

Methods for providing an earlier warning of emerging drug trends

JANE MOUNTENEY



Dissertation for the degree philosophiae doctor (PhD)
at the University of Bergen

JUNE 2009

Acknowledgements

The work presented in this dissertation was carried out at the Department of Public Health, Faculty of Medicine and Dentistry, University of Bergen, and at the Bergen Clinics Foundation. I am grateful to the Department of Public Health and the faculty for giving me the opportunity to undertake this doctoral study. A special thank you to my supervisor, Associate professor Siren Haugland for all her energy, encouragement and support during the last three years.

I am indebted to colleagues at the Bergen Clinics Foundation, who not only allowed me to set up the BEWS system in 2002 but funded and fully supported my doctorate study whilst working at the Competence Centre. In particular I wish to thank Liv Flesland and Siv Elin-Leirvåg who have enthusiastically assisted me with the development of the model, my manager Vibeke Johannessen, and director Erling Pedersen for their kindness and support.

Thanks to Meltzerfondet, HSH and Fagrådet who helped fund my study visits to Australia in order to work on this dissertation. I would also like to recognise and thank Australian colleagues who inspired, supported and contributed to this study, in particular Dr Craig Fry from Turning Point, Melbourne, Dr Mark Stooze from the Burnet Institute, Melbourne and colleagues at the UNSW in Sydney. Thank you also to Professor Neil McKeganey for his valuable contribution.

A very special thank you to my family for their support and encouragement, in particular my parents and Else Kristin. This work is dedicated to my father, Ivor Mounteney, who kindly helped with translations and who sadly passed away before it was completed.

Bergen, Norway

June 2009

Jane Mounteney

SUMMARY

There is increasing international interest in the improved timely identification and reporting of new and emerging drug trends. Research directed at examining drug trends is particularly important in the contemporary context where a variety of new substances are available to increasingly diverse populations and in an expanding range of settings. Against this background, the primary aim of this study is to take up the theoretical and empirical challenge of developing a methodology and a model for earlier identification and earlier warning of emerging drug trends. Based on the Bergen Earlier Warning System (BEWS), the objectives of this thesis are to examine: key features required for a city level drug earlier warning system; drug measures or ‘indicators’ to identify new and changing patterns in use; major challenges associated with data reliability, validity and triangulation; use of psychometrics to improve system validity; and how the model can report on the illicit use of medicines.

The Bergen Earlier Warning System (BEWS) was established in 2002 drawing on principles derived and lessons learned from a European feasibility study conducted in 1998 (EMCDDA, 1999; Griffiths et al., 2000). The system is multi-source (drawing on a range of indicators of drug use, mortality, morbidity and market characteristics), incorporates a mix of approaches (routine data collection, media monitoring, key informant study) and utilizes mixed methods (both quantitative and qualitative).

Results demonstrate that the use of the principles for psychometric scale development can assist with enhancing the validity of emerging drug trend monitoring systems (EDTMS), providing a coherent and explicit developmental framework, that has wider applications. A five stage review and refinement process is presented for the development of an EDTMS that focuses on strong construct, congruent and external validity. The use of a ‘pragmatic’ research paradigm is argued for in conjunction with a mixed method, multi indicator approach. Five criteria for indicator selection are

presented and it is demonstrated how these may be utilized to attribute weightings to individual sources in the analysis phase. Key issues relating to reliability and validity in the monitoring of emerging drug trends are identified, specifically challenges at the level of system construction, as well as reliability challenges at the level of individual data sources. A general approach to analysis of mixed data is proposed based on overt triangulation practices. A specific example of analysis is provided with reference to BEWS' use of an aggregated differential score. Finally, it has been shown how the BEWS can be used to monitor trends in alcohol, drugs and the street use of medicines and report back to policy makers and practitioners for early intervention purposes.

List of publications

- I Mouteney, J. & Leirvåg, S-E. (2004). Providing an Earlier Warning of Emerging Drug Trends: the Føre Var System. *Drugs: education, prevention and policy*, 11(6), 449–471.
- II Mouteney, J. & Haugland, S. (2009). Earlier warning: a multi-indicator approach to monitoring of trends in the illicit use of medicines. *International Journal of Drug Policy*, 20,161-169.
- III Mouteney, J., Fry, C., McKeganey, N. & Haugland, S. (2009a). Challenges of reliability and validity in the identification and monitoring of emerging drug trends. *Substance Use Misuse*. In press.
- IV Mouteney, J. Stoove, M. & Haugland, S. Monitoring emerging drug trends: psychometrics and validity in earlier warning systems. (2009b) *Submitted*.

Contents

ACKNOWLEDGEMENTS	2
SUMMARY	3
LIST OF PUBLICATIONS	5
1. INTRODUCTION	8
1.1 Background	8
1.2 Central concepts	13
1.3 Emerging drug trend monitoring	15
1.4 Challenges with developing a system	17
1.5 Theoretical underpinnings	20
1.6 Research questions / aims	24
2. METHODS	25
2.1 The BEWS method	25
2.2 Use of multiple indicators/data sources	31
2.3 Mixed methods	32
2.4 Analysis & triangulation	36
2.5 Reliability & validity	40
2.6 Psychometrics & refinement	42

3. RESULTS	43
3.1 Paper I	43
3.2 Paper II	43
3.3 Paper III	44
3.4 Paper IV	45
4. DISCUSSION	46
4.1 Summary of results	46
4.2 Results in context	47
4.3 Strengths and limitations	49
4.4 Ethical considerations	52
4.5 Impact for policy and practice	54
4.6 Future research	57
4.7 Concluding remarks	59
References	60
Papers	
Appendices	
Data sources	
Analysis tables	
Indexes & weightings	

Methods for providing an earlier warning of emerging drug trends

1. INTRODUCTION

1.1 Background

Drug epidemiology focuses on understanding the nature, extent, consequences and aetiology of drug use across individuals, families, age groups, gender, communities, and population groups. Epidemiologic research plays a critical public health role by providing an estimate of the magnitude, impact, and risk of drug use in a population, and by laying the foundation for developing strategies to prevent drug problems, plan and evaluate drug services, and suggest new areas for basic, clinical, and treatment research. The study of prevalence and incidence of drug use in the general population is, however, riddled with problems linked to small numbers of users, low reporting rates because of the illegal nature of drug use, and often hidden and disadvantaged populations who are not picked up in school or household surveys (EMCDDA, 1999).

There is increasing international interest in the improved timely identification and reporting of new and emerging drug trends. Research directed at examining drug trends is particularly important in the contemporary context where a variety of new substances are available to increasingly diverse populations and in an expanding range of settings. Both unpredictable patterns of drug availability and evolving social and cultural trends influence patterns of drug consumption. The ability to detect new developments, for example methamphetamine use or misuse of medicines, increases possibilities for policy makers and practitioners to respond with informed interventions.

At the international level, the Lisbon Consensus statement forms a basis for agreements on drug trend monitoring standards. A central issue is that of finding a balance between the need for comparable data and the need to develop data collection methods that are sensitive to local cultures and contexts. There has been international agreement to focus on a core data set – a limited number of indicators to be developed and included in monitoring systems: drug consumption among the general population; drug consumption among the youth population; high-risk drug abuse; service utilisation for drug problems; drug-related morbidity; and drug-related mortality. In a European context, the EU action plan on drugs calls for member states to provide reliable and comparable information on five key epidemiological indicators:

- prevalence and patterns of drug use among the general population (population surveys)
- prevalence and patterns of problem drug use (statistical prevalence/incidence estimates and surveys among drug users)
- drug-related infectious diseases (prevalence and incidence rates of HIV, hepatitis B and C in injecting drug users)
- drug-related deaths and mortality of drug users (general population mortality special registers statistics, and mortality cohort studies among drug users)
- demand for drug treatment (statistics from drug treatment centres on clients starting treatment) (Hartnoll 2003).

This growing emphasis on emerging trend identification is reflected at the inter and intra jurisdiction level in many countries, for example in the recent European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) regulation under which the agency is called upon to play a more active role in monitoring new drug use patterns and emerging trends (Regulation (EC) No 1920/2006). The European plan on Drugs 2005 to 2008 required all European member states and Norway to

establish national systems for this purpose, however in reality, very few nations have yet been able to make much progress against this objective. The challenge is that traditional epidemiological research tools and core indicator data currently being used to monitor drug trends are insufficient to identify and rapidly report new and emerging patterns.

Norway has a number of empirical studies which play a role in the monitoring of drug use in specific populations, primarily longitudinal surveys amongst school pupils (Hibell et al., 2007; Lund et al., 2007; Skretting, 2007). The Norwegian Institute for Alcohol and Drug Research (SIRUS) produces an annual compendium of official drug and alcohol related statistics and special surveys entitled “Alcohol and Drugs in Norway” (Bryhni et al., 2009). In addition, as the Norwegian focal point to the EMCDDA, SIRUS produce an annual report entitled ‘The Drug Situation in Norway’ each year (SIRUS, 2008). Norway also reports in to the EMCDDA Early Warning System on new synthetic drugs (EMCDDA, 2007). However, there has been little research activity geared specifically towards the rapid identification of emerging drug trends.

A range of drug trend monitoring systems operate internationally, most are multi-source (drawing on a range of indicators of drug use, mortality, morbidity and market characteristics), incorporate a mix of approaches (for example structured questionnaires, semi-structured and in-depth interviews) and utilize mixed methods (both quantitative and qualitative). Whilst some systems adhere to an epidemiological surveillance methodology with an emphasis on methods precision, others take a more ethnographic approach, emphasizing contextual information and richness in description. These approaches make different assumptions about the phenomenon in focus, and the manner in which it is studied. There exists both methodological diversity in the approach to monitoring emerging trends, and lack of a coherent

theory base on which such systems are developed (Griffiths et al., 2000). Systems have developed, often ecologically, in response to differing policy needs and in specific political contexts. It is often unclear what the underlying hypotheses are for individual monitoring systems. The political, social and ideological context in which a system operates, for example zero tolerance or harm reduction, will impact on its objectives and structure. In the former, more credence might be placed on interdiction, policing or corrections indicators, whereas for the latter, systems might want to focus more on morbidity, mortality and social outcomes of drug use.

Drug monitoring systems which do make reference to a theory base tend to adhere to the method that is primary within the system. For example, survey-led systems generally refer to epidemiological paradigms (Hando et al., 1998; Kemmesis & Hess, 2001), whilst informant focused systems cite social research and qualitative paradigms to explain their operation (Korf & Nabben, 2002; Mheen van de et al., 2006a). However, an issue that is rarely addressed is the fact that most models draw on a mix of methodologies. Survey-led systems may also use semi-structured interviews with key informants and focus groups. Qualitative interview-based systems include school or drug user survey data. In addition, most systems include a range of secondary data sources.

In general, little attention has been devoted to issues of reliability and validity in the context of identifying emerging drug trends. When considered, this tends to be explored at the level of individual information sources. However, the choice of sources and the way they are combined will affect and may change the results. A weakness common in many systems is undeveloped work on the challenges associated with whole system validity. There is often a poorly explained link between the methods described and the findings presented. Hartnoll's jigsaw puzzle analogy can be used to highlight this problem (Hartnoll, 1997, p.259). Systems are able to

report what the individual pieces (indicators) tell about drug trends and also what the unfinished jigsaw puzzle appears to be showing – but there is rarely sufficient explanation of the strategy used to put the puzzle together. It is common practice to name data triangulation as a solution to reliability and validity challenges, yet the reasons for, and exact nature of this triangulation often remain implicit. This topic of drug data analysis and triangulation may be of wider interest than rapid reporting of emerging drug trends. Many of the same challenges exist for international, national and local reporting of drug use, all of which rely to a greater or lesser extent on the use and analysis of a range of imprecise indicator data.

Emerging trends in the illicit use of medicines is currently high up on the international policy agenda. The United Nations has expressed concern that the variety of internationally controlled substances available on the unregulated market had been increasing (INCB, 2007). In addition, that drug traffickers are turning to innovative ways of diverting and smuggling such substances, and by making available medicines that are often poorly documented, unsafe, ineffective or of low quality, the unregulated market exposes patients to serious health risks. A recent summary of findings presented at the US Community Epidemiology Work Group found the sale of narcotic analgesic pills to be increasing as well as the diversion and non-medical use of prescription drugs (Maxwell, 2006). The 2006 US Monitoring the Future survey of 8th, 10th and 12th grade pupils indicated recent use of illicit drugs had dropped by 23% since 2001. By contrast, abuse of prescription opioids remained at ‘unacceptably high levels’ (Johnston et al., 2007).

The ongoing surveillance of the availability of medicines on the illicit drug market is important for a number of reasons. There are numerous adverse health consequences linked to misuse of medicines (Darke, 1994; Ghodse, 1995), including addiction, drug-related overdoses (Strang et al., 1999; Oliver et al., 2001), injection related

problems (Strang et al., 1994; Fry & Bruno, 2002; Degenhardt et al., 2006), and concerns about illicit use of prescription medicines by non-dependent drug users (Fountain et al., 2000; Mounteney & Leirvåg, 2005). In this context, the monitoring of prescribed medicines available on the illicit market allows for earlier reporting of emerging trends. Earlier identification increases the possibilities for earlier intervention and more rapid policy responses to prevent spreading and increased risk of drug-related harm.

This thesis focuses on one particular function that drug monitoring systems are asked to perform – that of providing an early warning of the emergence of new drug trends. In doing so, this thesis takes up the theoretical and empirical challenge of developing a methodology and presents findings from a model for ‘earlier’ warning at the city level. Topics to be addressed are:

- Selection of drug measures or ‘indicators’ in an earlier warning system
- Challenges associated with data reliability, validity and triangulation
- The use of psychometrics to improve system validity
- Findings with regard to the illicit use of medicines.

1.2 Central concepts

A number of concepts are central to this thesis and therefore working definitions are provided below (in alphabetical order):

Drug indicator – can be used to describe any data source on drug use, with agreed rules for recording and reporting, to measure drug use prevalence or incidence. Typical indicators include drug seizures, treatment demand and drug overdose deaths. The term ‘indicator’ is used to emphasize the point that the data are not a direct measure of drug use in the general population (Griffiths et al. 2000).

Early warning system – a drug information system designed specifically for the purposes of identifying changes at an early stage only. A term often used without precision (Griffiths et al. 2000).

Emerging drug trend monitoring system (EDTMS) – a drug monitoring system with a specified objective relating to the early identification of emerging drug trends. EDTMS typically provide a repeat ‘situation analysis’; utilize multiple methods and data sources; incorporate one or more sensitive or leading edge indicator; and are concerned with rapid reporting of findings to the policy and practice fields (Mounteney et al., 2009a).

Mixed methods – a research design with philosophical assumptions as well as methods of inquiry. As a method, it focuses on collecting, analyzing, and mixing both quantitative and qualitative data in a single study or series of studies. Its central premise is that the use of quantitative and qualitative approaches in combination provides a better understanding of research problems than either approach alone (Creswell & Plano Clark, 2007).

Monitoring – the intermittent performance and analysis of routine measurements, aimed at detecting changes in the environment or health status of populations. Surveillance refers to a continuous process (Last, 2001).

Multi-indicator model – used to describe a common method for modelling patterns of drug use that utilizes and contrasts two or more different indicators of drug consumption (Griffiths et al., 2000).

Trend – movement in one direction of a variable over a period of time (time series data). A trend is dependent on the time range considered. An essential feature is that the movement, while possibly irregular in the short term (fluctuations) shows movement consistently in the same direction over a longer term (Griffiths et al., 2000). An emergent drug trend can include the introduction of a new drug, a new combination of drugs, a new way of using an existing drug and a significant increase or spread in use of an existing drug into new groups or populations. Within the

BEWS reporting, a trend is defined as consistent changes over two or more years – four (six monthly) data points (Mounteney et al., 2009b).

Triangulation - refers to the combination of two or more theories, data sources, methods or investigators in one single study of a single phenomenon to converge on a single construct. Mutual validation involves cross checking findings from multiple sources against each other, on the basis that if a finding passes a series of tests with different methods, it can be considered more valid than with just one (Denzin, 1989, Patton, 1990).

1.3 Emerging Drug Trend Monitoring

This study takes as a starting point previous research undertaken on the development of drug information systems with an early warning objective or function. Internationally, there are numerous drug information systems in existence which employ diverse methods in order to provide an early identification and monitoring of drug trends (see table 1). No single blueprint exists stating what drug information systems (DIS) should look like or what specific tasks they should perform. An evolutionary process has produced a range of different models who share common features but whose configuration owes much to the socio-political context in which they were developed. Griffiths and colleagues (2000) reviewed 22 such systems, and differentiate between drug information systems in relation to: operational level (city/local, national or international); structure (organisational system or human network); function (early warning or multi function); range of data sources; and investigation method (continuous monitoring or outbreak investigation). Since then, there has been a continued growth in new models, ranging from international systems (Alvarez et al., 2003), to those focusing at a city level (Kemmesis & Hess, 2001; Mounteney & Leirvåg, 2004).

Table 1: Examples of drug information and monitoring systems with an early warning function

SYSTEM	Coverage, operational level	SURVEY	ROUTINE DATASETS	KEY INFORMANTS/ EXPERTS	MEDIA	QUALITATIVE RESEARCH	REFERENCE
EPOD (EMCDDA)	Regional Europe	✓	✓	✓	✓	✓	<i>EMCDDA, 2006</i>
CEWG (US)	National	✓	✓	✓	X	X	<i>Sloboda, 1999</i>
DAWN (US)	National	X	✓	✓	X	X	<i>OAS, 2006</i>
IDRS/EDRS (Australia)	National	✓	✓	✓	X	X	<i>Hando et al., 1998</i>
DTMS (Ireland)	National	X	✓	✓	✓	X	<i>O’Gorman et al., 2007</i>
SACCENDU (South Africa)	National	✓	✓	✓	X	X	<i>Parry et al., 2002</i>
ANTENNA (Amsterdam, NL)	City/ local	✓	✓	✓	X	✓	<i>Korf & Nabben, 2002</i>
MOSYD (Frankfurt)	City/ local	✓	X	✓	X	X	<i>Kemmesies & Hess, 2001</i>
FØRE VAR (Bergen, Norway)	City/ local	✓	✓	✓	✓	X	<i>Moutaney & Leirvåg, 2004</i>
DMS (Rotterdam, NL)	City/ local	✓	X	✓	X	✓	<i>Mheen van de et al., 2006</i>

At the international level, the Inter-American Drug Abuse Control Commission (CICAD) plays an important role in monitoring drug use in the Americas. The European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) is responsible for collecting data and reporting on drug use in Europe. UNODC supports the Accord network in Asia (UNODC, 2006) and is working to establish regional systems elsewhere. The collaborative European Trend project was established to identify and understand early changes in drug use or new drugs more quickly than by using standard monitoring systems (Alvarez et al., 2003).

At a national level the Illicit Drug Reporting System (IDRS) in Australia, has been monitoring trends since 1996 (Darke et al., 2001; Topp et al., 2004). Similarly, the national US Pulse Check system, utilising three key informant samples to inform on national and local trends, was established in 1995 (ONDCP, 2002). At the city level, the Antenna project has been providing annual updates on the youth and drug scene in Amsterdam since 1993 (Korf & Nabben, 2002). A two year research study in Berlin (Domes & Kraus, 2002) explored the ability of professional informants to accurately identify new drug trends as verified by statistical sources. And more recently, Frankfurt has developed the MoSyd system for monitoring drug trends, comprising an open scene survey, a school survey and a trend scout panel in order to monitor the Frankfurt drug scene (Kemmesies & Hess, 2001). New models appear regularly e.g. the Youth Drug Reporting System in Melbourne (Gray, 2004) and Vancouver (Duff et al., 2006), and the New Zealand Illicit Drug Monitoring System (Wilkins, Girling & Sweetsur, 2007).

Several national drug information systems monitor illicit use of medicines alongside other narcotic drugs, including the US Community Epidemiology Work Group (NIDA, 2005), Australia's Illicit Drug Reporting System (Hando et al., 1998) and South Africa's SACCENDU (Parry et al., 2002).

1.4 Challenges with developing a system

By definition, the identification of new drug trends requires information to be collected on behaviours that have previously been unidentified. New trends in populations already monitored may also remain undetected as no existing routines or codes cover the topic. When the behaviour occurs in a new population, even greater difficulties exist. However it is reasonable to assume that information exists, it is just not collected or collated. It remains 'trapped' and not available to inform policy development.

The 1999, the European Monitoring Centre on Drugs and Drug Addiction feasibility study highlighted a number of challenges that would need to be addressed by drug information systems aiming for the timely and reliable reporting of emerging drug use trends (EMCDDA, 1999). It concluded that the majority of traditional drug information systems, whether treatment databases, seizures figures or schools surveys, have not been developed with the rapid reporting of new drug phenomena in mind. With such systems there is generally a considerable time lag between the collection of data and reporting of findings. In addition, instruments such as surveys and databases require the addition of new codes each time a new topic is to be investigated. In particular, traditional drug information systems were found to provide relatively poor information on recreational drug use and new drug trends.

Arguably the most intractable issue for drug monitoring systems to address is this need for temporal relevance. The challenge is that reliable data on the existence of a new pattern are only likely to become available after it has become established. In addition, information systems are faced with the problem that the collection and reporting of data is often a time consuming business. The EMCDDA feasibility study

included a review of the UK literature documenting the emergence of the heroin smoking epidemic in the late 1970's and the emergence of ecstasy use in the late 1980's, which highlighted the existence of cultural and time gaps between emerging drug trends and drug information systems (Griffiths et al., 2000). In both cases many years elapsed between early media reports of the new trend and official reports from governmental or scientific sources. Such gaps represent obstacles to the rapid release of information to scientists, policy makers and service providers about new or changing patterns of drug use and their associated health risk (EMCDDA, 2001). The study identified a pattern of information diffusion, as details of the appearance of a new drug trend were recorded in the public domain. The first to write about new drug trends were the youth cultural press, shortly followed by the tabloid newspapers. The next written sources were annual reports from street agencies followed by customs seizures figures. This suggested a number of key information sources that could be considered for inclusion in a rapid reporting system.

In general, drug monitoring systems have to rely on indirect indicators of drug consumption rather than direct measures. As no single data source is capable of providing a reliable picture of drug use, use of multi-indicators and methods is the rule rather than the exception. However, the establishment of multi-indicator systems creates numerous methodological challenges. These include: the identification and collection of relevant sources of drug data; the coordination and standardisation of diverse data sets; and the cross referencing, weighting and analysis of data sets in order to provide a coherent picture. In terms of data source selection there are challenges relating to inclusion and exclusion criteria. Decisions need to be made as to which aspect of drug use data sources are measuring (drug consumption, health consequences, availability, public concern) and which populations are covered. Ideally, a balance needs to be found between sensitive and routine sources. The selection of methodological approach raises issues, such as whether it is realistic to combine sources from different epistemological and phenomenological traditions?

However, perhaps the greatest methodological challenge relates to choice of analysis procedures. All drug trend monitoring systems combine sources to some extent, the key question is how. Researchers need to give consideration to weighting of diverse indicators in the analysis and choose a method for triangulation. A risk here is resorting to the presentation of findings from different methods and sources in parallel, with little integration, not uncommon in mixed methods studies (Bryman, 2007). In reality we find a black box here for many systems, with the focus on a final product or report resulting in a dearth of methodological description.

A major challenge confronted ‘head on’ by this thesis is how can EDTMS demonstrate effectiveness – how can they show they ‘work’, in the sense that they succeed in the rapid identification of emergent drug phenomena. Many systems incorporate and utilise the very sources against which they might otherwise be evaluated. A local EDTMS might use national sources to compare for congruence in findings, however this would in many ways conflict with the knowledge that local patterns and variations in drug consumption do exist (Mheen van de et al., 2006b), so what happens nationally may not be a useful guide. Any analysis of ‘success’ would necessarily be retrospective, yet if an EDTMS was truly successful it would actually play a role in preventing the development of emerging trends by flagging and provoking a policy or practice response. If it is difficult to prove effectiveness by external comparison, an alternative approach, and one taken here, is to focus on system reliability and validity, in essence attempting to ensure the monitoring ‘tool’ is as considered and precise as possible. The in-depth focus on methodology is therefore an attempt to ensure any results or publicly reported findings are trustworthy and valid.

There are additional challenges specific to the monitoring of new and emerging trends in the diversion and illicit use of medicines. As with all illegal and stigmatized

behaviours, monitoring is plagued by under reporting, hard to reach samples, hidden populations, small numbers, and a dearth of reliable prevalence data (Hartnoll et al., 1998). Levels of incidence and prevalence of illicit use of medicines are not easily assessed through traditional health or social service channels (Hartnoll et al., 1998). There are multiple sources supplying medicines to the illicit market which can make surveillance complex, ranging from organised international criminal networks, theft from pharmacies and surgeries, forgery of prescriptions, procuring from family or friends, to individual users diverting small amounts of prescribed drugs (Fountain et al., 2000). The illicit medicine market is unpredictable and characterised by ‘doctor shopping’, ‘multiple scripting’, and ‘overscripting’ (McKeganey, 1988; Dale & Jones, 1992). Finally, the thriving global market linked to the internet sale of medicines from e-pharmacies, is particularly difficult to monitor.

1.5 Theoretical underpinnings

Choice of research paradigm - pragmatism

It is proposed that the ‘pragmatic’ research paradigm offers a useful starting point for the consideration of systems focusing on identification of emerging drug trends. Pragmatism as a general belief system has been used to justify combining qualitative and quantitative methods in the social sciences (Johnson & Onwuegbuzie, 2006). The pragmatic paradigm is concerned with applications and solutions to problems (Patton, 1990; Morgan, 2007). The research problem is most important, and researchers use a variety of approaches to understand the problem (Rossman & Wilson, 1985). It does not require commitment to any one philosophical system (Creswell, 2003) and researchers are free to choose methods that best meet their needs and purposes. It provides a philosophical underpinning for mixed method studies (Tashakkori & Teddlie, 1998). The pragmatic approach provides a flexible and strategic method for collecting and analysing data, useful as most drug trend monitoring research happens in environments that are both fluid and demanding of precision and timeliness.

Importantly, this approach also requires a clear rationale for choice of mixed/multiple data sources, and that attention is given to reliability, validity and triangulation issues.

Trend theories

The study of drugs and drug use is a truly multidisciplinary area. Depending on the discipline, drug use can be considered an illness (health and epidemiology), a social problem (social sciences), a cultural issue (anthropology and cultural studies), a criminal behaviour (legal studies and criminology), or drugs can be seen as a commodity (economics). As a result, a wealth of theoretical perspectives are available for the study of drug trends. Of particular importance to this study is literature that attempts to explain the reasons for and patterns in the way drug trends and epidemics develop (Kemmesies & Hess, 2001; Agar, 2001). Theories on the diffusion of innovation from the field of business and marketing have been used to explain patterns in drug use development within certain communities (Ferrence, 1994; Rogers, 1995; Golub & Johnson, 1996). Theories on the impact of social exclusion on trend development can also be found (Agar, 2001). More recent work on data modelling and drug trend development is also of interest (EMCDDA, 2001; Agar et al., 2004; Ritter, 2005) as is the potential for ‘futures’ methodologies such as scenario planning, to provide useful insights into the way trends can be detected (Caulkins et al., 2003; OST, 2005). Theory from three broad arenas: 1) public health 2) economics and marketing 3) social and cultural studies can be used to shed some light on two areas central to the development of EDTMS – trend behaviour, in particular patterns of diffusion, and key populations. These are briefly summarised below and possible implications for EDTMS development are drawn.

Health and epidemiological theories

The primary biomedical diffusion model follows an infectious disease route, with an infected (drug using) agent spreading ‘disease’ to a wider population. Such a model highlights the infected agent and ‘susceptibles’ as key players in trend diffusion. The

notion of 'epidemiological stages' assumes the spread of drug use is strongly linked to limits and bounds, primarily age, social status and geographic factors, which are the central differentiation criterion in classical epidemiology. The starting point of these theoretical models, named threshold model, critical-mass model or contagion model, refers to the idea of critical levels of incidence of a phenomenon in populations (Bless et al., 2002). If incidence stays below this point, the prevalence tends to gravitate toward some relatively low level equilibrium. But if incidence reaches the critical point, the process of spread can explode. Epidemiologists speak of a 'tipping or turning point', the point at which the usage of a drug can either turn into a serious public health problem, or, into a phenomenon remaining restricted to smaller user circles causing no striking social or health problems. Epidemiological models suggest the need to include drug users and their contacts (infected agents and susceptibles) within an EDTMS. In addition, they highlight the need to differentiate between an isolated or limited outbreak, and the tipping point for an emerging epidemic, where consumption spreads more widely to different populations.

Economic and marketing models

When drugs are viewed as a commodity, the classic diffusion of innovation and new technology models as described by Rogers (1995) lend themselves to our purpose. Rogers identifies a diffusion pattern with initial rapid take up of a new product followed by a slower spread through the wider population. The players most likely to try or buy a new commodity first, he calls innovators, closely followed by a group called early adopters. This suggests a system aiming for rapid identification of emerging trends needs ongoing contact with likely drug using innovators and early adopters. Economic theories of supply and demand are widely used in the study of drug markets with the common policy goals of supply reduction and demand reduction drawing on this model. A reminder here to include drug market indicators, linked to drug availability, price and purity in an EDTMS.

Social and cultural theories

Cultural theorists draw on both sociological and business models to explore trends. A new cultural trend may well be complex and multifaceted rather than simple – thus leading to discussion of new configurations of existing phenomena. In drug use settings this might involve new ways of using existing drugs, new modes of administration, or new cultural linkages between drugs, music and fashion. Social and cultural theorists emphasize the importance of cultural readiness and receptivity to a new trend – that the cognitive and material conditions need to be in place for a new trend to take root and develop (Kemmesis, 2002). Kemmesis identifies the importance of a pro drug mindset, which may be measured using a semantic differential tool (Kemmesis, *ibid*). Agar stresses the role of the circulation of cultural narratives in social networks – ‘the buzz’ – in the development of new trends.

Agar’s concept of ‘open marginalisation’ - the idea that certain population groups are marginalised from power and more susceptible to developing problem drug use – has been used retrospectively to explain heroin trends (Agar & Reisinger, 2001). In the context of the Antenna early warning system in Amsterdam, Korf & Nabben (2002) identify two particular youth subcultures both associated with new trends in drug use: 1) *Avant garde youth - clubbers/party goers*. These tend to be middle class young people, keen to be at the forefront of new social trends (including drug use). They are not generally in touch with social services or drug treatment services and are often linked with synthetic drug use. 2) *At risk youth - vulnerable young people*. These young people can include school truants, those in touch with the criminal justice system, those in social care etc and tend to be from more deprived backgrounds. They can be the first to experiment with ‘harder’ drugs such as crack cocaine and injectable substances. Korf & Nabben also highlight two different diffusion processes for new drugs, concluding that ‘avant-garde’ drugs, such as new synthetics, often make a downwards career movement from middle class to working class users, whilst

‘problem drugs’ such as heroin and crack, tend to stay amongst disadvantaged and marginalised groups.

These theorists remind us of the importance of taking a broad social and cultural perspective, using cultural mapping to help identify both marginalised and avant garde populations, as well as the cultural conditions and mindsets open to experimenting with new substances. In order to follow the ‘buzz’ and circulation of stories, we need to keep close contact with the user milieu, internet chat rooms and youth media. Taking on board the broad cultural trend definition, we are reminded to keep an openness to qualitative changes in consumption patterns, new and changing configurations, not merely new substances or quantitative increases or decreases. More recently theorists in all the above disciplines have explored the potential of complexity theory to explain trends – moving away from linear models to non linear dynamic models, better able, they argue to explain patterns and developments in complex systems such as emerging trends in drug use. Proponents such as Agar & Reisinger (2004) have incorporated complexity theory and agent based modelling in there work to attempt to develop a unified drug trend theory.

1.6 Aims of the study

The primary aim of this study is to take up the theoretical and empirical challenge of developing a methodology and a model for earlier identification and earlier warning of emerging drug trends. Based on the Bergen Earlier Warning System (BEWS), the specific aims of the thesis are to examine:

- key features required for a city level drug earlier warning system
- drug measures or ‘indicators’ to the identify new and changing patterns in use
- major challenges associated with data reliability, validity and triangulation
- use of psychometrics to improve system validity
- how the model can report on the illicit use of medicines.

2. METHODS

2.1 The BEWS method

The Bergen Earlier Warning System (BEWS) was established in 2002 drawing on principles derived and lessons learned from a European feasibility study conducted in 1998 (EMCDDA, 1999; Griffiths et al., 2000). The system is multi-source (drawing on a range of indicators of drug use, mortality, morbidity and market characteristics), incorporates a mix of approaches (routine data collection, media monitoring, key informant study), and utilizes mixed methods (both quantitative and qualitative).

Preparation stage 2001-2002

Review of empirical and theoretical literature

A comprehensive literature review provided the basis for system development. This has been discussed in detail earlier.

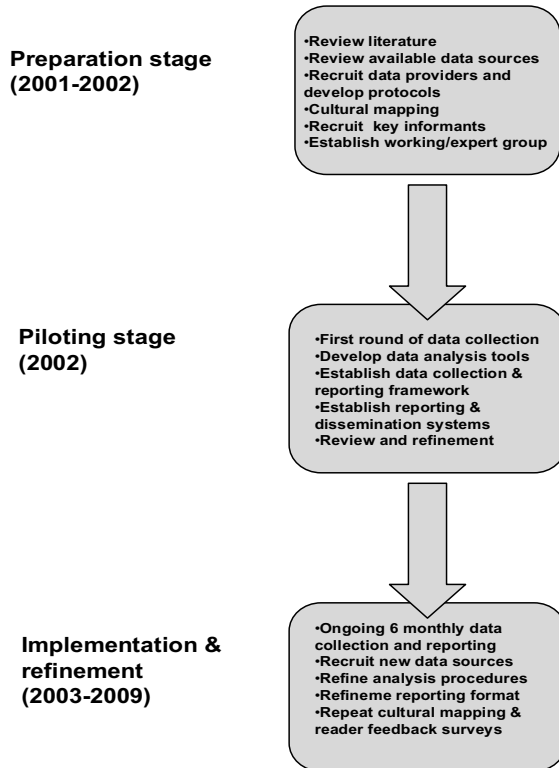
Review and selection of data sources

A wide range of services in the city and region were contacted asking for details of what drug/alcohol-related data they collected. In total over 50 different data sources were reviewed for possible inclusion in the project. These ranged from statutory organisations such as the police and customs to cultural sources such as youth magazines and the internet. All sources were reviewed against the following criteria:

- Relevance – is the data relevant for the project?
- Reliability – how reliable is the data provided?
- Timeliness – can this data source report six monthly?

Figure 1.

Stages in Føre Var system development



Of the sources reviewed, only seven initially matched up to the project criteria with the majority falling short on the timeliness issue. Drug services, for example, tended to report annually, with data up to two years old by the time of publication. Social services held individual case notes on drug users but no systematized or ongoing monitoring data. The main developmental stages are shown in figure 1.

Data collation protocols

Protocols were drawn up individually with each data provider, dependent on the format of the raw material. For example, police seizure statistics were provided verbally in a meeting, then collated into six monthly tables. Helpline data was sent in SPSS files, and alcohol data sent as pivot tables which required transferal into six monthly tables.

Cultural mapping & recruitment of key informants

In addition to collecting existing data on drugs and alcohol, a panel of key informants was established to provide an additional source of high quality information from local 'experts' on the city drug scene. The aim was to incorporate the voices and observations of young people and drug users themselves, plus the experiences of the wide range of professionals in close daily contact with them.

A detailed mapping of drug and alcohol using 'scenes' and arenas in the city was undertaken prior to the establishment of the key informant panel. The objective was to look beyond the injecting drug scene, into current youth trends and subcultures. This process involved interviews with a broad range of individuals in the city with a focus on youth sub-cultural trends and the associated alcohol and drug using patterns. Four detailed maps were developed with the assistance of interviewees, focusing on the broad themes of: music arenas, leisure, geographical hotspots, risk groups, and associated drug use patterns.

In order to map the diverse music scene, for example, contact was made with record shops, music promoters, local DJs, dance instructors, club owners and young people themselves in order to build up an accurate map of the current youth and music milieu in the city. There followed questions on what types of drug use were linked to the different genres and clubs. This same process was used to draw all four maps. The final step was to create links between the maps. For example those involved in the rap/hip hop culture, primarily used cannabis, visited one or two particular clubs and had close links with the graffiti and skating culture in the city.

A last step involved analysis of the maps and identification of differentiated scenes where drug use appeared to be taking place, and begin the search for a key informant with close links to the scene to join the panel. It was particularly important to avoid recruiting informants from the same scene - a worst case scenario would have been for a high number of the informants to report on the activities of a small group of drug users, thus giving a false impression of a much broader drug using trend in the city.

The avant garde and at risk youth theory (Korf & Nabben, 2002) was taken as an initial hypothesis for the BEWS project and used to underpin the cultural mapping and identification of key informants. Korf & Nabben provide a list of potential key informants, with a balance of young drug users themselves, cultural companions and professionals in close contact with drug users: - DJ, club bar staff, pub doorman, drug dealer, student events officer, hospital accident & emergency staff, police officer, drug users, outreach workers, ethnographic researchers. The BEWS team used this as a rough guide for the final selection of key informants. However, in spite of numerous interviews with members of the city's musical and artistic milieu, as well as the gay community, members of Bergen avant-garde scene proved elusive. In reality, this city with a population of approximately 250,000 has a relative integration

of scenes, and as one informant explained, until quite recently both those described as ‘avant-garde experimenters’ and ‘at risk youth’ could sometimes be found in the same clubs and pubs. As a result we redrew the model for Bergen, developing a new framework focusing on three primary arenas in order to provide a starting point for recruitment of key informants:

- 1) *At risk/problem drug use*. Informants with knowledge about risk scenes and problem drug using populations (e.g. sex workers, outreach staff, treatment professionals)
- 2) *Nightlife*. Informants with knowledge of Bergen music, club and nightlife scenes (e.g. bar staff, doormen, clubbers)
- 3) *Community*. Informants with a broader view on drug use in Bergen (e.g. police, emergency services, school staff, health services).

20 informants were recruited for the piloting phase – the number was extended to 30 for subsequent data collection rounds.

Establishment of working group and expert group

An important mechanism for both the cultural mapping and identification of key informants was the establishment of a working group with street workers from the outreach agency in Bergen. In addition to possessing a great deal of local ‘youth culture’ knowledge, the workers were also able to make introductions to potential informants, act as gatekeepers, and vouch for the researcher’s credibility. In addition, the group provided an invaluable venue for discussion of preliminary findings, checking out rumours and sharing of concerns. An expert group was also established, comprising representatives from drug treatment, criminal justice, research and policy sectors. This group meets twice a year and acts as an important quality assurance mechanism.

Piloting Stage (2002)

The first pilot report was used to test the feasibility of six monthly data collection from the selected sources – 7 routine sources, 3 media sources, and a school survey. An analysis system was established using SPSS for the key informant survey, alongside data tables with weightings – this is described in more detail in the analysis section. In addition, a reporting format and dissemination methodology was developed. There followed an in depth internal evaluation report with recommendations on the feasibility of full implementation.

Implementation & refinement (2003 to 2009)

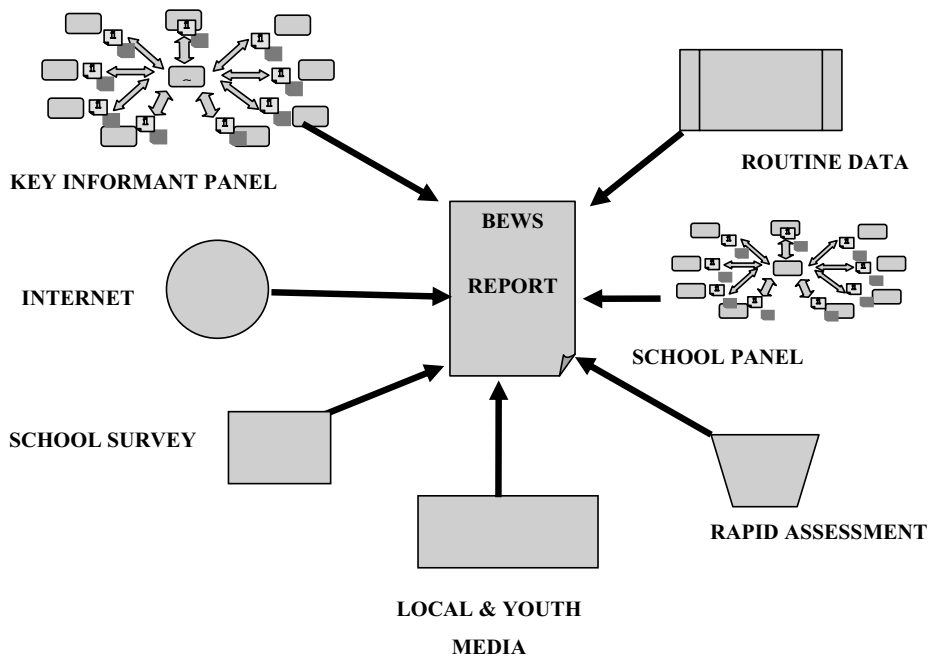
The system was fully implemented in 2003 and has been reporting publicly at six monthly intervals since. Reports are published in June and December, summarizing data relating to the period 1st October to 31st March, and 1st April to 30th September, respectively. The intensive period of data collection, analysis and report writing therefore takes place in a two month time slot. The project cycle is presented in diagram form in paper 1. As of June 2009, 13 six monthly reports have been produced.

The project has been developmental, based on continuous evaluation, and refinement of tools and methods. As the method itself and analysis is unique, there has been no blueprint to follow. Refinement has particularly focused on the use and integration of multiple indicators and mixed methods. Improving reliability and validity has been prioritised, and is a primary topic discussed in papers 3 and 4. In addition, two reader feedback surveys were undertaken in December 2005 and 2007 with a view to ascertaining the system's reach and impact in the city, as well as to gather information on enhancing reporting options.

2.2 Use of multiple indicators/ data sources

BEWS is a multi-indicator model and in the BEWS report from November 2008 the following data sources were used:

Figure 2. Overview of information sources used by BEWS



The most common sources used in drug trend monitoring systems are prevalence surveys and routine or secondary data sets, whilst systems focusing on emerging trends also utilise more sensitive sources such as key informants and youth media. The BEWS model draws on multiple drug-related indicators and data sources, summarised below. A full list is presented in Appendix 1.

Routine/secondary data sources

- Seizures – police, customs, prison
- Arrests
- Ambulance overdose call outs
- Overdose deaths
- Prison tests
- Treatment demand
- Hepatitis C, HIV, AIDS (new cases)
- Helpline calls
- Syringe sales/ dissemination
- Alcohol sales
- Pharmacy sales

Media/internet sources

- Local newspapers
- Youth culture magazines
- Drug user websites
- Drug professional media

Informant panels

- Key informant panel
- School panel

Local research studies

- School drug use survey
- Rapid assessment studies
- Ad hoc local drug-related studies

2.3 Mixed methods

A number of researchers have argued in favour of the use of mixed methods for drug trend monitoring (Hartnoll et al., 1997; Hando et al., 1998; Griffiths et al., 2000). If it is accepted that all methods have their blind spots, it has been argued that multi-

method approaches help construct a more three-dimensional and reliable picture of the phenomenon and are likely to produce judgement of greater validity (Rhodes et al., 2000). The pragmatic research paradigm presented earlier and discussed in more detail in paper 3, provides an underpinning for mixed method approaches, those utilising both quantitative and qualitative methods within the same model. The quantitative elements within the BEWS model include the use and analysis of existing statistical data sets in the form of routine indicators listed above. In addition, media monitoring includes substance-related searches on internet sites. Quantitative data is also collected via questionnaires with informants. Finally, results from the school survey are incorporated on a bi-annual basis. A limited amount of qualitative information is collected via semi-structured questionnaires, annual interviews with key informants and media reviews. Qualitative findings are primarily used to explain unexpected or inconclusive results from the quantitative sources. Ad hoc rapid assessment studies also provide qualitative findings which may be incorporated.

Secondary data collection - Every six months, data from relevant secondary sources is collected according to agreements made with the agencies producing the statistical data. The majority of data is drug specific, and this is used in the system's quantitative analysis (described below). Some data is related to consequences of drug use, for example overdoses, arrests, Hepatitis C registrations, and these findings are presented as separate graphs or tables in the six monthly reports.

Registration: Information is recorded in Excel tables.

Media monitoring – BEWS incorporates a range of media sources which are systematically reviewed on a six monthly basis for relevant content on both drugs and youth culture trends. Media monitoring involves following trends in drug use on the internet, in youth media magazines, in local newspapers and drug professional publications. Between 16-18 sources are monitored. To some extent it has proved

possible to standardise data collection from media sources building on the hypothesis that the relative frequency of references to a drug indicates its potential for diffusion (EMCDDA, 2001). Word searches on websites and databases provide an overview of frequency of mention by drug. In addition paper media are scanned, and drug-related articles logged by substance and topic.

Registration: Quantitative data is recorded in Excel tables. A data recording system has been established for collection of qualitative information.

Key informant panel - BEWS currently has approximately thirty key informants working with the project, ten from the risk/problem drug use arena, ten from the nightlife arena and ten from the wider community. They represent a mix of professionals, cultural companions (e.g. DJ's, bar staff) and drug users themselves. All key informants complete a semi-structured questionnaire every six months and between six and ten are selected to participate in an in-depth interview once a year. Informants are selected as 'expert observers' of drug use and are asked to share their observations of drug patterns and trends during the previous six month period. Informants are eighteen or over, and are not asked about their own drug use. They are given a music voucher as a 'thank you' for participating.

The questionnaire has been developed to be as user friendly as possible, as a number of informants have poor literacy skills and project workers cannot always be present to assist with its completion. In addition to observations of drug use and new drugs, the key informant questionnaire includes questions on drug price, purity, street names, health consequences, methods of use, settings for use, forthcoming problems, combinations, user groups and availability.

Registration: a questionnaire has been developed for use in Bergen drawing on instruments developed by Korf & Nabben (2002) and Kemmesies & Hess (2001). An

interview schedule is developed each year in order to explore findings in greater depth.

School panel (Kjentmenn) - The school panel was incorporated into the BEWS in 2003 and comprises approximately 15 representatives from Bergen secondary schools. These are teachers, nurses or advisors with training in drug-related issues. This panel focuses on drug and alcohol-related observations in school settings and otherwise operates in a similar way to the key informant panel described above. All informants answer an anonymous (simplified) questionnaire every six months. This questionnaire is generally sent out and returned by email.

Local research: schools survey & rapid assessment studies - School surveys provide a backbone or reference point for many monitoring models and are an accurate tool to assess drug use prevalence and trends over time (Korf & Nabben, 2002). BEWS also incorporates findings from a Bergen city schools survey of over 2000 pupils (aged 13/14 and 15/16) which is conducted on a biannual basis by the research department at the Bergen Clinics Foundation (Skutle et al., 2002; Iversen et al., 2008).

The school survey is one of the few BEWS sources which reports on drug use prevalence, whilst most other sources used in the system are indicators of consumption or availability. The school survey has a large sample base and provides a picture of drug use in a key section of school children, which is particularly valuable when considering the development and spreading of trends from niche subcultures into wider society. In this respect the survey provides a useful and necessary balance to other sources in the project which report more comprehensively on the heavier end of the drug using spectrum.

As a separate initiative, the BEWS team worked with the Bergen Outreach Service to develop a practitioner-friendly rapid assessment tool following the principles established by the World Health Organisation (WHO, 1998; Mounteney & Berg, 2008). As a result, the Outreach Service is in a position to provide high quality and relevant local assessment studies that can be included within the analyses. Of particular interest is the quick time frame for the rapid assessments - they take place within a six month period, from planning to fieldwork to production of a report. They have also been used to explore BEWS findings in more depth. A salient example being the identification of an increase in the number of young heroin users in 2008 (Mounteney & Flesland, 2007) which provided a basis for a rapid assessment on young people linked to the opiate using milieu in Bergen (Bergen Outreach Service, 2008).

2.4 Analysis & triangulation

Triangulation of indicators and methods is central to BEWS and a primary means of ensuring valid results. It is also an area that is left unexplained by many EDTMS. Triangulation is primarily used by BEWS for congruence – to check whether the findings from different sources are in agreement. Here, quantitative sources which can indicate trend behaviour are utilised and an aggregated differential is calculated (described in detail below). Triangulation is also used for complementary purposes, as qualitative findings help to explore and explain quantitative data. Interesting and ambiguous findings from the previous report are frequently included in key informant interviews in the next reporting cycle. Media reports are also used to help explain, understand or provide commentary on results that arise. Finally, existing research e.g. rapid assessments and other local studies may also be used to clarify the results.

Triangulation may be concurrent or consecutive (Morse, 1991). BEWS primarily uses concurrent triangulation as data is collected and analysed simultaneously every six

months. However a degree of ‘consecutive’ triangulation occurs to the extent that key findings from one period may be explored in depth during the subsequent round of key informant interviews. In addition, possible new substances flagged in one reporting cycle may be given a new code in questionnaires to key informants, or in the school surveys in the subsequent round of data collection.

Data analyses

The steps undertaken for six monthly data analysis are as follows: all routine and media data is collected and collated in tables by substance and data source. In order to establish a ‘common unit of analysis’ which allows for the comparison of otherwise disparate data types (Hilton, 2005), results are compared with those from the previous six months and the percentage change calculated. Each percentage is attributed a change value between 1 and 5 for each source/drug type unit: 1 = strong increase and 5 = strong decrease. The scales used for attribution of change values vary from data source to data source and have been developed systematically, through dialogue with the individual data providers and after review of past behaviour of indicators (see paper 4 for details). Informant questionnaires are analysed using SPSS 13.0 for Windows, and frequency distributions are calculated. Results related to consumption and availability changes are also allocated a change value based on an average reported increase/decrease for each drug for the period, and this is added to the analysis grid for routine sources (see appendix 2 for example of grids).

Change values are summed across indicators for each independent substance and a weighting system is used, differentiating between the validity of indicators. The initial weighting system drew on selected literature (EMCDDA, 1997; Hartnoll et al., 1998), internal evaluation of previous performance of indicators within the system, plus in-depth discussion with information providers on the strengths and limitations of their data (Mounteney & Leirvåg, 2004). During the refinement process presented

in paper 4, weightings were reassessed in a more systematic way, although the results differed minimally from the earlier weights. Specifically: x4: used for relatively reliable consumption measures without time lag (sales, informant consumption reports); x3: for relatively reliable availability measures (informant availability and number of seizures); x2: for less reliable availability measures and concern measures (seizures by weight, helpline data); x1: for heavily time-lagged measures (treatment demand) and rapid but unreliable measures (media).

The analysis phase results in the calculation of an aggregated differential score for each substance for each six month period, producing either a plus or minus value. These aggregated scores are plotted in to time trend graphs as demonstrated in paper 2.

Dividing up the aggregated differential

The refinement process resulted in the grouping of indicators into three categories, depending on whether they related closest to consumption, market or interest – and three different aggregated differentials were calculated for each substance. Consumption-related indicators include: use trend data from key informants and school experts, urine tests from prison, treatment demand data, pharmacy, and alcohol sales data. Availability/market indicators include: availability data from key informants and school experts, number and weight of seizures from the police, prison and customs. Public interest or ‘concern’-related indicators include: data from telephone help lines, local media and user websites.

Analysis of informant interviews

Interviews with key informants are audio taped and later transcribed. The interviews with key informants and qualitative findings from the semi-structured questionnaires

are primarily used to provide supplementary contextual information to help understand results from the quantitative analysis. Each year, a new interview schedule is devised in order to explore previous findings in more depth or to check out results. Examples include: identifying the characteristics and consumption patterns of cocaine users; exploring the range of anabolic steroid ‘scenes’; checking out the availability of methamphetamine in Bergen; and exploring the increasing use of heroin and synthetic opiates in the city (May 2009). In addition, interviewees are asked to explain and provide context to answers given in their questionnaire response. Interviews are coded by drug type and the key informant’s milieu. A simple form of negative case analysis is used whereby findings are gradually generalised to all cases during the process, by actively seeking deviant cases. In addition a form of ‘thick description’ is used whereby descriptive data describing major themes in a pithy way are incorporated into the final report (Geetz, 1973; Mheen van de et al., 2006a).

Analysis of drug-related consequences data

Indicators of drug-related harm and consequences are also collected alongside the drug specific sources. These include data where it is not possible to specify the substance involved – for example injecting related data such as number of syringes given out by street agencies and pharmacies; drug overdose call outs and deaths; data on numbers of people with hepatitis C and HIV/AIDS; arrests for drug/drink driving etc. This data is presented every 6 months in a separate chapter of the BEWS report using trend graphs and tables. Where possible, links are made with the primary substance-related findings in the form of a commentary.

2.5 Reliability & validity

Paper 3 covers the topic of reliability and validity in EDTMS in detail whilst Paper 4 explores the potential of using psychometrics for enhancing system validity. Below, the key issues are summarised.

The reliability of drug indicators or measures is important to consider when selecting them for use in a system, and a balance between reliable and more timely sensitive sources is likely to be beneficial for the system as a whole. Small sample size and relatively low numbers (e.g. the number of overdoses in a month), can lead to potential problems in ascertaining statistically significant differences over time (Degenhardt & Dietze, 2005). It is possible to explore the reliability of such measures, particularly prevalence surveys and key informant reports, using test retest for reliability studies (Day et al 2004). Data can be reviewed and adjusted for seasonal patterns, for example increased alcohol sales during Christmas festivities, in order to iron out short term data behaviours that do not constitute new trends. For key informants, it is important to assess reliability in terms of criteria such as knowledgeability; credibility; impartiality; willingness to respond; and the effect of outside constraints, and perhaps most importantly, eliminate interviewer or investigator bias (Kumar, 1989). However, in a drug trend identification context, sources that are consistently or reliably invalid can also remain of interest. Prison drug testing, for example, does not give a realistic measure of drug consumption amongst prisoners, as different drugs remain in the bloodstream for markedly different lengths of time (DDL, 2006). However, if these 'errors' remain consistent, then the trend data they provide will still prove useful.

The construct validity of measures - the extent to which they are able to reflect the emerging drug trend construct, will have implications for whether they are selected in the first place and for the weighting they are given in an overall analysis. The threat here is inadequate preoperational explication of constructs. There is also the key question of a source's timeliness as an indicator of an emerging drug trend. Here, techniques such as time series analysis on indicator data (Gilmour et al., 2006) have been utilised. Issues pertaining to internal validity are relevant to development of survey instruments. Factors such as key informant panel dropout or mortality can influence the internal validity. The convergent validity of findings from individual

measures will be key for triangulation and mutual validation purposes. Convergent validity enhances our confidence but the possibility of error remains. It is possible that approaches to the measurement of our construct are problematic. Of equal importance, non convergence of findings from sources challenges a deeper exploration of results in order to identify the underlying factors that cause this divergence.

External validity will be strengthened with repeated measures over time or with confirmation by the same model in another geographical context. The extent to which patterns in data are interpreted as a 'blip' or a more general trend, is to some extent one of external validity. Many data sources show short-term fluctuations and variations from one year to the next, and this cannot be taken as a reliable sign of change (Hartnoll et al., 1989). Transferability refers to the generalisability of qualitative results from one specific context to another. Cultural mapping can be a useful technique prior to the identification of key informants if the aim is one of achieving a spread of information on different sub cultural scenes (Korf & Nabben, 2002; Mounteney & Leirvåg, 2005).

An important question is whether an identified emerging drug trend is 'real'. New drug patterns may well be short lived, contained within one geographical region or identified by only one data source. The primary issue is whether the emerging trend will become a public health concern warranting a public health or public safety response. It is interesting to consider Type 1 and Type 2 errors within this framework. Reliability and validity challenges for drug trend monitoring systems, lie in two broad areas: at the level of individual sources and at the whole system level. A type 1 error – finding something that is not there would involve identifying a trend that does not exist. A type 2 error - missing something that is there – would involve a system failing to identify a new drug trend.

2.6 Psychometrics and refinement

Challenges related to the reliability and validity of a measurement or monitoring tool are not new. The field of psychometrics has explored refinement processes to evaluate the properties of scales for more than a century. Although there are obvious differences between the measurement of a psychological construct in an individual and the measurement of emerging drug trends at an ecological level, the problems of establishing reliability and validity are similar. Paper 4 presents a methodology derived from psychometrics that can be used to develop and refine systems geared towards monitoring emerging drug trends. This addresses the issue of whole system validity, with a particular focus on enhancing construct, convergent and external validity. The process involves the following steps: 1) Theoretical conceptualisation of the construct to be measured; 2) Score construction and metrics; 3) Weighting of items; 4) Examination of the prospect of factors (subscales); 5) Checking for external validity. The early steps geared towards ensuring construct validity were undertaken prior to the establishment of BEWS, in the planning and piloting stages 2001 to 2002. Steps 3 and 4 represent refinements of the system and took place between 2004 and 2008. The final step, checking for external validity is ongoing, with the increasing number of data collection points (repeated measures over time) enhancing external validity as the monitoring period increases. In addition a number of other Norwegian localities have been running limited versions of the BEWS model and it may be possible to examine results across these systems in the future.

3. RESULTS

3.1 Paper I. Providing an Earlier Warning of Emerging Drug Trends: the Føre Var System

Mounteney, J. & Leirvåg, S-E. (2004) *Drugs: education, prevention and policy*, 11(6), 449–471.

This paper documents the development of the Føre Var (BEWS) model as a citywide ‘earlier warning’ system geared towards the identification, monitoring and reporting of drug and alcohol trends in the city of Bergen, Norway. The paper details the system’s developmental stages and methodologies, making explicit the way it triangulates and cross references a wide range of statistical and quantitative data including seizures data, treatment figures, alcohol sales and a school survey, with information from a number of ‘leading edge’ or sensitive data sources, including internet sites, youth and local media, cultural mapping and key informants. Results from the first three rounds of data collection by Føre Var are presented in summary form and conclusions drawn on the strengths and weaknesses of the model, its replicability as well as the potential advantages of a city level network.

3.2 Paper II. Earlier warning: a multi-indicator approach to monitoring of trends in the illicit use of medicines

Mounteney, J. & Haugland, S. (2009). *International Journal of Drug Policy*, 20, 161-169.

This paper explores the feasibility of monitoring trends in the illicit use of medicines and considers potential impact for policy makers. Data collection and analysis were

undertaken using the Bergen Earlier Warning System (BEWS), a multi-indicator drug monitoring system. Data was gathered at six monthly intervals from April 2002 to September 2006. Drug indicator data from seizures, treatment, pharmacy sales, helplines, key informants and media monitoring were triangulated and an aggregated differential used to plot trends. Results for the four year period showed a decline in the misuse of Rohypnol and an increase in the misuse of Subutex. The results show that multi-indicator surveillance models can play a strategic role in the rapid identification and reporting of emerging trends in medicine misuse. They have a key role to play in providing evidence to policy makers and practitioners.

3.3 Paper III. Challenges of reliability and validity in the identification and monitoring of emerging drug trends

Mounteney, J., Fry, C., McKeganey, N. & Haugland, S. (2009a). *Substance Use Misuse*. In press.

This paper explores three inter-related areas relevant to trend monitoring that can benefit from a clearer focus in terms of increasing validity and reliability: the research paradigm to which systems adhere; the selection of sources or drug indicators utilised by systems; and the process of analysis used by systems to ensure valid results. The reliability and validity of currently utilised drug related indicators is discussed, with a focus on the validity of data sources as measures of emerging drug trends. The relevance and utility of current descriptives such as ‘lagged’ and ‘leading edge’ indicators are assessed. Five dimensions, against which the validity of drug indicators may be assessed in a trend monitoring context are proposed as an alternative. Faced with a lack of clear conceptual frameworks underpinning and driving monitoring systems, it is argued that a pragmatic research paradigm can be adopted as a basis for

guiding selection of indicators and helping to make explicit the concurrent or supplementary triangulation and analysis procedures on which valid results are necessarily founded. The current trend of using triangulation as the primary means of ensuring the validity of systems is critically reviewed and a challenge is issued to the field to make the analysis process more overt.

3.4 Paper IV. Monitoring emerging drug trends: psychometrics and validity in earlier warning systems.

Mounteney, J. Stoove, M. & Haugland, S. (2009b) *Submitted*

This paper presents a standardised and sequential approach to emerging drug trend monitoring system (EDTMS) development and refinement, that is grounded in the key elements of psychometrics, and illustrates its application using an established city level EDTMS. A five step process is presented and exemplified, incorporating: 1) theoretical conceptualisation of the construct to be measured; 2) score construction; 3) weighting of indicators; 4) exploration of the prospect of categories (subscales); and 5) checking for external validity. The practical application of these validity enhancing stages are demonstrated using the Bergen Earlier Warning System (BEWS). In conclusion, for non traditional systems operating in a fast changing environment, an iterative review and refinement process (rather than a standardised system or instrument) has clear benefits, and can be adopted to enhance validity in existing EDTMS, or be used in the development of new models.

4. DISCUSSION

4.1 Summary of results

By adopting a ‘pragmatic’ approach, this thesis presents the establishment of a city level system capable of identifying, monitoring and reporting emergent trends in drug and alcohol use. The capabilities of a multi-indicator, mixed method approach are explored, with details of the development process, data gathering methods and reporting capabilities. The benefits of an EDTMS operating at a city level are discussed with reference to the possibilities for rapid collection and turn around of data as well as the advantages of local ownership and the relevance of results to the locality.

Results from papers 3 and 4 have particular relevance for other systems engaged in the study of new drug trends. These papers deal with a number of fundamental and little explored topics such as how we can bring together and analyse such diverse data sets, how we might explain and justify the methods we use to do so. Paper 4 borrows from a long established psychometric tradition of attempting to measure abstract traits or behaviours, where we have no obvious or direct data sources, with a view to demonstrating that a considered and systematic process of empirical review, assessment of data and consideration of its relevance to the topic can assist in enhancing the validity of eventual results.

The results presented in this thesis are both theoretical – particularly in terms of methodology - but also empirical and applied, in terms of developing, testing out and refining a ‘real life’ model, the BEWS system. Papers 1, 3 and 4 explore via a working model, many of the conundrums and challenges in this field of enquiry. In

doing so it is evident that the developmental nature of this study has both strengths and weaknesses. Continuous improvement results in a stronger methodology, but requires revision and updating of datasets as new insights and understandings are incorporated into the model. Paper 2 focuses on results and their application, and was published prior to papers 3 and 4, which are primarily concerned with enhancing and improving the reliability and methodology of emerging drug trend monitoring. Development and revision in terms of data weightings resulted in little impact on the overall results.

Results demonstrate that the use of the principles for psychometric scale development can assist with enhancing EDTMS validity, providing a coherent and explicit developmental framework, that has wider applications. A five stage review and refinement process is presented for the development of an EDTMS that focuses on strong construct, congruent and external validity. The use of a 'pragmatic' research paradigm is argued for in conjunction with a mixed method, multi-indicator approach. Five criteria for indicator selection are presented and it is demonstrated how these may be utilized to attribute weightings to individual sources in the analysis phase. Key issues relating to reliability and validity in the monitoring of emerging drug trends have been highlighted, specifically challenges at the level of system construction, as well as reliability challenges at the level of individual data sources. A general approach to analysis of mixed data is discussed based on overt triangulation practices. A specific example of analysis is provided with reference to BEWS' use of an aggregated differential score. Finally, it has been shown how the BEWS can be used to monitor trends in alcohol, drugs and the street use of medicines and report back to policy makers and practitioners for early intervention purposes.

4.2 Results in context

This thesis demonstrates that city level EDTMS alongside traditional epidemiological systems can play a key role in identification and monitoring of emergent trends in drug consumption. EDTMS such as BEWS have an inbuilt flexibility and adaptability. They can report more rapidly having less levels of bureaucracy. They can provide local targeted information - as opposed to nationally aggregated data. However careful and deliberate system construction is crucial, and the key to developing a reliable and valid system. Many international models have neglected to be explicit with regard to source selection, method of analysis and system reliability and validity. There is a challenge to the field to be more explicit around the use of mixed methods. One way of demonstrating system validity is to demonstrate solid and rigorous system development and refinement. Use of the psychometric scale development process is a novel means to enhance construct validity – using a psychological tool or approach in a drug monitoring context. To the extent that this is successful – it means the system is robust, internally. Such an approach might well be transferable to other arenas.

These papers build on the seminal paper by Griffiths et al. (2000) – taking forward a number of challenges. Whilst Griffiths et al. provided a review and critique of existing drug monitoring systems and their potential for improving early warning capabilities, this thesis tests out a number of the recommendations, in a real world setting, including: the construction of a multi-indicator model; incorporating both leading edge or sensitive sources alongside routine data; using an expert/ key informant panel; and utilizing theory to guide system development. In doing so, this thesis applies research undertaken by Korf & Nabben (2002) in Amsterdam, on the use of key informants and trend diffusion theory, in the development of an integrated ‘smaller city’ model.

The validity paper progresses work by Degenhardt & Dietze (2005) on drug indicators, suggesting five criteria which might be used for indicator selection. The discussion and use of mixed methods can be seen to complement the work of van de Mheen et al. (2006a) on triangulation in qualitative systems, adding a quantitative dimension with the use of an aggregated differential. The use of psychometric methods to enhance the validity of developmental models draws on limited tradition of transferring this methodology across disciplines – other examples include econometrics and clinimetrics.

A limited literature exists on trends in the misuse of medicines. Results presented in this thesis demonstrate the potential for utilization of trend monitoring methods in this expanding arena. Use of an aggregated differential enabled the identification of new and emerging consumption patterns as demonstrated for Subutex and Rohypnol. When combined with data from key informant interviews and media monitoring a more complete picture can be produced. The findings suggest that the key informant panel may be a particularly useful and sensitive data source in this context. The misuse of medicines is also identified as an area with potential for impact on early intervention in terms of policy and practice.

4.3 Strengths and limitations

Strengths of the model presented include its explicit theoretical underpinning, rapid reporting capabilities, local/city level nature, incorporation of reliability and validity checks, and relatively low operational costs.

This study presents a system which has clear theoretical and empirical foundations, drawing on a European feasibility study (EMCDDA, 1999) and implementing many of the recommendations in a working model. The developmental approach described,

has enabled a process of continuous improvement and refinement, drawing constantly on the scientific and methodological literature and ensuring the system improves with the latest knowledge and can remain flexible to changes in the environment it was established to monitor. The local and city level nature of the system has had many advantages including the rapid and non bureaucratic collection of data and a proximity to information providers, practitioner and policy makers. This has undoubtedly enhanced a sense of ownership of the system, witnessed by the contribution of data at no cost in fast time.

It can be argued that BEWS six month reporting capability provides a genuine 'earlier' warning of emerging trends when compared with systems with longer reporting timescales. All data sources included in the quantitative analysis submit data within three to four weeks of the end of each the six month reporting period. Such rapid turnaround is only possible because of establishment of good cooperation and standardization of routines with partner agencies. Goodwill is an important factor here, and maintained by involving partners fully, via checking of findings, invitations to presentations of results, regular sending of reports etc. Rapid reporting allows for new substances, sometimes identified via key informant reports in one period, to be added with a new code in the questionnaire within six months. Similarly reports of emerging trends, such as an increase in young heroin users, can be explored using interviews.

The system operates at relatively low cost, largely due to the fact that the model utilises existing data sources, with all routine and media data being provided for free. The key informant panel is the only 'new' data source developed specifically to enhance the system's coverage, however professional informants are unpaid and non professionals only receive a cd voucher for their time. In terms of human resources, it

is estimated that the system runs with roughly one half time post a year (this time being divided between a project manager and project worker post).

From its inception in 2001, BEWS has increased its sophistication in terms of analysis, validity and reporting capabilities. Presentation of findings relating to the reliability and validity of indicators and EDTMS fills a gap in the literature, issues raised relating to triangulation provide a challenge to the field as well as proposing a new model for data analysis. Similarly, the adoption of the psychometric model for scale development as a way of enhancing validity of such developmental models, offers a potentially unique method for others working with system development.

Whilst BEWS incorporates a biannual school survey, it has no access to survey data from general population, party goers or problem users. Survey-based EDTMS are able to incorporate repeat cross sectional prevalence data via quantitative user and key informant surveys (Hando et al.,1998), something that BEWS would undoubtedly benefit from, but which would be prohibitive in terms of cost and human resources for this city based model. Ideally BEWS would also have access to hospital and price/ purity data – currently not available at a local level in Norway.

Whilst in many ways a strength, the developmental nature of this study has its drawbacks. Here we set out with a challenge – how to effectively monitor and measure emerging drug trends - and have incrementally developed a methodology to attempt this. The scientific and empirical literature is scarce and of limited assistance. Existing models have been developed in other locations and may not be transferable. There is a real feeling of taking a step in the dark, testing the water, then evaluating regularly to assess whether it was a useful direction to take. The very fact that monitoring of new and emerging drug trends is such a new and challenging field has

required a focus on methodology – in particular focus on reliability and validity. Much of the quality checking and refinement has occurred in tandem with public reporting. This is clearly the nature of developmental studies – it is not viable to wait until everything is in place and perfect before reporting results. In the case of BEWS, continuous refinement has had little impact on previously published findings. Results from the more finely tuned 2009 model did not diverge greatly from the basic version established in 2003. The addition of weightings and data updating improved the validity of the findings and helped provide a more sophisticated analysis but did not essentially affect the direction or the importance of the trend findings previously reported.

A further limitation of this study relates to its local nature. Whilst it can easily be argued that the proximity to drug using scenes as well as data providers and policy makers has many benefits – it remains unclear whether such a model has national or even international relevance or transferability. Certainly national policy makers cannot rely on one city's data to describe drug trends. A network of results from several cities might provide one solution but this is as yet untested.

4.4 Ethical considerations

Important ethical challenges for the field of drug epidemiology as identified by Fry & Hall (2002) include: free and informed consent; confidentiality, privacy and legal hazard; and safety issues. The BEWS system works primarily with official published secondary data sources (treatment demand, arrests, seizures etc) where the agencies themselves require strict internal routines and controls in order to collect and report statistical data. All partner agencies provide anonymised and aggregated six monthly data for the project.

Ethical considerations are particularly relevant to work with the thirty key informants. All are provided with information on the project (an explanation of the process, their role and how information will be used) at the recruitment stage and invited to participate. Research tools have been developed to be as simple and straightforward as possible, to allow informants with poor literacy skills and those whose first language is not Norwegian, to participate. Importantly, the key informants are anonymous and are not asked to provide personal information about their own drug use, rather they are asked for their general observations of drug trends in the previous six months. No information is identifiable back to individuals or places (club or organisation names are not reported). In addition, people under the age of 18 are not recruited. Informant details and identifiers are not stored on computer and are kept separately and securely from completed anonymous questionnaires.

The payment of participants raises issues of consent in studies involving drug users. Whilst common practice in countries such as the US and Australia, critics argue that payment can be an inducement, and be used to buy drugs (Brody & Waldron, 2002). Others argue that non cash methods may reflect drug user stereotypes and a paternalistic approach (Grady, 2001). The BEWS non professional informants are provided with a cd voucher as a thank you for their time – a non cash reimbursement. The safety issue arises in connection with interview locations and timing; interview content; and response to crises that may arise, amongst other things (Fry & Hall, 2002). In the case of BEWS, face to face interviews are carried out either in public spaces, such as cafes or in the research offices. Interviewers are professionally trained to be able to handle any difficult situations that might arise.

The epidemiological gaze may increase recognition and reporting of a problem, and may spuriously influence social facts such as new drug trends. The project team has an ethical responsibility not to become a ‘trend creator’ – something which might

happen if the media takes hold of a story and publishes in an irresponsible way. In order to prevent this happening, much energy has been put into building responsible relationships with local journalists and developing the local news media's understanding of the project aims and objectives. A final important ethical consideration is how the reported results might be utilised. The intention is that results from the project feed into the wider public health, prevention and harm reduction policy making agenda and are not utilised for criminal justice or prosecutory purposes. Confidentiality of informants and the anonymity of data sources become extra important in this context.

This project has been approved by both the Regional Committee for Medical and Health Research (REK) and the Norwegian Data Inspectorate (Datatilsyn).

4.5 Impact and relevance for policy and practice

Policy makers require timely and reliable information on new trends in order to make evidence-based decisions and plans that can minimise the public health risk and other potential harms of drug use. Without up to date information, there is an increased risk that drug policy and interventions will be based on outdated research or sensationalist media reports, for the simple reason that this is the only information available.

The May 2009 EMCDDA conference focusing on Europe's future drug information needs was summarised on their website with the following headline: "Experts and policymakers underline need for rapid and innovative responses to Europe's changing drugs problem" (EMCDDA 2009a). In summarising key points from the conference, the Head of Epidemiology, Griffiths concluded: 'Multi-methods approaches, sensitivity and timeliness are common issues for drug monitoring systems, and combining different types of information (qualitative/ quantitative) and levels of

analysis (local/national/international.), remains a key challenge' (EMCDDA 2009b). In this context, the BEWS model, methods and conclusions of this thesis have much to offer the wider field of drug trend monitoring, both at a scientific and a policy level.

A primary aim for BEWS has been the early identification and reporting of emerging drug trends in order to facilitate timely and effective drug policy responses. One measure of the system's success is whether the results reach policy makers and practitioners in Bergen and further a field, as well as the extent to which they elicit a response. In this context the dissemination of results in a policy friendly format has been an important consideration. In practice two 'findings' reports have been widely disseminated each year to approximately 1000 policy makers and practitioners both locally and nationally. An annual conference is held each December where the findings are presented to a broad public. In addition, results are regularly presented at local, national and international seminars and conferences. Several workshops focusing on implications of BEWS results are held each year with a mix of agencies including, police, prisons, ambulance services, lawyers, outreach staff, childcare services, treatment specialists, school heads etc. Six monthly results receive wide media coverage, with both national and regional television, as well as radio and newspapers reporting on trends. In addition, a BEWS trend column appeared in the national drugs journal (*Rus & samfunn*) between 2005 and 2006, reporting results to policy makers and practitioners in the field.

Two small reader satisfaction surveys from 2005 and 2007 provide an insight into who the reports are reaching and how the results are being used (Mounteney, 2005; Flesland & Mounteney, 2007). Both samples (n=56) and (n=109) respectively were primarily drawn from annual conference attendees. These demonstrated that BEWS findings were reaching a broad range of local professionals in Bergen, ranging from pharmacy workers, customs officials to educational, health and social workers. On

average, respondents reported three different uses for the BEWS findings, most commonly to keep themselves informed of the latest drug trend development, but also using the findings as an evidence base for planning, and project funding proposals.

Drug monitoring systems have been described as management information systems based on scientific methods (Mheen van de et al., 2006a). In this respect, a measure of BEWS's success can be linked to the fact that results have been integrated in city planning mechanisms – the reports have been utilised as a source for the city drugs plan, in the city childcare plan as well as in the police annual report. In addition the results have been used in the Norwegian national drug report reports to the EMCDDA and as evidence in advisory meetings for the Norwegian Health Directorate. Data produced by BEWS has also been incorporated in the EMCDDA E-POD studies (EMCDDA, 2008).

The system has successfully dovetailed with other city level research studies. New codes have been added to the biannual Bergen schools survey – both anabolic steroids and Rohypnol were included after these substances were identified as being on the increase in younger populations. Findings on emerging trends have been cited as the starting point for in-depth studies and for early intervention activity. For example, reports of an increase in use of anabolic steroids, sparked off a project by the city outreach service working with young men and steroid use in Bergen. Similarly when BEWS flagged an increase in young heroin users, the finding was used as a motivator for a rapid assessment into the needs of this group (Bergen Outreach Service, 2008).

As described in detail in paper 2, BEWS results have much potential for adding to the evidence base on trends in the street use of prescribed medicines which is a topic of

increasing international concern at the policy level (INCB, 2007). Consistent reports of increases in leakage of Subutex were cited as one reason for the introduction of Suboxone in Bergen 2007. BEWS findings were one of many sources reporting increases in street use of Rohypnol and Temgesic, both of which subsequently had tighter prescribing restrictions imposed. Finally, EDTMS such as BEWS have a potential role in the evaluation of policy decisions, through monitoring the street level side effects of particular interventions.

4.6 Future areas for research

This thesis takes a small step forward into a large and increasingly important arena. In many respects, it opens up questions and dilemmas and by no means provides all the answers. It challenges the field by highlighting a need to improve methods for monitoring emerging trends, and to consider flexible and innovative ways of doing this. The problem exposed, however, by use of non traditional methods, is that of ensuring reliable and valid findings. A number of ways forward are presented but there is need for more focused work in this area. Evaluation of such a system and its findings is difficult – necessarily retrospective – and in the case of BEWS which utilises almost all relevant local data sources, virtually impossible to find unused external sources to benchmark or crosscheck results against. Demonstrating the external validity of the BEWS results remains a challenge. Ideally the system needs results from other models for comparison purposes. A manual has been developed and a number of other localities have established similar methodologies with varying degrees of success. Following up on these will be an important area for the future.

There are a number of additional areas that would benefit from further attention. The issue of factor analysis as taken up in paper 4 remains unresolved. The BEWS system as yet has too few time/data points to allow a useful factor solution. Follow up of this option in a couple of years time might well strengthen the approach. In addition the

qualitative dimension of the study could be developed. At present, qualitative methods incorporated into BEWS include interviews with key informants, the open questions on the key informants' semi structured questionnaire, and review of media – in particular newspapers, professional journals and drug user websites. In order to fully benefit from the mixed methods paradigm presented in paper 3, qualitative methodologies could be enhanced. Work by van de Mheen et al. (2006a) provides a clear direction into ways this has been achieved elsewhere.

In the field of EDTMS there are a number of areas which would benefit from further research and development. These include further work on the reliability and validity of information sources used for timely and sensitive monitoring, in particular use of key informants. It would be interesting to undertake test retest of interviews for informant reliability. Findings presented in paper 3 suggested key informants may be six months earlier than other sources in identification of new patterns of medicine misuse. This phenomenon could be explored in more depth. In addition other models of triangulation could be explored and developed, adding to the debate in the developing mixed methods arena. The theoretical underpinnings for EDTMS remain weak and often unstated – this is certainly an area that would benefit from further development both in terms of trend development and diffusion theories and their relevance and application for EDTMS. A particularly interesting area would be to link together a network of city level systems, able to provide a big picture overview using comparable methodologies, of national and international development in the drug trend arena. Finally the potential of EDTMS for policy monitoring and evaluation is likely to be an increasingly important field in the future. Making stronger links and connections between monitoring and policy makers' needs, and providing useful results that answer pressing policy questions are important next steps.

4.7 Concluding remarks

To conclude, the identification of emerging drug trends is a young and inexact science so continuous improvement is necessary. EDTMS models will need to be in advance of the mainstream and flexible enough to pick up on new practices. Cultural monitoring will be important in order to follow youth fashions and trends. Monitoring systems will undoubtedly benefit from a mix of indicators – some traditional and some novel, able to tell us about both known and less known drug using populations. There is a need for flexible research tools which are quick to adapt in the face of new evidence. Indicators will need to be selected with due consideration to their reliability and validity within an overall system. Whole system validity can be strengthened by a process of systematic development and continuous refinement. Attention to the analysis and triangulation of mixed methods and multiple data will increase the credibility of the results. Drug use trends are fast changing, and the misuse of prescription medicines is one area of political concern. City level systems such as BEWS have the potential to make a real contribution and provide an important earlier warning of new developments in this area.

References

- Agar, M. & Reisinger, H. (2001). Trend Theory: Explaining Heroin Use Trends. *Journal of Psychoactive Drugs* 33(3), 203-212.
- Agar, M., Guerin, S., Holmes, R. and Kunkle, D. (2004, October). *Epidemiology or Marketing? The Paradigm Busting Use of Complexity and Ethnography*. Proceedings of Agent 2004: Social Dynamics: Interaction, Reflexivity and Emergence. Chicago.
- Alvarez, J., Bello, P., Faasen, I. et al. (2003). *Emerging Drug Phenomena: European manual on the Early Information Function for Emerging Drug Phenomena*. Observatoire Francois des drogues et des toxicomanies. Paris: OFDT.
- Bergen Outreach Service. (2008). *Young people linked to the opiate milieu in Bergen*. A rapid Assessment Report. Bergen Kommune.
- Bless, R., Kemmesies, U. & Diemel, S. (2002). *3rd Multi-city Study*, Council of Europe.
- Brody, J. & Waldron, H (2002). Ethical issues in research on the treatment of adolescent substance abuse disorders. *Addictive Behaviours*, 25, 217-228.
- Bryhni, A., Bretteville-Jensen, A.L., Bye, E.K., Hauge, R., Nordlund, S., Lauritzen, H.C., & Skretting, A. (2009). *Rusmidler i Norge 2008*. SIRUS report.
- Bryman, A. (2007). Barriers to integrating quantitative and qualitative research. *Journal of mixed methods research*, 1(8), 8-22.
- Caulkins, J., Reuter, P., Iguchi, M. & Chiesa, J. (2003). *Drug Use and Drug Policy Futures. Insights from a Colloquium*. RAND Drug Policy Research Center. Policy paper. US.
- Creswell, J. (2003). *Research Design. Qualitative, Quantitative and Mixed Method Approaches*. Sage.
- Creswell, J. and Plano Clark, V. (2007). *Designing and conducting mixed methods research*. Thousand Oaks CA, Sage.
- Dale, A. & Jones, S. (1992). *The Methadone Experience*. London: The Centre for Research on Drugs and Health Behaviour.
- Darke, S., Topp, L. & Kaye, S. (2001). IDRS: Illicit drug reporting system. *Illicit drug trends bulletin*, December. Sydney: National Drug and Alcohol Research Centre.
- Darke, S. (1994). The use of benzodiazepines among injecting drug users. *Drug Alcohol Review*, 13, 63-9.

Day, C., Collins, L., Degenhardt, L., Thetford, C. & Maher, L. (2004). Reliability of heroin users' reports of drug use behaviour using a 24 month timeline follow-back technique to assess the impact of the Australian heroin shortage. *Addiction Research and Theory*, 12 (5), 433-443.

Degenhardt, L. & Dietze, P. (2005). Monograph No. 10: *Data sources on illicit drug use and harm in Australia*. DPMP Monograph Series. Fitzroy: Turning Point Alcohol and Drug Centre.

Degenhardt, L., Black, E., Breen, C., Bruno, R., Kinner, S., Roxburgh, A., Fry, C., Jenkinson, R., Ward, J., Fetherston, J., Weekley, J. & Fischer, J. (2006). Trends in morphine prescriptions, illicit morphine use and associated harms among regular injecting drug users in Australia. *Drug and Alcohol Review*, 25, 403-412.

Denzin, N. (1989). *The research act: A theoretical introduction to sociological methods*. Chicago. 3rd edition. Aldine, Chicago.

Domes, R. & Kraus, L. (2002). An early recognition system for drug trends in Berlin. In EMCDDA (Ed.), *Understanding and responding to drug use: the role of qualitative research*. Lisbon: European Monitoring Centre for Drugs and Drug Addiction.

Drug Detection Laboratories Inc. (2006). Retrieved from <http://www.drugdetection.net/drug.htm>

Duff, C., Chow, C., Ryan, E. et al. (2006). *Vancouver youth drug reporting system: 2006 preliminary findings*. Vancouver: Vancouver Coastal Health.

EMCDDA. (1997). Estimating the prevalence of problem drug use in Europe. *EMCDDA Scientific Monograph*, 1. Lisbon: European Monitoring Centre for Drugs and Drug Addiction.

EMCDDA. (1999). *Feasibility study on detecting, tracking and understanding emerging trends in drug use. Summary*. Lisbon: European Monitoring Centre for Drugs and Drug Addiction.

EMCDDA. (2001). *Summary of a feasibility study: Monitoring youth media as a new source of information for detecting, tracking, and understanding emerging drug trends*. Lisbon: European Monitoring Centre for Drugs and Drug Addiction.

EMCDDA. (2007). *Early-warning system on new psychoactive substances — operating guidelines*. Lisbon: European Monitoring Centre for Drugs and Drug Addiction.

EMCDDA. (2008). *GHB and its precursor GBL: an emerging trend case study*. Thematic Paper. Lisbon: European Monitoring Centre for Drugs and Drug Addiction.

EMCDDA. (2009a) Retrieved from: <http://www.emcdda.europa.eu/html.cfm/index190EN.html>

EMCDDA. (2009b) Retrieved from: http://www.emcdda.europa.eu/attachements.cfm/att_78824_EN_2-PGriffiths_RSimon.ppt#292,12,Trends

-
- Ferrence, R. (1994). Diffusion of innovation as a model for understanding population change in substance misuse. In G. Edwards & M. Lader (Eds.), *Addiction: Processes of Change* 189-201. Oxford: Oxford University Press.
- Flesland, L. & Mounteney, J. (2007). *Føre Var reader evaluation study*. Bergen Clinics Foundation. Norway.
- Fountain, J., Strang, J., Gossop, M., Farrell, M. & Griffiths, P. (2000). Diversion of prescribed drugs by drug users in treatment: analysis of the UK market and new data from London. *Addiction*, 95(3), 393-406.
- Fry, C. & Hall, W. (2002). An ethical framework for drug epidemiology: identifying the issues. *Bulletin on Narcotics*, 54, 1 and 2.
- Fry, C. & Bruno, R. (2002). Recent trends in benzodiazepine use by injecting drug users in Victoria and Tasmania. *Drug Alcohol Review*, 21, 363-7.
- Geertz, C. (1973). Thick description: toward an interpretative theory of culture. In: C. Geertz. *The interpretation of cultures. Selected Essays*. New York: Basic Books.
- Ghodse, H. (1995). *Drugs and Addictive Behaviour: a guide to treatment*, 2nd edn., Oxford, Blackwell.
- Gilmour, S., Degenhardt, L. Hall, W. & Day, C. (2006). Using intervention time series analyses to assess the effects of imperfectly identifiable natural events: a general method and example. *BMC Medical Research Methodology*, 6:16.
- Golub, A. & Johnson, B. (1996). The crack epidemic: Empirical findings support an hypothesized diffusion of innovation process. *Socio-Econom. Plann. Sci.*, 30(3), 221-231.
- Grady, C. (2001). Money for research participation: does it jeopardise informed consent? *American Journal of Bioethics*, 1, 41-44.
- Gray, D. (2004). Project to assess youth drug problem. The Age, Dec 30. Retrieved from <http://www.theage.com.au/news/National/Project-to-assess-youth-drug-problem/2004/12/29/1103996612018.html>
- Griffiths, P., Vingoe, L., Hunt, N., Mounteney, J. & Hartnoll, R. (2000). Drug information systems, early warning and new trends: Can drug monitoring systems become more sensitive to emerging trends in drug consumption? *Substance Use and Misuse*, 35, 811-844.
- Hando, J., Darke, S., O'Brien, S., Maher, L. & Hall, W. (1998). *The Illicit Drug Reporting System (IDRS) Trial: Final Report*. NDARC Monograph 31. Sydney: National Drug and Alcohol Research Centre.
- Hartnoll, R., Avico, U., Ingold, F., Lange, K., Lenke, L., O'Hare, A. & de Roij-Motshagen, A. (1989). A multi-city study of drug misuse in Europe. *UNODC Bulletin*.

- Hartnoll, R. (1997). In Estimating the prevalence of problem drug use in Europe. *EMCDDA Scientific Monograph No.1*. Lisbon: European Monitoring Centre for Drugs and Drug Addiction.
- Hartnoll, R., Hendriks, V. & Morrival, M. (1998). *The assessment of drug problems*. World Health Organisation.
- Hartnoll, R. (2003). Drug epidemiology in the European institutions: historical background and key indicators. *Bulletin on Narcotics*, 55 1&2, 53-71.
- Hibell, B., Guttormsson, U., Ahlström, S., Balakireva, O., Bjarnason, T., Kokkevi, A. & Kraus, L. (2007). *The 2007 ESPAD Report, Substance Use Among Students in 35 European Countries*. The Swedish Council for Information on Alcohol and other Drugs (CAN), The European Monitoring Centre for Drugs and Drug Addiction (EMCDDA, Council of Europe, Co-operation Group to Combat Drug Abuse and Illicit Trafficking in Drugs (Pompidou Group).
- Hilton, A. (2005). Should qualitative and quantitative studies be triangulated? *International Society of Nurses in Cancer Care*. Retrieved from <http://www.isncc.org/lists.asp%3FTab>.
- INCB. (2007). *The Report of the International Narcotics Control Board for 2006*. United Nations (E/INCB/2006/1).
- Iversen, E., Skutle, A., Bolstad, A. & Knoff, R. (2008). *Young People and Drugs in Bergen. A survey amongst year 8. and 10 pupils in Bergen Kommune*. Bergen Clinics Foundation. Norway.
- Johnson, R. & Onwuegbuzie, A. (2006). Mixed methods research: A research paradigm whose time has come. *Educational researcher*, 33(7), 14-26.
- Johnston, L. D., O'Malley, P. M., Bachman, J. G. & Schulenberg, J. E. (2007). Monitoring the Future national results on adolescent drug use: Overview of key findings, 2006. *NIH Publication No. 07-6202*. Bethesda, MD: National Institute on Drug Abuse.
- Kemmesies, U. & Hess, H. (2001). *MoSyd. Monitoring-System Drogentrends*. Frankfurt: Centre for Drug Research.
- Kemmesies U. (2002). *The Semantic Differential in Research on Drug Trends – an old methodological approach towards 'new' drugs*. Frankfurt: CDR.
- Korf, D. & Nabben, T. (2002). Antenna: a multi-method approach to assessing new drug trends. In EMCDDA, *Understanding and responding to drug use: the role of qualitative research*. Lisbon: European Monitoring Centre for Drugs and Drug Addiction.
- Kumar, K. (1989). *Conducting key informant interviews in developing countries. A.I.D. program design and evaluation*. Methodology report no.13. Agency for International Development.

-
- Last, J.M. (2001). *A Dictionary of epidemiology*, 4th edition New York: Oxford University Press.
- Lund, M.K.Ødegård, Skretting, A. & Lund, K.E. (2007). *Rusmiddelbruk blant unge voksne, 21-30 år*. Oslo: SIRUS.
- McKeganey, N. (1988). Shadowland: General practitioners and the treatment of opiate abusing patients. *British Journal of Addiction*, 83, 373-386.
- Maxwell, J. (2006). *Trends in the abuse of prescription drugs*. Gulf Coast Addiction Technology Transfer Center. Texas.
- van de Mheen, H., Coumans, M., Barendregt, A. & van der Poel, A. (2006a). A Drug Monitoring System: keeping a finger on the pulse by triangulation of qualitative and quantitative methods. *Addiction Research and Theory*, 14(5), 461-473.
- van de Mheen, H., Toet, J., Knibbe, R., Garretsen, H., Spruit, I. & van den Berg, M. (2006b). A local and regional Alcohol and Drugs Monitor in the Netherlands: a tale of three cities. *Drug and Alcohol Review*, 25, 259-267.
- Morgan, D. (2007). Paradigms lost and pragmatism regained: Methodological implications of combining qualitative and quantitative methods. *Journal of Mixed Methods Research*, 1, 48-76.
- Mounteney, J. & Leirvåg, S-E. (2004). Providing an Earlier Warning of Emerging Drug Trends: the Føre Var System. *Drugs: education, prevention and policy*, 11(6), 449-471.
- Mounteney, J. (2005). *Føre Var reader evaluation study*. Bergen Clinics Foundation. Norway.
- Mounteney, J. & Leirvåg, S-E. (2005). *Føre Var report – Autumn 2005*. Bergen Clinics Foundation, Norway.
- Mounteney, J. & Flesland, L. (2007). *Føre Var report – Autumn 2007*. Bergen Clinics Foundation, Norway.
- Mounteney, J & Berg, E.K. Utne. (2008). Youth, risk and rapid assessment: a new model for community social work assessment? *International Journal of Social Work*, 11(3), 221-235.
- Mounteney, J. & Haugland, S. (2009a). Earlier warning: a multi-indicator approach to monitoring of trends in the illicit use of medicines. *International Journal of Drug Policy*, 20,161-169.
- Mounteney, J., Fry, C., McKeganey, N. & Haugland, S. (2009b). Challenges of reliability and validity in the identification and monitoring of emerging drug trends. *Substance Use Misuse*. In press.
- Mounteney, J. Stooove, M. & Haugland, S. Monitoring emerging drug trends: psychometrics and validity in earlier warning systems. Submitted.

National Institute on Drug Abuse and Community Epidemiology Work Group. (2001). *Epidemiologic Trends in Drug Abuse: Advance Report*, NIDA. December 2001.

National Institute on Drug Abuse. (2005). *Epidemiological Trends in Drug Abuse*. CEWG Advance Report and Highlights/Executive Summary: Abuse of Stimulants and Other Drugs. NIDA.

Office of Science and Technology. (2005). *Foresight. Drug Futures 2025?* Executive summary and overview. OST. UK.

O’Gorman, A., Doyle, M. & Crean, D. (2005). *National Drug Trend Monitoring System: Results from a feasibility study*. Dublin: Reports.

Oliver, P., Keen, J., Rowse, G. & Mathers, N. (2001). Deaths from drugs of abuse in Sheffield, 1998: the role of prescribed medication. *Br J Gen Pract.* 51(466), 394–396.

ONDCP. (2002). Pulse Check: Trends in Drug Abuse. Office of National Drug Control Policy. Washington. DC: U.S.

Parry, C., Bhana, A., Plüddemann, A., Myers, B., Siegfried, N., Morojele, N., Flisher, A. & Kozel, N. (2002). The South African Community Epidemiology Network on Drug Use (SACENDU): description, findings (1997–99) and policy implications. *Addiction* 97, 969–976.

Patton, M. (1990). *Qualitative Evaluation and Research Methods*. 2nd Edition. Sage.

Regulation (EC) No. 1920/2006 of the European Parliament and of the Council. L 376/1. *Official Journal of the European Union*.

Rhodes, T., Kumar, S.M. & Fitch, C. (2000). Special Issue: Rapid Assessment and Response. *International Journal of Drug Policy*, 11.

Ritter, A. (2005). Bulletin No.1 *Overview of the Drug Policy Modelling Project (DPMP)*. Turning Point, Australia.

Rogers, E. (1995). *Diffusion of Innovation*. 4th edn. New York, NY: Free Press.

Rossmann, G. & Wilson, B. (1985). Numbers and words: combining quantitative and qualitative methods in a single large-scale evaluation study. *Evaluation Review*, 9(5), 627-643.

SIRUS. (2008). *The Drug Situation in Norway*. Annual report to the European Monitoring Centre for Drugs and Drug Addiction. EMCDDA. SIRUS, Oslo.

Skretting, A. (2007). *Ungdomsundersøkelsen 2007*. Hovedresultater fra de årlige ungdomsundersøkelsene 1968-2005. SIRUS-rapport.

-
- Skutle, A., Bolstad, A. & Iversen, E. (2002). *Young People and Drugs in Bergen. A survey amongst year 8. and 10 pupils in Bergen Kommune*. Bergen Clinics Foundation. Norway.
- Sloboda, Z. & Kozel, N. (1999). "Frontline surveillance: the Community Epidemiology Work Group on Drug Abuse." In Glantz, M.D. & Hartel, C.R. (eds.), *Drug Abuse Origins and Interventions*. *American Psychological Association Press*, 47-62.
- Sloboda, Z. (2003). Understanding drug trends in the United States of America: the role of the Community Epidemiology Work Group as part of a comprehensive drug information system. *Bulletin on Narcotics*, 55, Nos. 1 and 2.
- Strang, J., Griffiths, P., Abbey, J. & Gossop, M. (1994). Survey of injected benzodiazepines among drug users in Britain. *BMJ*, 308: 1082.
- Strang, J., Griffiths, P., Powes, B., Fountain, J., Williamson, S. & Gossop, M. (1999). Which drugs cause overdose amongst opiate misusers? A study of personal and witnessed overdoses. *Drugs and Alcohol Review*, 18, 253-261.
- Tashakkori, A. & Teddlie, C. (1998). *Mixed methodology: combining qualitative and quantitative approaches*. Thousand Oaks. Sage.
- Topp, L., Breen, C., Kaye, S. & Darke, S. (2004). Adapting the Illicit Drug Reporting System (IDRS) to examine the feasibility of monitoring trends in the markets for 'party drugs'. *Drug and Alcohol Dependence*, 73, 189-197.
- UNODC. (2006). *East Asia and the Pacific 2005 Regional Profile*. Bangkok: United Nations Office on Drugs and Crime Regional Centre for East Asia and the Pacific.
- Wilkins, C., Girling, M. & Sweetsur, P. (2006). *Recent trends in illegal drug use in New Zealand, 2006*. Findings from the combined modules of the 2006 Illicit Drug Monitoring System (IDMS). Centre for Social and Health Outcomes Research and Evaluation & Te Ropu Whariki. Auckland: Massey University. Retrieved 4th. September 2007 from [http://www.ndp.govt.nz/moh.nsf/pagescm/1109/\\$File/idms-2006-final-report-v2.pdf](http://www.ndp.govt.nz/moh.nsf/pagescm/1109/$File/idms-2006-final-report-v2.pdf)
- World Health Organisation & UNICEF. (1998). *The Rapid Assessment and Response Guide on Psychoactive Substance Abuse and Especially Vulnerable Young People*. Geneva: WHO & UNICEF.

