher number of FNs but it also fails to recognise all the domestic violence recidivists that have never been caught. While it is important to prevent domestic violence offenders from reoffending, it is also important to thwart it from the outset.

Predicting the Onset of Domestic Violence

There are many practical reasons as to why the onset of domestic violence should be predicted. It may be useful to a woman when entering a new relationship for example. Lots of research has been conducted in order to find the empirical correlates of the onset of domestic violence. These include low income, ethnic minority (Brownridge & Halli, 2001) and psychological disorders such as borderline and antisocial personality disorders (Edwards, Scott, Yarvis, Paizis & Panizzon, 2003). There are also many clinical characteristics that have been associated with domestic violence, including jealousy,
anger, insecure adjustment and hostility (Holtzworth-Munroe, Bates, Smutzler & Sandin 1997). A variable found to strongly associate with domestic violence is exposure to violence during childhood. Hines and Saudino (2002) found that men who victim of child abuse or witnessed domestic violence between their parents were more likely to assault when in a relationship. O’Leary, Malone and Tyree (1994) also found that seeing their parents being violent and being willing to aggress was also associated with later domestic violence offences.

Alcohol and substance abuse has also been able to distinguish future domestic violence offenders. Murphy, O’Farrell, Fals-Stewart and Feehan (2001) studied 303 males and found that those with severe substance abuse were more likely to assault. A prospective study carried out by Leonard and Senchak (1996) involved 541 couples applying for a marriage license. They found that alcohol abuse at this time predicted domestic violence offences after a one year follow-up.

As an attempt to predict the onset of domestic violence, Dutton (1995) developed the Propensity for Abusiveness Scale (PAS). The PAS was devised using components from various other scales such as the Multidimensional Anger Inventory (MAI; Siegel, 1986) and the Relationship Scales Questionnaire (RSQ; Griffin and Bartholomew, 1992). The scores of 149 men from college were correlated with their partners’ reports of aggression, finding that men with the highest score on the PAS were more aggressive compared to those with lower scores. Unlike the risk assessments predicting recidivism, this scale has no questions about past history of violence.

Berk et al (2005) also attempted to predict the onset of domestic violence. They used the same method as before, combining classification and regression trees, and again claimed that the cost of a false negative was higher than that of a false positive. The model was able to correctly predict new domestic violence offences more than 50% of the time, and houses where no domestic violence calls were predicted were correctly identified 80% of the time. A new call would be predicted if:

1. the police have been called to the household in the past, and
2. the perpetrator is unemployed, and
3. the violence is getting worse.

(Berk et al, 2005, p.376)
Predicting a new domestic violence offence is difficult as it can be quite a rare event. However, the results from this study show that using CART (Breiman et al, 1984) is an effective method of prediction. However, the results from this study must be taken with caution as it was not always monitored whether the call to police was due to a domestic violence offence. Also, there are many cases in which domestic violence may occur but no phonecall to the police was made, this may lead to an increase in FPs.

Only a few studies have been conducted that look at the onset of domestic violence and it's important to remember that wife assault is not stable in early marriage. One-time offenders are generally different from recidivists, which is why it is also important to predict whether someone is likely to reoffend.

**Victim Predictions**

It can be said that a victim, or survivor, of domestic violence is likely to make the most accurate assessment regarding whether their partner will reoffend because they have superior knowledge of their attacker (Hart, 1994). Walker (1984) claimed that victims were able to sense when an assault was about to occur, however, this was not accurately assessed.

The Danger Assessment (DA; Campbell, 1986) is a slightly different tool in the sense that it is completed by the victims of domestic violence and assesses the risk of lethal assault. It contains risk factors taken from a range of studies; these were then discussed with victims, shelter workers, police officers and experts on domestic violence, who supported the content validity. In a study of 49 women who completed the questionnaire, the DA score was associated with recidivism after a three month follow-up.

In a study by Weisz, Tolman and Saunders (2000), victims of domestic violence were asked to rate how likely a dispute would end in violence. A number of variables successfully predicted violence at a four month follow-up. These included history of repeat violence, psychological and physical abuse and the victims attempt to get protection. Victims rating of the likelihood of violence were also strongly associated with future violence and when added to multiple regression, victims predictions significantly improved the model. However, this study has been criticised for many reasons. Victims were asked to rate how likely it was that a dispute would end in violence, however, in some cases
violence occurs when no dispute takes place. Also, victims were asked to predict the likelihood of a domestic violence attack within the next year, yet the follow-up period was only four months. Therefore, victims who may have rated themselves as safe, were not reassaulted within the four month follow-up period, but were repeatedly assaulted within the next year (FP). Also some women may have rated themselves as in danger and in fact experienced violence after the four month follow-up period (FN).

When looking at victims predictions, they must be interpreted with caution. Campbell (1995) points out that victims of domestic violence suffer psychological trauma and this may reduce their awareness to danger. They may repress memories of early attacks (Browne, 1987) or doubt their own judgement due to being made to feel ‘stupid and crazy’ (Dutton & Dionne, 1991).

**Practical Implications of Predicting Domestic Violence**

The obvious advantage to predicting domestic violence is being able to identify who might pose a risk in the future and to be able to intervene before an assault occurs. However, there may be ethical issues involved, especially when attempting to predict the onset of domestic violence. To have any real effect, this would involve collecting and holding copious amounts of information on a large proportion of the population so that interventions are directed towards those who need it. This may be controversial as it involves some invasion of privacy and is unfair to those who may be singled out for a crime they are not intending to commit (in the case of a FP). This may lead to more problems regarding labelling and self-fulfilling prophecies.

Domestic violence risk assessments have also been used by the criminal justice systems so that judgements can be made regarding appropriate sanctions and protection for victims. It has been found that officials find it useful in making decisions about the allocation of resources, which are scarce (Roehl & Guertin, 2000). However more research needs to be carried out to ensure the reliability and validity of prediction tools as ethical issues still remain.
Conclusion

To conclude, there is some evidence that there is potential to predict domestic violence recidivism, allowing prevention of future assault. Some of the most powerful predictors seem to be past history of assault (Berk et al, 2005), substance or alcohol abuse (Leonard & Senchak, 2001) and the exposure to violence during childhood (Hines & Saudino, 2002). Using actuarial methods of forecasting in particular, it is possible to identify domestic violence recidivists more accurately than chance and so further research is needed to increase the accuracy of such methods and decrease forecasting errors. However, predictions will never be certain and so a trade off between errors will still need to be made. It is also important to remember, as Halvorsen (2004) states, that it may be possible that an FN may be made within an FP and this must be accounted for.

Problems will always emerge when attempting to forecast domestic violence with regards to accuracy and so it is important to improve them as much as possible. It is important to understand that it is not ethically acceptable to delve into people’s private lives and histories, yet we must create a balance with safety of women potentially at risk. The effects of self-fulfilling prophecies must be considered and it must not be forgotten that people have the ability to change their beliefs at actions at their own will, and human behaviour can be capricious.
References


