



## Using risk factor statistics in decision making: prospects and challenges

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## Using risk factor statistics in decision-making: prospects and challenges

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## **Abstract**

Society expects social workers and other professionals to use the best available knowledge in making decisions. Statistical (numerical) data is rapidly becoming an increasing part of the repertoire of knowledge available to professionals. However, social workers can at times seem reluctant to use statistics to inform their judgement processes when considering the assessment and seriousness of risk factors. This paper explores and considers the potential use of statistical methods in understanding risk factors. Potentials of using statistics include reducing variability in human judgements, increasing accuracy and reducing human bias. When contemplating these potentials, it is important to consider ethical, legal and organizational as well as technical issues. Acknowledging that potentials and challenges need to be weighed, it is imperative that the profession engages in the development of adequate statistical methods to improve the knowledge and skill base for social work in the best interests of clients and families.

## **Keywords**

Decision-making; decision support systems; risk assessment; risk factors; statistics.

## **Introduction**

The deaths of children and vulnerable adults often result in the media and politicians criticising the ability of social workers and other professionals to predict harm accurately (Warner 2014). The most common instances of public concern involve cases of child abuse, along with cases of suicide, homicide by mental health patients or harm caused to an older person (Warner 2018). These cases often give rise to a media uproar urging the public and politicians to take a critical stance towards social work and other professionals for failing to predict the harmful outcome despite 'obvious' signs of risk. Adequate risk assessment and subsequently making the correct decision about how to act are essential elements of good social work (Taylor 2017a), but obtaining the necessary knowledge for making robust assessments and good decisions are not as straightforward as it may appear to politicians, the media and the public at large. This type of media coverage is resulting in an increasing focus of social work research on decision-making, professional judgement and assessment of risk with the ambition of providing a more robust evidence base for assessing and managing risk.

Studies indicate that statistical methods are superior to clinical judgements (Dawes, Faust & Meehl, 1989; Grove et al, 2000; Ægisdóttir et al. 2006). In this context, we define 'statistics' to mean the scientific discipline concerned with collecting, organising and analysing data. Amidst various efforts to address the issues (Broadhurst et al, 2010), research shows that the use of statistical methods offers promising avenues for improvements in decision-making in social work (Vaithianathan et al., 2013; van der Put, 2014). Using statistical models in decision-making involves identifying factors associated with potential future harmful behaviour and rating these factors according to their importance (Calder & Archer, 2015). Statistical models have the potential to improve the accuracy of predictions compared with human predictions as large amounts of complex information may be analysed beyond the capacity of the human brain (Miller, 1956, Putnam-Hornstein, 2013). Statistical models might contribute to the standardising of how information is processed in particular decision types, and how these might improve the consistency with which organisations respond in similar situations (Cuccaro-Alamint al 2017). The aim of this article is to provide an understanding

of how statistics might influence and improve risk assessment, professional judgement and decision-making in social work, as well as highlighting key challenges.

For our purposes, we define risk as a 'situation where the outcomes are not known and where benefits are sought but undesirable outcomes are possible.' (Taylor, 2017a, Glossary). Risks may be considered in terms of the seriousness of the harmful outcome that may occur, and also in terms of the likelihood (probability) of the undesirable event occurring. The main focus of this article being on the latter, and the extent to which the likelihood of harm can be estimated or predicted on the basis of risk factors. When making decisions about care and intervention options, the social worker is weighing up the possibility of harm against the potential benefits of a course of action. This essential dimension of practice is beyond the scope of this paper, and the interested reader is referred to Killick & Taylor (2020, Ch9) and Taylor (2017a, Ch7) for further reading. Using statistics to analyse potential risk means examining the probability of something happening based on previous events (Taylor, 2017a, Glossary). For a broader consideration of risk in relation to decision-making in contemporary social work see Taylor and Whittaker (2019) and Whittaker and Taylor (2018).

Our focus is the role of statistics when assessing risks in relation to professional judgements and decision-making processes. For our purposes, we define professional judgement as: 'When a professional considers the evidence about a client or family situation in the light of professional knowledge to reach a conclusion or recommendation' (Taylor, 2017a, Glossary). We define decision-making as: 'A conscious process (individually or as a corporate exercise with one or more others) leading to the selection of a course of action from among two or more alternatives' (Taylor, 2017a, Glossary). The intrinsic inter-connection between risk and decision-making is discussed in Taylor (2020c).

The article draws on the perspectives of social work scholars across Europe to discuss the potentials and challenges in using statistical information about risk factors when assessing and determining the level of risk for a child, adult or family. In this article, the potential benefits of using statistical methods to support decision-making in social work are considered in terms of three main headings:

- reducing variability in human judgements;
- increasing accuracy and reducing human bias; and
- benefitting from the practice experience of others.

The challenges in using statistical methods within professional judgement are considered under three main headings:

- ethical issues;
- legal and organisational issues; and
- technical issues.

For each issue, key ideas within the domain are considered in relation to the realities of using statistical data; the alternative of relying on human intuition; and ways in which the issues might be addressed.

An initial presentation of the theory of probability will pave the way for the discussion of the potentials and challenges of using statistics. In order to maintain focus (and for reasons of length), this article devotes its attention to the issues in incorporating statistical data within social work assessment of risk. Issues relating to computerised machine learning and big

data itself are beyond the scope of this paper, as are the broader political aspects of the expansion of statistics in democratic societies. It must be recognised that many things that we would like to know in social work practice are 'uncertain' (ie cannot be calculated) rather than 'risks' which can be calculated. However, a key point in this paper is that with the development of statistics (and in future machine learning approaches), matters which up to the present we might regard as 'uncertain' will become matters for which some estimate of risk becomes possible.

### **Probability theory and its application in social work**

Using statistical information in decision-making is based on the theory of probability which essentially originates in mathematical and logical principles (Kallenberg 2002). Human thinking is accustomed to a probabilistic way of predicting how things will most likely take place. To give a simple example, probability theory will help you calculate how likely it is that a thrown dice will stop on number three. You will also be able to calculate how likely it is for it to fall on another number. One of the pioneers of the theory of probability explained probability by saying: "The probability of any event is the ratio between the value at which an expectation depending on the happening of the event ought to be computed, and the value of the thing expected upon it's happening" (Bayes, 1763, 376).

In this article, we are interested in the application of probabilistic results in the field of social work. It is an area that is extremely sensitive because it deals with people experiencing certain difficulties. When deciding on potential solutions, social workers are trying to make the best decision based on the information they have. Can probabilistic calculations help social workers make better judgments and decisions? We are eager to explore how statistical information can contribute to a clearer insight of the situation at hand, which factors contributed to this situation and most importantly; what are the probabilities that the situation will develop positively or negatively? The intention is to discuss whether statistics can help social workers make better judgments.

Statistical data is one among several types of information. When assessing risk and making decisions, various forms of information are relevant, including the voices of the service users, experiences from professionals working with the service users as well as data about the past. In this article we are looking at probabilistic calculations as one type of knowledge that can guide the judgements and decisions made by social workers.

An important consideration when applying probability theory to social work are the specific circumstances related to this field of practice. While the throw of a dice is pure coincidence, the likelihood of a risk turning into harm is not only determined by chance but is mediated by human action. While human action might challenge classical rules of probability, the variability that evolves from human judgement is also exactly the reason why including statistics may strengthening social work practice.

### **Potential benefits in using statistically calculated risk factors in social work**

#### *Potential benefits (1): reducing variability in human judgements*

Professional judgement in social work is generally complex and ambiguous as it is sensitive to decision makers' heuristics and subject to personal perceptions of different cultures

(Miller, Cahn, & Orellana, 2012; Morton, Ocasio, 2011; Enosh, Nouman, & Schneck, 2018; Nouman, Enosh, & Jarjoura, 2018). Individual professional judgements are an inherent part of social work. Human beings are complex individuals who do their best to perform the duties assigned to them. Social workers are no different when doing their job whether this includes making decisions, assessing needs and risks or determining which services to provide for individuals in need. Consequently, variation exists in the assessment and judgement of risk in social work and empirical evidence shows that assessment of cases varies across caseworkers, which leads to variation in the decisions made (Davidson-Arad & Benbenishty, 2010). Professional judgements in relation to individual circumstances, is generally considered a cornerstone of social work, as individuals are different and treating each service user according to their individual needs is the essence of social work (Killick & Taylor, 2020). However, since the decisions are often made on the basis of imperfect information combined with individual preferences and experiences of social workers a large variability is inevitable.

Studies show that a considerable variability exists in the determination of risk. Social workers may be more likely to assess children of minority and low socio-economic groups as being at risk (Enosh & Bayer-Topilsky 2015). A study from New Zealand found that although social workers had a common knowledge-base and definition of risk and safety factors, they assessed children differently. The difference was explained by the social workers' tendency to be risk-averse or risk-friendly (Keddell, 2017) which may be characterised as a personality trait rather than a professional stance. In addition, professional knowledge and personal experience as well as professionals' own everyday knowledge and socio-cultural norms add to the variety in decisions (Hardy, 2017).

Introduction of statistics in health services has been a significant driver in medical advances and improvements in predictions, diagnostics and treatment in health sciences (Bates et al 2014), and there may be similar potential in reducing variability in social work. While the inclusion of statistics offers potentials of reducing personal bias, the introduction of statistics is challenged by a social work logic of individualistic perceptions of risk (Hardy, 2017) as well as a strong focus on professional judgement (Taylor, 2017b). Statistics offer the potential of identifying patterns leading to an increase in accuracy. A challenge for human beings is how to weigh up the combination and interaction between probabilities of various risks in a particular situation (Webber, 2015). One of the merits of a statistical approach is that the combination of risk factors and interaction effects can readily be studied and built into the model.

*Potential benefits (2): increasing accuracy and reducing human bias*

Social workers are subject to a range of systematic biases in their decision-making process (Garb 2005). Caseworkers can overlook relevant information, attach too much importance to irrelevant details, and tend to pay attention to information that confirms their previous judgments (Garb, 2005; Munro, 1996, 1999 & 2008; Stanley, 2013). Furthermore, the human mind is incapable of processing too much information which leads to bias (Miller, 1956). When there is information overload, professionals place differing importance on types of information (Britner & Mossler, 2002) which means that although social workers have access to the same data, their assessment of risk may differ. This is increasingly true when large amounts of data are involved.

One of the potentials of using statistical data is that large amounts of information can be included in the assessment. By aggregating large amounts of data and deducing comparative cases and issues, it is possible to provide information and knowledge on a completely different scale. Statistics thus allows for increased harmonisation and accuracy in assessments. A decision about risk is no longer based on a single case and a single social worker's perception of the case, but on hundreds or thousands of cases. In statistical analysis, the ability to take a small sample and compare it to the larger population provides statistical significance.

Risk assessment tools are designed to weigh different variables against each other. Comparing the accuracy of actuarial modelling versus human assessment generally favours statistical calculation (Grove & Meehl 1996; Dawes, Faust & Meehl 1989; Meehl 1954). Using statistical data will lead to greater equality between individual service users as all cases with similar characteristics will be assessed to contain the same level of risk, and the challenges of human bias is reduced. As social work is about people, the human factor will not be eliminated by the introduction of statistics, but it will be moderated. This leads to an increase in legally-sound as well as ethically correct judgements and decisions. An incorrect assessment, whether based on human judgement or statistical calculation, creates the opposite, a misrepresentation of the rights of individual service users. The potential of statistics lies in the improvement of the knowledge leading to a reduction of human bias but it is important to stress, that decisions themselves should be made by individual or teams of social workers.

*Potential benefits (3): benefitting from practice experience of others*

An important component of decision-making in social work is past experience. Risk may be considered as a combination of current circumstances combined with knowledge of earlier experiences for the individual analyzed in relation to the knowledge of what constitutes risk for individuals in these circumstances and conditions. Including statistical information in social work decision-making adds to the role of previous experience. Statistical data is by definition based on previous experience as the data collected is based on something that happened in the past and has been recorded in the form of numerical data. In other words, statistical data is always retrospective.

This means that including statistical data makes it possible to use previous experience of not only the specific social worker or team of social workers making the decision, but from thousands of decisions made regarding a similar situation. A statistical tool can include data from an enormous amount of cases, distill the data, and within seconds instantly present a pattern of what constitutes risk for the individual in question. Not all previous decisions were correct which means that statistical information is inevitably flawed. However, when including a large number of similar cases, a statistical calculation can provide the best empirical evidence of what is needed. It might be argued that the good social worker is already capable of including past experiences as well as expertise from other professions. The inclusion of statistics however makes the process much faster and more structured. Within minutes (or perhaps seconds), data can be calculated, and an assessment is available based on data from a large number of previous cases.

The strength of statistical approaches is that they can combine numerous variables to estimate correlations (i.e. relationships) (not causation – see discussion below) between

these variables. The combination of factors can be based on the strength of these risk factors as evidenced through research. The alternative, and probably the norm in current practice, is that individual social workers (and other professionals) weigh the risk factors based on their own work and personal experience, leading to variations in judgements and hence decisions.

In summary, using statistics in risk assessment in social work has promising prospects, however there are a number of critical challenges that will be addressed in the following section. As the discussion of including statistics in social work is a cross-professional issue, the topics to discuss are plentiful. In this article, we have limited the issues to ethical, legal, organizational and technical issues.

## **Challenges in using risk factor statistics in social work**

### *Challenges (1): ethical issues*

When discussing statistics and risk, a common concern is that statistics are ignorant of ethical issues. This critique may be correct in the sense that statistics encompass individual considerations within overall patterns of behaviour of 'typical people' with those characteristics, ie based on the data in the risk model. The statistical method is only as good as the data included which makes data accuracy a technical as well as an ethical issue.

It is clearly important that the data included in any decision or assessment is accurate. Those working in the field of social work know the inherent limitations in many information systems. If misleading (such as mis-categorized) data is used to predict risk, this will reduce the accuracy (and hence the value) of any calculations of risk based on the data. Data must be up-to-date, and sufficiently accurate and precise in order for the calculation of risk to be precise. Furthermore, the weight of various input must be considered carefully.

Sensitive issues such as to whether information on cultural background should be gathered and included in the statistical model are highly important. Statistical models to assess risk of child abuse operating in the United States include race as a variable (Vaithanathan et al 2013), while race and ethnic origin are not included in a model being tested in Denmark (Søbjerg & Vijayarankan, 2018). Arguments pro and con including this kind of data are highly important when designing the model that assesses risk as minority groups may be over-represented as recipients of welfare services. An important question unrelated to the use of statistics may be whether to register cultural data in the first place? The important thing is how the data included are dealt with and why, which means that thoughts around cultural context and representation of minorities come into consideration when we seek greater accuracy in predicting risk. Statistical models might reduce the potential cultural bias of human beings (including professionals), if data on cultural or ethnic issues are properly incorporated and calculated in the models. This must be considered when defining outcome measures.

When discussing statistical calculations of risk, it is important to stress that correlation is not causation. A correlation for instance between gender and crime (men are more often convicted of a crime than women) does not mean that all men are criminals. Equally, it does not mean that no women are criminals. If we were asked to predict the risk of harm, crime, child abuse and suicide, certain groups from for instance ethnic or religious minority groups



or certain deprived areas of the community, may be considered more likely to present those risk factors and from a statistical point these are valid indications. The problem is not the statistical model itself, but human beings using statistical correlation to create stereotypes without understanding how to use such information (Pollack, 2010).

An added dimension is the development of preventive services which are by definition targeted at those who are regarded as being at greatest risk. Identifying those at risk (whether of being harmed or of harming others) is symptomatic of the labelling practice that professionals' work within. Being labelled "at risk" may have adverse social consequences of stigmatization. Families may feel stigmatized and labelled because of things that happened in the past, but which are no longer present in their lives. A former drug abuse will affect a statistical assessment of risk, despite of the individuals having overcome the addiction years ago. When an assessment is based on information about previous behavior, the challenge of how much weight to put on historical data is present. This ethical challenge is present with both statistical and manually-provided information. For social work, attention needs to be paid to the dynamic factors where social workers might help people to make a difference in their lives. This may require stronger data and modelling power. The provision of statistical information will not change the central ethical issue here, but it will no doubt sharpen the debate as the information becomes more reliable and - to some - more concerning (Axford & Berry, 2018; Featherstone, Morris & White, 2014).

#### *Challenges (2): legal and organisational issues*

Institutional and legal aspects of risk assessment are important and interlinked issues related to statistics in social work. Abiding by legislation regarding data usage is an essential aspect of the development of the science of understanding risk factors in social work. One of the strengths of statistics is using large amounts of data, however legal restrictions mean that not all data may be included. The data included can in principle be all kinds of information about the service user, but that does not mean that all kinds of information can be legally included. The General Data Protection Regulation (GDPR) which has been in operation in the European Union since May 2018 has a strong focus on data protection of quantitative data and the rights of individuals. A key rule in GDPR is that personal data may only be used for the purposes for which it was gathered (European Commission 2018). National and local legislation can put additional restraints on the sharing and analysing of data. For social work services it may be that statistical data from, for instance health services or the judicial system, might require procedures not yet developed in order to be included in the holistic assessment of welfare risks.

The aim of analytical statistics in social work risk assessment is to identify and help individuals in need of public assistance but there is a concern that this benevolent concern violates personal rights and individual integrity. A distinction should be drawn between population-based assessment and assessments based on potential risks of individuals who are already referred to public services. Organisational matters relate to the organization of social work, the management and social workers themselves. Irrespective of the inclusion of statistics, an increased focus of effectiveness and the avoidance of scandals has led to legal and organizational changes in social work practice. A demand for speedy and precise assessments and decisions place a pressure on social work managers. Managers may be eager to engage with statistics if they expect new technologies and tools to save money and

make less mistakes. Furthermore, managers might be interested in showing that they run a professional, rational operation and using data and statistics supports this impression.

As a social worker, concerns about individual issues are not only related to service users but also to themselves. An important question to ask as a social worker is obviously; what is in it for me? Does the new technology provide new opportunities, increased responsibilities or support the fundamental job role? A primary concern might be how the introduction of technology will affect social workers' judgements. Fear of being replaced by a computer furthermore instigates pressure on social worker's professionalism and feeling devalued in decision-making does not make acceptance of technologies easy. A fear of numbers perhaps based on lack of understanding or knowledge of statistical methods can add to a sense of inferiority.

Education and inclusion of social workers in the development of statistical methods are imperative to the development of constructive statistical tools. The responsibility for decisions based on statistical models remains with those who use the models as well as those who develop them. Social workers need to acknowledge this responsibility and engage in the debate and the development (Lagsten & Andersson, 2018). Only by engaging actively in the debate and the development of tools will it be possible to influence the development in a direction which suits the social work profession and provides actual improvements for the users of social care services.

### *Challenges (3): technical issues*

Key technical issues relate to the availability, validity and reliability of data (Mendoza et al, 2016; Putnam-Hornstein, Needell, & Rhodes, 2013; Simpson et al, 2000; Camasso & Jagannathan, 2000). Reliability is essentially about whether the calculations based on statistics can be trusted. Phrased in a philosophical frame, the question is how we judge the truthfulness of probabilistic information based on certain mathematical and logical principles. Can an assessment based on statistical models be trusted, when considering a specific case of suspicion of abuse in a family? By including statistical data generated by probabilistic calculations on the subject of abuse, a conclusion might be that in seven out of ten cases (70%) the abuse is likely to be substantiated and to happen again. How trustworthy is this information in the specific case? This case may be one of the 30% in which abuse does not recur. Statistics based on data from the past cannot determine with 100% certainty that harm will occur. Nor can humans! In an article about predictive models, Gillingham (2019) discusses whether an accuracy of 70% is sufficient to argue that a model can predict risk. Obviously, if the target is 100% accuracy, 70% is not impressive but the question is what this percentage is compared to. Manual decision-making is not 100% certain either. The important thing is to strive for a higher knowledge of risk combining all the information possible.

The fact that statistical prediction comes out with a number or percentage illustrates the distinction between traditional professional judgement and the outputs of statistical models. The existence of a percentage makes it easy to blame the models for the same flaws that are inherent in the decisions that have no clear rationale (Shlonsky & Wagner, 2005).

Probabilistic calculations are based on available life factors that are taken into account as numbers and put into different equations. However, are the variables used in the calculation

equal, similar or even comparable to the factors in the particular case being considered? Most data related to social work exists in the form of text rather than numbers which means that much of the information that social workers normally include in their assessment cannot be included in a statistical calculation. Furthermore, the quality of available data may be questionable if the collection and handling of data is not sufficiently systematic.

The design and implementation of risk assessment tools are important to include in the development of statistical models (Gambrill & Shlonsky, 2000). However there are sufficient examples of promising developments on technical issues to suggest that the use of statistics within social work assessment of risk now needs to be on the agenda for the profession (Baumann et al, 2005; Coohy et al, 2013; Johnson, 2011).

## **Discussion**

Research indicates that all-too-human professionals have limited capacity to predict the likelihood of future events, and that there is wide variability in such judgements. There is great potential to reduce bias through statistical methods which enable us to learn from the experience of others, in line with sound ethical principles of using best available evidence to inform practice. However, there are legal, ethical, organisational and technical challenges to using statistical approaches to analyse risk factors. Professionals and the public can feel threatened if they do not understand the methods. There may be issues of labelling and stigma to address. For service managers, there may be issues of responsibility for data, and how it is used. Technically there are challenges in turning mountains of data into 'actionable intelligence', bringing a need for statistical understanding in the profession.

### *Linking with assessment processes and tools*

Assessments, and tools to support the task and process of assessment, are a mainstay of social work practice (Fengler & Taylor 2019). There are many varieties of approach, from simple checklists which primarily support the interactive process with clients (Taylor & McKeown 2013) through those that standardise language and facilitate coordinated services (Taylor 2012a) to those that are starting to embody quantified risk factors (Johnson, Clancy, & Bastian, 2015). However, the integration of meaningful, accurate and widely understood risk factors into assessment is still at an early stage of development (Barlow, Fisher & Jones, 2012). With the advent of computers, it is possible to develop assessment tools into interactive web-based decision-support systems that can support practice by incorporating the latest knowledge on risk factors. The integration of client-based statistical knowledge with other forms of evidence (knowledge) to inform social work is an important area for future development of the profession (Taylor, Killick & McGlade, 2015).

### *Linking with decision processes and professional judgement*

Even when we have robust statistical data on risks, it will be necessary to consider how this interacts with human judgement and decision processes (Mullineux, Taylor & Giles 2019; Mullineux, Taylor & Giles, in press; Taylor 2012b) and the use of other forms of evidence within social work (McCafferty, 2020; Taylor, 2020a; Zheng et al, 2020). It cannot be assumed that human beings will process data in a way that a computer would; it is much more likely that some form of mental heuristic ('shortcut') is used in practice, even if subconsciously. This has implications for how risk data is conceptualised and communicated (Stevenson, McDowell & Taylor 2018), and the extent to which words are used instead of

numbers to express the likelihood of some event happening (Stevenson & Taylor 2017; Taylor, Stevenson & McDowell 2018). It will be essential that statistical approaches are developed in tandem with the development of clear argument-based approaches which give an overview of the human as well as the statistical dimensions of risk and decision-making (Whittaker, 2018), building on time-honoured practice wisdom (Ferguson, 2010). Further discussion on this point is beyond the scope of this article, and the interested reader is referred to Gigerenzer and Goldstein (1996) and Taylor (2017b).

#### *Implications for education and training*

The development of better understanding of risk will require social workers (and other professionals) to be more numerate in the future (Taylor, 2020b) and may radically re-shape the profession (Mohan, 2018). The tasks facing the professionals of tomorrow will be how to incorporate statistical knowledge into their cognitive judgement processes, rather than attempting to predict human behaviour using unstructured methods (Taylor, 2020) which cannot be fully explained or taught to others. There are, of course, dangers that professionals might come to rely too heavily on statistical methods, particularly if they are newly-qualified or not sufficiently numerate. Whilst the statistical and risk literacy of professionals, including social workers, needs to be improved, the task will focus more on understanding and using presented data, rather than human estimation of probabilities of rare events. Initial research suggests that newly educated social workers might be more prone to follow the judgement of statistics than experienced social workers (Søbjerg, forthcoming). This may indicate that statistics can lead to increased equality among service users. Or it may indicate that statistics could gain more power than anticipated. Further research is necessary to know whether the introduction of statistics in social work should be adjusted to different groups of social workers. It is imperative that social workers are involved centrally in building tools for integrated assessment rather than leaving it to others. We also need to ensure, however, that developing statistical tools does not lead to de-skilling of the profession (Crisp, 2004; Gillingham, 2011) but provides usable decision support (De Bortoli & Dolan, 2015).

#### *Developing the knowledge base for practice*

As systems of professional governance develop (Taylor & Campbell 2011), perhaps in response to political and media pressure, it will become increasingly important to be able to demonstrate the reasoning process behind decision-making. In a context where the possibility of harm in the future ('risk') is a major aspect of social work decisions, increasing interest in developing robust approaches to statistical data about risks will inevitably grow. However it has to be acknowledged, particularly by research funding bodies and those responsible for inquiries into tragedies, that the profession has a low starting point in terms of statistical literacy. The challenge for the social work profession is that if professionals do not embrace the rapid developments of the digital age, we will be swept along in the stream of wider currents.

To develop statistical approaches to risk to a point where they can effectively inform practice requires research on aspects such as:

- creating clear definitions of risk factors;
- creating a categorisation of outcome harms (risks);
- developing useful and usable measures of risks and of outcome measures;
- developing information systems to gather measures of risk and outcomes;

- testing mathematical models for analysis of risk factors; and
- developing effective human-machine interfaces to communicate risks.

In a broader perspective, future research along these lines could lead to innovative development of a new discipline of 'social epidemiology', as well as the prospects of computerised machine learning.

## Conclusions

Statistical methods have potential for reducing human bias, for reducing variability in human judgements and for learning from the experience of others. Although there are ethical, legal, organizational and technical challenges, the social work profession can no longer ignore the widespread and growing use of statistical approaches to understanding risks. The social work profession needs to acknowledge its responsibility and engage in the debates and the development of statistical systems, for the ultimate benefit of the those who need the help of social workers. Operational systems to support decision-making and training courses need to embrace the use of numeric data as a form of knowledge to support the core interpersonal skills. Despite the various challenges, it is time for the profession to embrace the new and emerging technologies so that they can be developed within an ethical framework in the best interests of clients and families. The issues outlined here will become more acute, and have added dimensions, as we progress towards 'big data' and machine-learning approaches to analysis of risks.

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## Declaration of Interest

Brian Taylor has recently been involved in setting up DARE Training & Development Ltd ([www.daretraining.eu](http://www.daretraining.eu)) which includes within its purposes the development of predictive analytics for health and social care. The other authors declare that there is no interest relevant to their authorship of this paper.

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