DRUG USE AND DRUG CONTROL POLICY: EVALUATING THE IMPACT OF PRECURSOR REGULATION ON DRUG USER BEHAVIOUR

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ABSTRACT

Controlling the availability of illicit drugs and their use is an exemplar of a wicked problem. Reducing the scale of the illicit drugs market through suppressing supply has proven extremely difficult. A recent systematic review of studies by Cunningham and colleagues who have produced a series of research papers examining the impact of precursor regulations on various methamphetamine outcomes in North America, argue this research represents the most compelling evidence to date that ‘precursor regulations, or indeed any supply control strategy, can have significant impacts on the retail market for illicit drugs’. The review of this work concludes that the question for future research is ‘not so much whether precursor regulations work, but which regulations work best and in what context’; this is the starting point for my research.

The market for methamphetamine is entrenched, broad and dynamic and represents an important criminological and public health problem in Australia. Within Australia the production of methamphetamine has been concentrated in Queensland and that state government has responded by developing a coercive regulatory framework which co-opts pharmacies into a partnership with drug law enforcement that is aimed at preventing the diversion of licit precursor chemicals to the illicit market for manufacture into methamphetamine. In 2005, the Queensland Pharmacy Guild in partnership with the Queensland Police Service developed an electronic medication recording system Project STOP, - which is a real-time web based database used by police to track and apprehend ‘pseudo runners’ - to facilitate adherence to the compulsory requirements of recording and reporting sales of pseudoephedrine placed upon them by both health regulations and the criminal law. In my thesis, I refer to the family of innovations (legislative, policy and technological interventions) underpinning the police–pharmacy partnership as Third Party Policing (TPP).

My thesis seeks to evaluate the effectiveness of the TPP partnership approach to supply reduction of a specific contemporary drug problem, that is, methamphetamine use. A related aim was to develop and use a theory-driven evaluation framework – that goes beyond the traditional drug supply/demand evaluation paradigm – to assess, in an innovative way, the range of mechanisms that influence changes in methamphetamine treatment seeking behaviour. I achieve this by developing a framework that integrated the strength of a quasi-experimental design with the insights of a theory driven approach in order to answer ‘how’ and ‘why’ the intervention worked or not. Meeting these aims required an understanding of: the historical development of drug policy as a state response to a historically situated drug ‘user’; and current theoretical developments in drug law enforcement approaches, specifically third party policing. In addition, I consider the evidence from
epidemiological research that focuses on trends and patterns of drug use behaviour and that highlight the sometimes unintended consequences of law enforcement efforts.

The methodological approach I develop includes firstly, applying a heuristic proposed by Left Realist criminology’s ‘Crime Square’ to develop a theory based evaluation framework. I identified a number of mechanisms drawn from a review of the relevant extant research literature noted above, namely: specific deterrence, compensation, intransigence and diffusion. I then used confidentialised monthly counts from the Alcohol and Other Drugs Treatment-National Minimum Data Set for Queensland from 2002/03 to 2008/09 to develop empirical indicators that measured the mechanisms. I tested the mechanisms by applying Pawson and Tilley’s ‘context-mechanism-outcome’ approach and used interrupted time-series analysis to analyse the indicator series. Overall I found a deterrent effect of the TPP intervention on treatment admissions. I then develop an account for the observed changes that resulted from the introduction of precursor regulations alongside the implementation of a key technology Project STOP in Queensland over the study period. The discussion applies the theoretical framework developed in the first half of the thesis to develop a causal explanation of the macro-micro-macro impact.

In my thesis I unpack the complexity and outcomes of one family of policy responses to one very specific drug problem – methamphetamine users seeking treatment for their drug use. By developing and using a theory driven evaluation framework I have made an important contribution to evaluating a new kind of drug law enforcement intervention – a third party policing approach to preventing precursor chemical diversion. I have built upon Cunningham and his colleagues’, ground-breaking epidemiological research into the impacts of precursor regulations on various methamphetamine indicators and have started a more ‘sophisticated analysis’ of how a supply reduction intervention might impact on drug use behaviour and, by implication, the harms associated with injecting methamphetamine use. The research makes an important contribution to drug policy evaluation efforts by establishing the macro-micro impact of policy on behaviour and by demonstrating the dynamic relationship between two important drug policy pillars, namely law enforcement and treatment.
STATEMENT OF ORIGINALITY

This work has not previously been submitted for a degree or diploma in any university. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made in the thesis itself.

Ingrid Diana McGuffog

20/12/2012
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<th>Description</th>
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<tbody>
<tr>
<td>ACC</td>
<td>Australian Crime Commission</td>
</tr>
<tr>
<td>AIHW</td>
<td>Australian Institute of Health and Welfare</td>
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<tr>
<td>AODTS</td>
<td>Alcohol and other drug treatment services</td>
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<tr>
<td>AODTS-NMDS</td>
<td>Alcohol and other drug treatment services national minimum data set</td>
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<tr>
<td>ASCDC</td>
<td>Australian Standard Classification of Drugs of Concern</td>
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<tr>
<td>CJS</td>
<td>Criminal justice system</td>
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<tr>
<td>CTE</td>
<td>Closed treatment episode</td>
</tr>
<tr>
<td>CURF</td>
<td>Confidentialised unit record file</td>
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<tr>
<td>DLE</td>
<td>Drug law enforcement</td>
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<tr>
<td>DUMA</td>
<td>Drug use monitoring in Australia</td>
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<tr>
<td>IDRS</td>
<td>Illicit drugs reporting system</td>
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<tr>
<td>IGCD</td>
<td>Intergovernmental Committee on Drugs</td>
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<tr>
<td>NDSHS</td>
<td>National Drug Strategy Household Survey</td>
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<tr>
<td>NMDS</td>
<td>National minimum data set</td>
</tr>
<tr>
<td>SUSMP</td>
<td>Standard for the Uniform Scheduling of Medicines and Poisons</td>
</tr>
<tr>
<td>TGA</td>
<td>Therapeutic Goods Administration</td>
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<tr>
<td>TPP</td>
<td>Third party policing</td>
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To my daughter Lauren who travelled through the darkest places with me, and whose love guided me back...
Chapter 1 INTRODUCTION

A WICKED PROBLEM

Illicit drug use is an exemplar of a wicked problem. Whilst the use of mind altering drugs dates back to ancient times, new technologies that heighten drug potency, more efficient methods of drug delivery and escalations in drug availability have unleashed unprecedented forces that converge to make illicit drug use one of the most intractable, wicked problems of contemporary times (McKee & Leon, 2005; Musto, 1999; White, 2004). A wicked problem is one that is hard to define, has a changing nature, can never be truly solved, and has a range of different and conflicting stakeholder views. Rittel and Webber (1973) first used the phrase ‘wicked problems’ to describe a problem that is difficult or impossible to solve because of incomplete, contradictory, and changing requirements that are often difficult to recognise. For Rittel and Webber (1973), the search for scientific bases for confronting problems of social policy is bound to fail, because of the nature of these problems. They are called ‘wicked’ problems because science is structured to typically deal with ‘tame’ problems. Because of complex interdependencies, the effort to solve one aspect of a wicked problem may reveal or create other problems (Ackoff, 1981).

International systems of drug control seek to address the wicked problem of drug use both unilaterally and internationally (UNODC, 2009). Indeed, both domestic and international drug control efforts range from, law enforcement to harm reduction to treatment to prevention, and, for some countries (notably Portugal), to a de-criminalisation perspective. Despite these broad based sets of approaches, the international system of drug control has produced some unintended consequences. One unintended consequence has been the creation of a highly profitable and violent illicit drug market (Robinson, 1950). Another consequence of domination of law enforcement efforts to control drug use and supply is the relative reductions in resources away from health approaches (Robinson, 1950) to what is, essentially, a public health problem. Research also shows that law enforcement efforts in one geographic area can result in the displacement of the problem into other areas (Weisburd & Green, 1995), and pressure on the market for one particular substance can, inadvertently, promote the use of an alternate drug (Topp, Day, & Degenhardt,
Finally, the use of the criminal justice system against drug users, who often come from marginal groups, has in many instances increased their marginalisation and diminished the capacity to offer treatment to those who need it most (UNODC, 2009).

Simply put, controlling a wicked drug problem through policy is about governments’ attempts to prevent and control the use and abuse of prohibited substances. Nonetheless, the nature of the problem is difficult to define because of competing causal paradigms, and tensions between the different institutions responsible for enacting (at times) conflicting drug policy goals (James & Sutton, 2000). For example, the harm minimisation objectives of health-care providers often are in stark contrast to the objectives of law enforcement, which has a mandate to enforce drug laws and punish those who supply and/or consume illicit drugs. Despite the range of responses to the problem (enforcement, treatment, prevention and harm minimisation), the prevalence and harmful effects of illicit drug (ab)use at the individual and community level remains a widespread and endemic problem both globally and in Australia. There appears to be no clear solution to the ‘drug problem’ and the best that can be hoped for is a ‘least bad’ solution (Mugford, 1993; Reuter & Caulkins, 2009).

As with all types of wicked problems, reducing the scale of illicit drug market activities through government action has proven extremely difficult. Indeed, the global market has expanded exponentially (Roberts, Trace, & Klein, 2004), despite international efforts to reduce the size and scale of drug production, supply, demand and use. Roberts et al. (2004) argue that it is hard to find solid evidence for a straightforward link between supply reduction initiatives and sustained falls in the consumption or availability of illegal drugs. In addition, even where there is evidence of a fall in the use or availability of drugs, this will not necessarily be correlated to a reduction in drug-related harm (Roberts et al., 2004). The apparent limited ability of drug law enforcement (DLE) to reduce prevalence does not mean, however, that supply reduction initiatives are having no impact on drug markets. It is widely argued that supply reduction contains the expansion of drug markets, even if it fails to reduce markets (Roberts et al., 2004).

**My Thesis Aims**

Given the dearth of evidence to understand what works (and what doesn’t) to reduce or contain illicit drug market activity, the first aim of my thesis is to evaluate the effectiveness of a third party policing intervention directed at suppressing the supply of a specific illicit drug on the collective
outcome of drug treatment admissions. My thesis focuses on a specific police-led, third party policing partnership with the Pharmacy Guild. Together, the police and the Pharmacy Guild of Queensland developed an innovative approach to dealing with the rapid rise of methamphetamine use in the early 2000s. In my thesis, I refer to the family of innovations (legislative, policy and technological interventions) underpinning the police–pharmacy partnership as Third Party Policing (TPP) (see Mazerolle & Ransley, 2005). The intervention involved police harnessing the crime control capacity of community pharmacies in the prevention of pseudoephedrine diversion through the development of an electronic medical recording system. Regulatory changes also were enacted that compelled pharmacists to comply with new requirements for the recording and reporting of sales of the main precursor chemical needed to manufacture methamphetamine, pseudoephedrine. This new regulatory mechanism shifted part of the policing function to a third party, in this case, pharmacists.

Taken together, I define the family of regulatory responses as an example of a TPP intervention. In a general sense, TPP marks a shift away from traditional reactive ‘law enforcement’ methods (L. G. Mazerolle & Ransley, 2005) that are known to cause the most harms to drug users (Maher & Dixon, 1999; Wood & Kerr, 2005; Wood, Tyndall, Spittal, Li, & et al., 2003). Indeed, in a recent systematic review of street-level drug law enforcement that compared community-wide policing, problem-oriented/partnership approaches that were geographically focused, hotspots policing and standard, unfocused law enforcement efforts found that interventions that leverage partnerships are more effective in dealing with drug problems than traditional, law enforcement-only interventions (L. G. Mazerolle, Soole, & Rambouts, 2007). The results of this review suggest that ‘the key to successful drug law enforcement lies in the capacity of the police to forge productive partnerships with third parties’ (Mazerolle, et al., 2006, p. 406, emphasis added).

Not only is there a dearth of drug law enforcement intervention evaluation, it is particularly important to begin to address the sometimes dismissive notion that ‘nothing works’ in supply-side drug law enforcement, which arguably misrepresents a complex and inadequately conceptualised policy problem (Windle & Farrell, 2012). In addition, rather than focusing on traditional policing ‘outcomes’ such as arrests and seizures, ‘effectiveness’ can be usefully thought of in terms of wider social impacts, especially public health outcomes, such as the ‘help seeking’ behaviour of individuals who are involved in an illicit drug market. This rationale fits with the raison d’être of Australia’s drug policy: harm minimisation. In my thesis, therefore, my first goal is to examine the effectiveness of the Queensland partnership between the police and pharmacies in Queensland, which I define as a TPP intervention, on patterns of drug treatment admissions.
The second aim of my thesis is to develop and use a theory-driven evaluation framework — that goes beyond the traditional drug supply/demand evaluation paradigm — to assess, in an innovative way, the range of mechanisms that influence changes in methamphetamine treatment seeking behaviour. In many regards, this theory driven effort to better understand context-mechanism-outcome configurations (Pawson & Tilley, 1997) is the centrepiece of my thesis. I recognise the ‘gold standard’ of evaluation is the true randomised experiment and take note of the Campbell Collaboration's efforts to promote the use of the medical model of ‘evidence’ for developing improvements in criminal justice policy and practice. I recognise, however, that the exclusive focus on better methods of evaluation, without concomitant developments in the theoretical frameworks that underpin them, overlooks the importance of uncovering the causal processes or ‘mechanisms’ that link intervention contexts with outcomes (Tilley, 2009). Realistic evaluation offers a theory-driven approach that can overcome the limitations of so-called method driven evaluation (Pawson & Tilley, 1997). There is nothing inherently incompatible with attempting to combine Campbell Collaboration standards with the realist objective of developing explanatory evaluation models based on context-mechanism-outcome configurations (van der Knaap, Leeuw, Bogaerts, & Nijssen, 2008), indeed the evaluation approach I develop and use in this thesis is one such attempt.

In this introductory chapter to my thesis, I begin by describing the nature of the methamphetamine problem in Queensland, Australia and the policy responses that have been developed to address this wicked problem. I then outline my specific research questions and describe the structure of the chapters in my thesis.

THE METHAMPHETAMINE PROBLEM IN QUEENSLAND, AUSTRALIA

Over the last decade or so, the market for amphetamines has become entrenched in Australia in general and in Queensland in particular, and the abuse of these illicit drugs has become a significant problem for drug law enforcement, as well as for social and health agencies. Epidemiological evidence has demonstrated that Australia has a large population of dependent methamphetamine

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1 The Campbell Collaboration - named after Donald Campbell, the American psychologist and evaluator who advocated the idea that governmental reforms can be seen as societal experiments to which scientific rules of evidence can be applied – has a mission to make systematic reviews of research evidence available to policy makers, practitioners, researchers and the public. (Tilley).
users, most of whom inject the drug. Moreover, the size of this population is similar to the estimated size of the heroin using population in the late 1990s, which was one of the highest in the world (McKetin, McLaren, Kelly, Hall, & Hickman, 2005; UNODC 1996: 77). The production of amphetamines in clandestine laboratories in Australia grew significantly in the 1990s, and was reported to represent a substantial part of the global production of these illicit substances by the mid-1990s (UNDCP, 1996). During the decade from 1996 to 2005, the Australian Crime Commission reported an almost seven-fold increase in the detection of clandestine laboratories Australia-wide (Schloenthal, 2007). The vast majority of the illicit production of methamphetamine within Australia has been particularly concentrated in Queensland (UNODC 1996: 130).

Figure 1.1 shows the number of clandestine laboratories seized in Queensland between 1999/2000 to 2009/10. The graph shows steady growth from 1999/2000 until 2004/05 and a steep decline thereafter. The most recent data shows what could be a ‘bounce’ back in methamphetamine production, after a few years of contraction. Queensland reported the greatest increase in detections in the year 2009/10 and the most recent findings from the Drug Use Monitoring Australia trend analysis suggests that the continuing decline in methamphetamine use since 2004 may have ended, with rates of use among police detainees increasing in both 2010 and 2011 (Australian Crime Commission, 2011; Macgregor & Payne, 2011).

Source: Queensland Police Service

Figure 1.1: Clandestine labs seized in Queensland from 1999–2000 to 2009–2010
The Illicit Drug Reporting System (IDRS) is a monitoring system designed to identify emerging trends of local and national illicit drug markets. The reporting system comprises data collected each year from three sources: interviews with a sentinel group of people who regularly inject drugs (participants), interviews with key experts, and analysis of pre-existing data related to illicit drugs. When looking over the past decade at the drug most often injected in the previous month in Queensland, the three most commonly injected drugs (heroin, methamphetamine and morphine) have fluctuated in use (Figure 1.2). In general, there has been a trend for fewer participants to report most often injecting methamphetamine since the middle of the decade. In 2010, 22% of participants nominated methamphetamine, whereas in 2003, it was 57% (McIlwraith, Hickey, & Alati, 2010).

One way to monitor fluctuations in drug harms involves tracking and assessing phone calls to the Alcohol and Drug Information Service (ADIS) for telephone counselling. These phone calls represent the number of calls about a drug from people who had a drug history and were willing to provide information about it, and can, arguably, be used as an indicator of drug harms. Figure 1.3 shows the trends in phone calls about methamphetamine. Following a relatively high number of calls, which peaked in 2006/07, in the past three years there has been a downward trend in the number of calls to ADIS pertaining to methamphetamines. In 2010, methamphetamine related calls comprised only

Source: Queensland IDRS participant interviews, 2000-2010

**Figure 1.2: Drug of choice, Queensland Participants in the IDRS 2000–2010**

**Figure 1.3: Trends in phone calls to ADIS about methamphetamine, 2000-2010**
10% of all calls (McIlwraith et al., 2010). This pattern is consistent with the patterns reported above, that is, there was an increase in the supply and use of methamphetamine in the early part of this decade, which began to decline around 2004 to 2005. Methamphetamine use and associated harms during this period was perceived to be an epidemic arguably in response to the sudden shift and decline in the heroin market around 2000.

![Number of enquiries to ADIS regarding methamphetamines, 2001/02 to 2009/10](image)

Source: Queensland Alcohol and Drug Information Service

**Figure 1.2 Number of enquiries to ADIS regarding methamphetamines, 2001/02 to 2009/10**

I also note that the trends in methamphetamine use in the first decade of this century appear to be interrelated with trends in the supply of heroin. In the latter part of 2000 and the first quarter of 2001, there was a sudden, unprecedented reduction in heroin supply and purity, referred to as the ‘heroin drought’. Prices doubled, and street level purity declined from averages of 55% to 30% (Degenhardt, Day, Dietze, et al., 2005; Longo, Henry-Edwards, Humeniuk, Christie, & Ali, 2004). Importantly, the readjustment of the heroin market was not transitory; that is, although supply has recovered, prices have remained higher and purity levels remain lower. One consequence of this rapid change in the illicit drug market was a decline in heroin use and a corresponding increase in psychostimulant use (Day, Degenhardt, & Hall, 2006). Simultaneously, there was a shift from low purity amphetamine powder to crystalline methamphetamine (‘ice’), a high potency form of the drug analogous to crack cocaine (Topp & Churchill, 2002; Topp, Degenhardt, Kaye, & Darke, 2002).
The more potent crystalline form of methamphetamine is preferred by methamphetamine users, and has a higher risk of dependence. These patterns are consistent with marked increases in high purity methamphetamine use in many regions around the Pacific Rim, including western North America, South-East Asia and Oceania (Schloenhardt, 2007).

These factors coalesce to give rise to what is referred to as a methamphetamine epidemic in Australia (and Queensland) in the early 2000s. A recent study examined whether these changes in the drug market were reflected in the treatment seeking patterns of heroin and methamphetamine users (Campbell, Darke, Popple, & Toson, 2011). They found a number of trends, ‘the most salient was the marked decline in heroin as the primary presenting problem, and the contiguous increase in methamphetamine presentations’ (p. 109). Thus, in 2003 heroin users comprised a third of initial admissions and by 2008, they comprised a fifth. The pattern for methamphetamine mirrored this trend, such that by 2008, a third of admissions were for primary methamphetamine dependence. (Campbell et al., 2011) argue that the marked change in case mix presenting for treatment was consistent with the broader drug trends seen in the illicit drug market.

This brief introduction to some of the dimensions of the methamphetamine problem in Queensland (and Australia) demonstrates its wicked nature, its complexity, and the cyclical nature of the methamphetamine drug epidemic in Queensland. Tackling this problem in Australia has required the use of innovative policing and legislative responses. The regulatory response to the problem of the diversion of legally obtainable precursor chemicals for the manufacture of illicit methamphetamine in local clandestine laboratories is briefly introduced next.

**Precursor Regulations**

In recent years, all Australian States and Territories have reviewed and changed regulations regarding the storage, display and sales of pseudoephedrine-based medicines. These changes are part of a national strategy that seeks to curb the volume of these medicines diverted to the illicit drug market as precursors for the manufacture of amphetamine type substances (ATS). Significant national legislative requirements now underpin pharmacists’ professional responsibilities concerning their role in the supply of pseudoephedrine products (Ransley, 2012). An important aspect of the new regulatory frameworks involves the imposition of significant law-enforcement related responsibilities on third parties, such as community pharmacists, who are now regulated in how they deal with precursor-based medicines and how they respond to consumers. The national roll out of Project STOP supports the legislative requirements of reporting over-the-counter medicine sales: Project STOP is a database that consolidates sales history by individuals based on previous
transactions registered on the system through a web based portal. The database provides pharmacists with relevant information to determine the legitimacy of the current transaction and provides police with intelligence on pseudoephedrine ‘runners’ and rogue pharmacists. I note, however, that the uptake of Project STOP and the impact of the regulatory changes have occurred in the absence of a systematic evaluation.

In the Australian context, there currently exists two disparate models of pharmacy reporting requirements: legislative-based mandatory reporting and voluntary reporting, with support structures in place (such as Project STOP) to facilitate pharmacists reporting pseudoephedrine sales (Ransley, 2012). In Queensland, Western Australia, Tasmania, Northern Territory, South Australia and the Australian Capital Territory a legislative mandatory model is in place, whereas Victoria and New South Wales still operate under a voluntary reporting system. In states where a mandatory reporting process exists, sellers of pseudoephedrine based medicines must be licensed, must register all sales, request ‘proof of identification’ from purchasers, and report to police any perceived or real non-legitimate sales. In these states Project STOP – the online real time recording and reporting database – has been mandated in the reporting of transactions relating to pseudoephedrine-based medicines. In contrast, the voluntary reporting system of Victoria and New South Wales simply requires pharmacists to take all reasonable steps to ascertain the identity of the purchaser and the legitimacy of sales; however, there is no legislation that requires the reporting of sales or advising police of perceived or real non-legitimate sales. Furthermore, whilst some pharmacists use Project STOP in these states it is not a mandatory requirement for all pharmacists.

Thesis Aims and Research Questions

Overall, my thesis seeks to evaluate the effectiveness of the TPP partnership approach to supply reduction of a specific contemporary drug problem, that is, methamphetamine use. The nature and context of the emergence of a methamphetamine drug problem resulted in the Queensland police seeking innovative strategies to control the growing problem. The police worked closely with the Pharmacy Guild (i.e. the third party) to lever their support in an effort to control and prevent the diversion of precursor chemicals to the illicit market. In Australia, there is a concentration of illicit manufacture of methamphetamine geographically in the state of Queensland, so my evaluation is focused on that state’s responses.
In my thesis I sought to measure the intersection between the two mainstays, and oft opposed, policy approaches to drug problems: law enforcement and health. I wanted to assess whether, how and why interventions in one sphere of tackling the wicked illicit drug problem (drug law enforcement) might impact on another sphere (drug treatment). I was curious to explore the interconnectedness of these two spheres of the generally siloed drug response ‘pie’. As such, the selection of an appropriate outcome measure was important, as I wanted to go beyond the usual approach to evaluating drug law enforcement, which typically uses drug seizures or arrest data that are also collected by law enforcement. I chose an outcome that is an administrative and routine collection but is also from another drug policy ‘pillar’, namely, drug treatment. This gave me the opportunity to assess the broader outcomes of the TPP intervention.

In my thesis, the theoretical and evaluative issue becomes one of establishing macro-micro links between intervention outputs\(^2\) and outcomes (the evaluation ‘black box’). In paying attention to this evaluation ‘black box’, I apply the principles of realistic evaluation to the issue of assessing the impact of the TPP intervention on treatment seeking and drug use patterns. I recognize that an important component of impact assessment is the logic model, or theory of change (Rossi, Lipsey, & Freeman, 2004). At the most general level the logic model of realistic evaluation is its context-mechanism-outcome configuration. The social explanatory framework I develop in order to theorise macro-micro links comes from Coleman’s typology of mechanisms and Left Realist criminology.

The commonality across all these components of my approach: realistic evaluation, Coleman’s typology of social mechanisms and Left Realist criminology, is a branch of the philosophy of science. ‘Realism’ approaches to science proposes a theory of ‘emergent’ causation such that rather than assuming X causing Y, a social phenomenon emerges out of a set of interrelationships between social structural factors such as the state and society and between organising institutions like markets and the individuals that comprise them (Little, 2011). Conceptualising the wicked drug problem by utilising this kind of ‘systems’ thinking was enormously helpful in my efforts to address the complexity inherent in evaluating the outcomes of the TPP intervention on drug treatment seeking behaviour.

\(^2\) The inputs and processes of this intervention have been evaluated as part of a larger project and have been reported in (Ransley et al., 2012).
The evaluation framework I develop is theory-driven, and based on a systems approach to conceptualising the problem. In order to establish macro policy effects on micro level behaviour I needed to develop an innovative approach to the evaluation task. In my thesis, I do this by developing a frame based on mechanistic thinking; and the causal logic from realistic evaluation.

The link between macro-level structure and micro-level outcomes is ‘action’, in Merton’s terms, ‘purposive social action’ (Merton, 1936); this is the crucial process of change that needs to be theorised in the evaluation in order to address the concern with how the TPP intervention can influence treatment seeking behaviour. With this context driving my thesis, I developed two basic aims:

1. To evaluate the overall effectiveness of a TPP intervention;
2. To develop and use a theory-driven evaluation framework – that goes beyond the traditional drug supply/demand evaluation paradigm – to assess, in an innovative way, a range of mechanisms that influence changes in methamphetamine treatment seeking behaviour.

Specifically, I have formulated three basic research questions:

1. Did the TPP intervention impact on methamphetamine treatment seeking behaviour?
2. How did the TPP intervention impact on methamphetamine treatment seeking behaviour?
   a. What kind of impact did the TPP intervention have on treatment seeking behaviour? That is, was the impact abrupt or gradual, and was its duration temporary or permanent?
   b. Did the TPP intervention impact on treatment seeking behaviour for other drug types? Is there counterfactual evidence that the TPP intervention effect was due to other secular or system-wide factors?
   c. Did the TPP intervention impact diversion of drug users into treatment? That is, did the TPP intervention influence criminal justice system responses to methamphetamine users?
3. What are the mechanisms that link the macro-level TPP intervention to observed changes in methamphetamine treatment seeking behaviour?
   d. How can these mechanisms be conceptualised?
   e. How are these mechanisms observed in the data?
WHAT IS TO FOLLOW

I set about answering these research questions in the following way: first, the aim of Chapter Two is to conduct a brief historical survey of Western societies’ understanding of the drug user because this underlies both the process of naming drug (ab)use as a social problem and of responding to that problem (Smart, 1984). The development and application of knowledge in psychiatry, neuroscience, epidemiology, anthropology and criminology have all contributed to the various ways in which governments have responded to controlling drug problems. My rationale for examining this issue historically is that the relationship between the drug user and society is best illustrated by tracing the historical progression of our understanding of chronic dependent drug use and emergent policy responses. Using the crime square from Left Realist criminology I structure the historical review in order to demonstrate the interconnections between each of the four key ‘players’ they identify that are responsible for the ‘production’ of crime.

Chapter Three then provides a background to the methamphetamine problem globally and in Australia. I briefly provide context to the emergence of the most recent methamphetamine ‘epidemic’ which further illustrates how one drug problem lays the ground for the next as the pattern of illicit drug epidemics cycle from one to another. In this chapter I examine the international, national and local (that is, state) contexts of the policy responses to methamphetamine and develop a detailed policy timeline. I also introduce the family of policy responses that were introduced in Queensland in the study period that I refer to as the TPP intervention.

The aim of Chapter Four is to develop the evaluation framework and hypothesise a theory of the impact of how program outputs (the regulations and Project STOP) can induce change processes that lead to particular impacts (outcomes). This forms the basis for the empirical impact evaluation (interrupted time-series analysis) that will be done later in the thesis. I then outline the dominant approach to drug policy evaluation and offer a critique. Following this, I develop a theoretical and analytic framework drawing from sociology, criminology and theory-based evaluation methodology. I use two heuristic frameworks to do this: the context-mechanism-outcome (CMO) realistic evaluation approach (Pawson & Tilley, 1997) which links mechanisms with context and outcome. The other frame I draw upon is based on James S. Coleman’s work on social mechanisms which was further developed by (Vaessen & Leeuw, 2010) and allows for the specification of an intervention theory.
Chapter Five details the data I use to develop my impact theory and I provide a discussion of the statistical procedures I use to conduct the impact assessment. The data are from the Alcohol and Other Drug Treatment Services National Minimum data set. I applied for and received confidential unit record files of all closed treatment episodes in Queensland from the beginning of collection in 2002/03, to 2008/09, from the custodian of the data, the Australian Institute of Health and Welfare. I discuss in detail the indicator variables I develop for use in the analysis. The second part of this chapter is a detailed technical discussion of the statistical procedure I use to analyse the data. I use interrupted time-series analysis (ITSA), a quasi-experimental method, to conduct an impact assessment of the various measures I developed. ITSA enables me to test for the type of impact pattern an intervention has on an outcome of interest and offers a parsimonious and elegant approach to the evaluation task I have set.

The next three chapters present the results from my impact analysis. Chapter 6 presents descriptive analysis of the trends in methamphetamine treatment seeking in Queensland in comparison with Australia. I then present more detail about the trends and characteristics of treatment seeking for methamphetamine and compare them with other major drugs of concern, namely, alcohol, cannabis and heroin. Chapter 7 presents the initial impact analysis of the overall data series, voluntary treatment admissions. I also conduct ITSA on the other drug series, alcohol, cannabis and heroin, which I use as quasi-controls. Finally, I examine the admissions for treatment episodes from those methamphetamine users who were diverted into treatment by the criminal justice system. The results in this chapter are descriptive and do not offer insight into how or why the TPP impacted on drug treatment seeking. Chapter 8 is where I explore the mechanisms of change that I posed in Chapter 4. I decompose the overall treatment admissions into series that measure the various ‘contexts’ or important attributes of drug users. I then analyse the impact of the various intervention time-points on each of these contexts and report the findings.

Chapter 9 brings together the results from the analysis in Chapters 7 and 8. In my concluding chapter (Chapter 9), I discuss the context-mechanism-outcome configurations. A detailed examination of these configurations allows me to accept one of the theories of change proposed in Chapter 4. Each of the three other mechanisms is rejected and these in fact represent ‘counterfactuals’ to the change mechanism that is seen to be in operation. I then reflect on these findings in terms of traditional approaches to drug law enforcement evaluation.
Chapter 2 Drug Users, Drug Markets, State & Society

INTRODUCTION

Left Realism developed an analytic framework in which crime is analysed in terms of the interaction of four key factors: the state, the social structure, offenders and victims. This chapter uses the Left Realism approach to review the complex interplay of four factors in order to understand the historical and contextual nature of drug policy, drug use and drug control. I begin by describing the theoretical framework taken from Left Realism – the crime square – and use it as a way of organising and understanding the research literature. I will then explore the historical context of shifting approaches to controlling drug problems, initially in the global context and then specifically in Australia. The structure of this chapter is as follows: I introduce the crime square as a means of conceptualising the macro–micro dynamic nature of policy and its impact on behaviour. I then present the historical context and development of drug control policy via discussing the four dimensions of the crime square. Finally, I will draw together the dimensions of the crime square in order to develop a theory of drug use behaviour that emerges from the interactions of the four elements of an explanatory model drug use behaviour: namely, the state, society, drug markets and drug users.

THE CRIME SQUARE

Left Realism emerged in the 1980s in the United Kingdom in response to conditions in which criminality and other social problems facing the working class were worsening, while radical criminologists remained focused on a social constructionist view of crime, which views crime as simply a reflection of media-orchestrated moral panics or political diversion (Young, 1986). The contribution of Left Realism was the development of a framework in which crime (the outcome) was analysed in terms of the interaction of four key factors: the state, social structure, offenders and victims (see Figure 2.1, Lea, 1991). By the ‘state’ was meant both criminal justice agencies in the narrow sense as well as the political system in the broad sense. The political system was seen as an important conduit for the reception from and transmission to other elements of the framework.
Similarly, ‘society’ implies ‘civil society’ as a set of legally, culturally and economically defined relations; as well as, in a narrower sense, for example, media which can act to receive and transmit culturally defined attitudes and norms via ‘moral panics’. The relations between the components of the framework were framed as ones of ‘action’ and ‘reaction’ in which the state and the system of social control are structures which ‘react’ to the ‘action’ of offenders and victims by redefining their activities, and devoting resources to their containment. State and society thereby play an active role in the ‘production’ of the final level of crime in society. State and society do not simply respond to the problem of crime but also engage in various pre-emptive activities in the prevention and definition of crime. Likewise, the behaviour of both the victim and offender (who is not necessarily an individual but could be a group, organisation or other entity) can be seen as not only constituting ‘problematic situations’ to which the state and the system of social control react, but they also respond and react to the state and social system. The state and social system are determinant in the sense that the ‘victim’ and ‘offender’ only exist as they are recognised by some combination of social and legal definition, whereas the state and social structure are not derived from the existence of offenders and victims (Lea, 1991; Young, 1986).

![Figure 2.1: The Crime Square](image)

Transposing these components into a framework for the analysis of drug control and drug use behaviour, where the ‘offender’ is replaced by ‘Drug market’ and the victim is replaced by ‘Dependent drug user’, I have organised the literature review that follows into sections that discuss
each dimension of the square. The next section surveys the development and changing conception of drug users through different historically situated lenses: moral, criminal and medical. The subsequent section discusses the state and social dimensions of Australia’s approaches to drug control, which is followed by a discussion of drug markets and how law enforcement approaches to evaluation are conceived through a supply/demand economic frame. Organising the research literature in this way facilitates analysis of the dynamic interactions between the different dimensions of an illicit drug problem.

**Drug Users – Concepts and Responses**

Developments in drug policy in the early 20th century are partly explained by their connections with broader social changes (Seddon, 2007). The individual ‘addict’ became the subject of social control and the governance of the addict was achieved via three institutions: the emerging medical and psychiatric professions and the police. Throughout the 20th century there has been a ‘tug-of-war’ between health/welfare and crime/penal responses to drug abuse (Seddon, 2007).

The historical survey of Western societies’ understanding of the drug user involves both the process of naming drug abuse as a social problem and of responding to that problem (Smart, 1984). The relationship between the drug user and society is best illustrated by tracing the historical progression of our understanding of chronic dependent drug use and emergent policy responses. The ‘conventional wisdom’ regarding the history of the concept of addiction as a ‘disease’ is that intoxication began to be problematised at the beginning of Western modernity (Cohen, 2000; Levine, 1978; Room, 2003), and it was ‘in this historical and cultural context that the notion that a substance might ‘cause’ one to ‘lose’ self-control became thinkable’ (Reinarman, 2005, p. 310). In this account, the role of self-control was central to explaining why the disease concept of addiction emerged when it did. Indeed, Levine (1978) argued that a new paradigm, which represented a

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3 The survey in this section draws on sources mainly from Britain and the United States. Much of the discussion here occurs prior to the colonisation of Australia. I consider the United States as the exemplar of ‘our’ understandings (i.e. Anglo-western society) of addiction, and because of its international dominance over drug policy, beginning early in the twentieth century, see (Musto, 1999) and (D. Manderson, 1993)
radical break from the past, had emerged that emphasised self-control and was consistent with the intellectual principles of the Enlightenment and the triumph of bourgeois individualism.

I propose that these arguments overstate the case that addiction was suddenly ‘invented’ or ‘discovered’ by one individual in particular, Dr Benjamin Rush (Cohen, 2000; Levine, 1978; Reinarman, 2005). I argue that there was not a sudden paradigm shift but rather an intensification of social and economic structural forces already at play during the enlightenment period in the 17th and 18th centuries (McKee & Leon, 2005). Further, these ‘constructionist’ analyses of the addiction concept are focused at the level of the individual and consequently the galvanising effect of social and economic conditions as causes of problematic drug use are underplayed (Hough & Natarajan, 1980). Moreover, the political (i.e. class/power) significance of elites – the clergy, moral reformers and the medical profession – defining addiction as a social problem and thereby acquiring ‘cultural ownership’ of responses to it are underemphasised (Gusfield, 1989).

The three objectives of this section are first, to illustrate that substance abuse problems are produced by social, political and economic structures and cultural shifts that emerged from the transition of Western society into the modern liberal state. Second, to demonstrate that the ways in which we theorise the use of drugs and the meanings we give to behaviours associated with chronic, dependent use lay the foundation for drug control policy responses. The third aim is to briefly look at the consequences these factors have had for Australian drug policy development throughout the 20th century.

**Early Modern Concepts of Addiction**

The use of mind altering drugs has been present in all cultures over time and their use in traditional societies is associated with ritualistic or medicinal purposes (Saah, 2005). Alongside this relationship however, have been accounts of the excessive use by a small number of individuals and groups (Vogt, 1989). Excessive use was not seen as a social problem for centuries. The images and ideologies about the virtues and vices of mood altering drugs began to change with the rapid social and economic changes brought about by the transition of traditional society to a modern industrial
one. The roots of modern concepts of addiction came from the Christian culture of Europe\(^4\); drunkenness in this time was seen as part of the sin of gluttony although it was indulged in by all classes (Warner, 1992).

Warner (1994a) argues that the modern conception of addiction and related concepts of ‘habitual drunkenness’, ‘progressive disease’ and ‘loss of control’ dates from the early 17th century and can be found in ‘the religious oratory of Stuart England’. In 1673, Increase Mather, in his sermon ‘Woe to Drunkards’ declared: ‘Drink in itself is a good creature of God … and to be received with thankfulness, but the abuse of drink is from Satan; the wine is from God, but the drunkard is from the Devil’ (Lender, 1973 p.353).

The massive social upheavals that were experienced in preindustrial England, together with a breakdown of traditional (i.e. informal) social controls, led to changes in the rhetoric and writings of the clergy, who began to extol the virtue of inner discipline in a society characterised by external chaos (Warner, 1994a). ‘Habitual drunkenness’ began to be defined as a social problem of the working class and the poor by elites who were concerned with maintaining social order. In preindustrial society it was moralists and preachers who wrote and preached about drinkers, whose descent into problematic drinking ‘progressed from bad to worse, culminating in a loss of control over drinking behaviour’ (Warner, 1994b, p. 689). In the 18th century the target for regulation was ‘the crowd’, unknown, unstudied and generally feared\(^5\) (Rimke & Hunt, 2002).

### The Gin Epidemic\(^6\)

The ‘gin mania’ that occurred in London between 1720 and 1751 was the first well known drug crisis in history (Nicholls, 2006; Vogt, 1989; Warner, 1994b). Drunkenness was common amongst all the social classes; however, the gin ‘epidemic’ was associated with social unrest among the poor and was perceived as a threat to the ruling class. The ‘gin craze’ in eighteenth century London was

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\(^4\) The Greek, Roman and Hebrew cultures were the foundation of the Christian culture of Europe and these contributed to the ‘Western’ ideology of drinking including over-drinking and its punishments as well as our ways of reacting to the problem of drunkenness (Keller, 1979).

\(^5\) In the 20th and the 21st century the target for regulation, especially crime control is the so-called ‘criminal underclass’.

\(^6\) Increasing problems associated with alcohol consumption also occurred in colonial America and Australia (Levine, 1984; Powell, 1988)
largely caused by poverty, overcrowding and extreme social inequalities (Abel, 2001; Clark, 1988; Vogt, 1989; Warner, 1994b). Social reformers and moralists however, attacked the ‘inferior classes’ for their drunkenness because of the perceived threat that gin would enfeeble England’s labour force, and would reduce its manpower by decreasing its population (Abel, 2001).

William Hogarth was a social critic and satirist and in ‘Gin Lane’ (Figure 2.2) he depicted the poverty and squalor of a slum district rife with addiction to gin. The businesses in this slum are gin shops, distilleries, brothels and pawnbrokers (Warner, 1994b). The woman in the centre is intoxicated and as indicated by the syphilis sores on her legs is likely a prostitute. The child she was holding falls to its death as she takes a pinch of snuff. The infant has indications of foetal alcohol syndrome (Haslam, 1992). Gin was blamed for ‘robbing the “lower kind of people” of their will and power “to labour for an honest livelihood, which is a principal Reason of the great Increase of the Poor”’ (Abel, 2001, p. 402). Gin was also blamed for an increase in crime, infant mortality and a host of other social ills (Warner, 1994b).

Figure 2.2: ‘Gin Lane’ by William Hogarth
Two social historians, Charles Dickens, who worked as a freelance journalist in London in the 1830s, and Eric Hobsbawm, a twentieth century historian wrote about the ‘labouring poor’ in the early 1800s, argued that chronic drunkenness was a way of adapting to the economic and social dislocation that grew as western nations moved towards free-market liberal democracies (Alexander, 2008)

_Gin-drinking is a great vice in England, but wretchedness and dirt are a greater; and until you improve the homes of the poor, or persuade a half-famished wretch not to seek relief in the temporary oblivion of his own misery, with the pittance which, divided among his family, would furnish a morsel of bread for each, gin-shops will increase in number and splendour. (Dickens, quoted in Alexander, 2008)_

... Faced with a social catastrophe they did not understand, impoverished, exploited, herded into slums that combined bleakness and squalor, or into the expanding complexes of small-scale industrial villages, [most of the labouring poor] sank into demoralisation. Deprived of the traditional institutions and guides to behaviour, how could many fail to sink into an abyss of hand-to-mouth expedients, where families pawned their blankets each week until pay-day and where alcohol was ‘the quickest way out of Manchester’? Mass alcoholism, an almost invariable companion of headlong and uncontrolled industrialisation and urbanisation, spread ‘a pestilence of hard liquor’ across Europe. (Hobsbawn, quoted in Alexander, 2008)

Contemporary historians have argued that the ruling elite were blind to the economic and social conditions that produced the conditions of unrest, displacement and poverty and were motivated by concerns about social control, not public health (Abel, 2001; Warner, 1994b). Agitation and a media propaganda war against gin (as epitomised by ‘Gin Lane’) led to Parliament enacting a series of Acts against the gin trade (Clark, 1988).

The importance of the gin craze to our present story is that it had all the social and political factors that together ‘produce’ a modern drug crisis (Vogt, 1989; Warner, 1994b). First there was an increase in the availability of one or more drugs on the market. Warner, Her, Gmel, and Rehm (2001) argue that gin was in effect a new drug because the introduction of distillation produced a far more potent substance than traditional ale. There were no rules or rituals; that is, no informal social controls were available to govern its use and limit its negative effects. Next, there was the filtering down of consumption of the new substance to the ‘lower’ classes. The ‘mob’, ‘proletariat’ or the ‘poor’ were blamed for using the drug and concerns about heightened criminality became
widespread. Then a drug crisis was announced and responded to with calls for actions to restrict or prohibit the supply and/or production of the drug. The control measures that were put in place included legislation that introduced taxes and regulations on retailing and consumption (Warner et al., 2001). Finally, drug crises arise most often in times of large-scale social changes (Aaron & Musto, 1981; Abel, 2001; Alexander, 2008; Keller, 1979; Musto, 1999; Vogt, 1989; Warner, 1994b). Both Vogt (1989) and Warner (1994b) suggest that in terms of their structural aspects, modern drug crises have not changed much since the gin epidemic, although the content varies over time and across countries.

**Liberalism, Industrialisation & Social Dislocation**

The images and ideologies about the virtues and vices of mood altering drugs changed drastically as industrialisation progressed and through the globalisation of markets during the age of European empires (Courtwright, 2001; Keller, 1979; Vogt, 1989). Ownership of the problem of intoxication began to shift from religion to the emerging medical profession (Vogt, 1989). There was ongoing concern about excessive drinking and drug taking during the 19th century. In concert with these changes were three revolutions that had begun in the previous century.

Politically, there was the emergence of a new discourse on ‘individualism’ which has survived ‘as the infrastructure of liberal theory today’ (Holloway, 1995). Central to this discourse was a concept of ‘possessive individualism’:

> Its [individualism] possessive quality is found in its conception of the individual as essentially the proprietor of his own person or capacities, owing nothing to society for them. (Quoted in Holloway, 1995, p. 3)

This theory of possessive individualism was important to ideas about the individual in modernity and the associated ‘libertarian’ philosophy of governance in early modernity which advocated minimal state interference in the private affairs of the individual (Gerstein & Harwood, 1990; Shiner, 2007). The free subject of the early modern era owned ‘himself’; he was ‘slave’ to no other individual or collective. The central moral imperative of the emerging liberal society was individual responsibility (McCandless, 1984).

In 1776, Adam Smith, in the *Wealth of Nations*, built his conception of the natural economic order on the assumption of possessive individualism (Holloway, 1995, p. 81). The economic revolution was a transition from a feudal economy based on guilds, to a free-market which was unfettered by regulation and where the sovereignty of the individual consumer was dominant. There was a
dramatic transformation of agrarian rural society into an industrial and urban one led by the ‘bourgeoisie’ or middle class: the industrial revolution. It was at the juncture of these transformations that drug and alcohol abuse became identified as a social problem by various commentators, including an emerging medical profession, and various, and at times conflicting, theories emerged.

The Moral–Medical Model of Addiction

Reviewing a wide selection of historical sources on the topic addiction and inebriety during the 18th and 19th centuries did not yield a straightforward chronology or progression of ideas (Aaron & Musto, 1981; Acker, 1995; Aurin, 2000; Engstrom, 2007; Ferentzy, 2001; Galton, 1904; Hickman, 2004; Hurley, 1990; Jaffe, 1978; Keire, 1998; Malleck, 1999; McCandless, 1984; Musto, 1999; Nicholls, 2006; Parascandola, 1995; Parssinen & Kerner, 1980; Rimke & Hunt, 2002). The literature on the history of the concept of chronic dependent drug use and the regulatory responses to that behaviour in the 19th century reveals that there was no straightforward displacement of religion by medical science. The problem of addiction (and its management) as variously ‘vice’ or ‘illness’ was highly contested and disputed by a range of authorities; namely, religious, medical and political (Rimke & Hunt, 2002):

It is not that one form [idea] replaced another in sequence, but rather that different configurations in combination came to the fore; such combinatory authorities were generally not the result of any concerted strategy, but rather were ushered in by the cultural preoccupations of the period. (p. 61)

The development of the ‘disease’ concept of addiction, typically credited as being articulated by Benjamin Rush (in the United States) and Trotter (in England), began in the 18th and continued throughout the 19th century. Its development was rooted in the social conditions of the time and in contemporary medical theories (Aurin, 2000; McCandless, 1984; Rimke & Hunt, 2002). The ‘disease’ concept was controversial from its inception and understandings of the phenomenon were intrinsically tied to emerging notions of insanity, the asylum and the new medical profession of psychiatry (Hurley, 1990; Jaffe, 1978; Malleck, 1999; McCandless, 1984; Rimke & Hunt, 2002; Weinberg, 2008).

Underpinning the problem were the limitations of contemporary scientific endeavours in explaining (and ameliorating) causes and effects. Physicians at that time and prior had noted the effects of
chronic drunkenness on the physical and mental functioning of affected persons; however, there was no systematic medical science of the disorder. Benjamin Rush and others articulated the core ideas of the disease concept: biological predisposition, drug toxicity, morbid appetite, tolerance, progression, and loss of control over the amount taken (White, 2000). Doctors during this period tended to link theories of disease causation with the traditional view that sin was a ‘fruitful cause of disease’ (McCandless, 1984, p. 53). Rush embodied an important dynamic of the time: he was both a doctor and a reverend. His importance to this account of how the chronic substance user has been viewed historically is that he linked drunkenness with insanity and sin and helped to establish a medical–moral model of the problem.

The Early Medicalisation of Addiction

From the middle to the end of the 19th century there emerged a fledgling medical specialisation and institutions for the treatment of alcohol and drug problems. The ‘inebriety’ movement consisted of physicians and social reformers whose aim was to advance the notion of addiction as an illness and not a vice: they deplored incarceration as a response to the problem (Jaffe, 1978; White, 2004). During this time treatment facilities, ‘inebriate’ homes and asylums were established and in 1870 the first professional association for the providers of addiction treatment was established, the American Association for the Cure of Inebriety (Aurin, 2000; Jaffe, 1978; White, 2009). By 1876 they had established a professional journal: The Quarterly Journal of Inebriety. This movement occurred on both sides of the Atlantic and in England Dr Norman Kerr helped establish the Society for the Study and Cure of Inebriety in 1876 and its publication the British Journal of Inebriety (Aurin, 2000). The inebriety movement instigated scientific research into addiction and established the idea that it was a curable medical disorder.\(^8\)

The addict of this period was most likely a middle- or upper-middle-class woman who used the expensive services of physicians (Aurin, 2000). Pharmaceutical advances such as the isolation of botanical alkaloids such as morphine (and later heroin) and cocaine created potent new drugs that

\(^7\) Inebriety was the preferred term at this time and was analogous to addiction; texts of the day referred to alcohol inebriety, opium inebriety, cocaine inebriety and inebriety from coffee and tea (White, 2004)

\(^8\) A competing professional organisation emerged in 1875, the Association of Medical Superintendents of American Institutions for the Insane, and through its publication, the American Journal of Insanity, disparaged the disease concept (Jaffe, 1978).
were injectable. Technological advances such as the invention of the hypodermic needle meant that
the new more concentrated substances could be administered in ways that increased their potential
to induce addiction and had unanticipated disease implications (Courtwright, 2001; Gerstein &
Harwood, 1990; Parssinen & Kerner, 1980). The widespread use of injectable morphine among the
patients of doctors led to the iatrogenic addiction epidemics in the 1860s and 1870s. As doctors
became aware of the potential dangers of injectable morphine they gradually became more cautious
in their use of it. Over time the total number of addicts declined; however, the proportion of non-
middle-class non-iatrogenic addicts began to outnumber ‘normal’ addicts (Aurin, 2000).

The emergence of a new type of recreational or pleasure user led to concerns about the non-
medical use of drugs which intensified as social problems emerging from urbanisation and
immigration led to calls for drug reform. Along with the rising temperance movement in the United
States and the ‘vice society’ in Britain, medical views of addiction polarised and by the end of the
19th century the disease concept had waned and with it the fledgling treatment profession (Jaffe,
1978; McCandless, 1984; White, 1998).

**The Twentieth Century**

During the transition from the end of the 19th and into the early 20th century there was a cultural
shift in the understanding of addiction as a biomedical illness. Historians have argued that
underpinning this shift were a number of factors including power-elite concerns with class, race,
urbanisation and also global economic politics (Acker, 2002; Courtwright, 2001; Musto, 1999). By
the 1920s the ‘ownership’ of the problem of addiction had shifted to psychiatry in alliance with law
enforcement. In 1919 Dr A. G. DuMez of the Public Health Service in the United States reported to

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9 Courtwright (2001) surveys the role of the trade in psychoactive substances (i.e. wine, spirits, tobacco, coffee,
tea, chocolate, opium and coca) in the development and expansion of empires in the early modern period. He
discourages how initially the trade in drugs made the power elite wealthy and served to expand commerce
globally, but that industrialisation made drug abuse more likely and more visible, which led to concern among
the elite as the wide availability and consumption of drugs threatened the industrial process and the need for
a disciplined, ‘sober’ work-force. Drawing from the lessons of China’s experiences with widespread opium
addiction, reformers began to move for drug control at the national and international level. A series of
international agreements banning the production and distribution of opiates became the cornerstone of the
international regulatory system that evolved after 1911. Subsequent United Nations treaties and amendments
brought ‘psychotropics’ (i.e. manufactured drugs such as amphetamines) under international control (see
especially Chapter 9 ‘About-Face: Restriction and Prohibition’, pp. 166–186), and also (Room, 2006; UNODC,
2009).
the Surgeon General that since ‘our present methods of treating drug addiction must be considered failures’ the only acceptable course of action lay in a ‘more rigid and thorough enforcement of the present anti-narcotic law’ (Aurin, 2000, p. 426). The next section briefly outlines the events that led to such radical reform and the criminalising of addiction (which by this time was viewed as a psychiatric and not a purely biomedical disorder). The introduction of prohibition effectively redefined addiction from a medical condition to a de facto crime and physicians who provided maintenance treatment to opiate addicts were regarded as criminals (Acker, 2002; Musto, 1999).

The Establishment of Addiction Orthodoxy – The Harrison Act

In his seminal history, Musto (1999) argues that the reformist preoccupation with drug prohibition had its roots less in concern for public health than in the politics of social and racial prejudice. To sum up, the social and class ‘myths’\(^ {10}\) that captured the public’s imagination in the first decade or so of the new century included that immigrants, especially the Chinese, were conspiring to undermine national will; that adolescent promiscuity and juvenile delinquency stemmed from drug abuse; and that minority groups were stimulated by heroin or morphine (and later, in the thirties, marijuana) to commit political violence and sexual crimes\(^ {11}\). Indeed, in the United States there was the idea that cocaine enabled blacks to shrug off bullets which could kill a white man (Gerstein & Harwood, 1990). The other ‘dangerous’ group, along with immigrants and blacks, was the white urban criminal who was linked with prostitution, thievery and saloon-going (Acker, 2002).

The Harrison Anti-Narcotic Act\(^ {12}\) was legislated in the United States in 1914 and required that opiates and cocaine could be prescribed to addicted patients on a maintenance basis. Between 1914 and 1919 a series of Supreme Court decisions interpreting the Act deemed that it was illegal for

\(^{10}\) For content analyses of the creation of the ‘dope fiend’ mythology the reader is directed to (Lindesmith, 1940; Reasons, 1976; Speaker, 2002).

\(^{11}\) These racial and social impulses were not unique to the United States, they were also symptomatic of the cultural anxieties throughout the Western world including Australia (D. Manderson, 1993; D. R. A. Manderson, 1988a)

\(^{12}\) The Treasury Department was responsible for enforcing the Harrison Act, which was technically a tax law (Aurin, 2000)
a physician to maintain an addict. Following this the care of addicts shifted to penal institutions, the ‘foul wards’ of large public hospitals and to the newly emerging field of psychiatry (White, 1998).

Psychiatry became ‘responsible’ for the addict and leading the field was Dr Lawrence Kolb who headed the Mental Hygiene Division\textsuperscript{13} of the Public Health Service. The central tenet of his theory was that normal people do not experience pleasure from opiates and that feelings of pleasure were a symptom of underlying psychopathic tendencies\textsuperscript{14}. While the disease concept of biomedicine had promulgated the idea that addiction was an illness that needed treatment, this newer psychiatric theory\textsuperscript{15} of the addictive personality viewed it as a behaviour to be controlled and ‘corrected’ (Aurin, 2000). As addiction came under the umbrella of psychiatric illness, addicts were subjected to whatever psychiatric treatments were in vogue for the mentally ill: mandatory sterilisation, psychosurgery (prefrontal lobotomies), electroconvulsive therapies, and drug therapies (that eventually included barbiturates, amphetamines and LSD) (White, 1998).

By the 1950s the use of narcotics had declined throughout the United States. The so-called ‘classic era’ of narcotics control in the United States, which lasted up until around World War II was a time of vigorous law enforcement against addicts and increasingly punitive laws. During this climate of intense anti-drug rhetoric and policy, the nonmedical use of heroin, morphine and cocaine declined such that ‘personal knowledge of a “dope fiend” was unusual for the vast majority of Americans by the 1950s’ (Musto, 1999, p. 245).

The Addict and the Welfare State – The Post-War Period

By the 1960s the baby-boomer generation (those born in the early post-war period and aged between 15 and 24 in the 1960s) had no direct experience or knowledge of drugs but had been exposed to the exaggerated ‘mythology’ of the ‘dope fiend’ or ‘junkie’ established in their grandparents’ generation (Acker, 2002; Lindesmith, 1940; Reasons, 1976; Speaker, 2002). The 1960s

\textsuperscript{13} It is now the National Institute of Mental Health (Acker, 2002)

\textsuperscript{14} His theory of addiction consisted of five classification levels: iatrogenically addicted ‘normal’ addicts, pleasure-seeking ‘psychopathic diathesis’ afflicted patients, those with ‘crystallized neurosis’, psychopathic habitual criminals, and inebriates (see Aurin, 2000).

\textsuperscript{15} Early psychiatry was Freudian, that is, concerned with underlying socio-psychological causes of behaviour (Aurin, 2000).
was a period of radical social change and was characterised by a vast number of largely middle-class young people experimenting with and using drugs recreationally (Musto 1999). As the drug ‘epidemic’ progressed in this decade among all Western nations including Australia, concern with the harmful consequences of abuse and dependence led to a renewed ‘War on Drugs’ in the United States.

New scientific advances were made in support of a bio-psychosocial model of addiction (A.I. Leshner, 1997; A. I. Leshner, Smelser, & Baltes, 2001). Clinical studies of amphetamines focused on linking brain chemistry, biological psychiatry, and animal behaviour. This line of research helped to redefine ‘addiction’ physiologically as well as behaviourally, supporting its revival as a neurochemical disorder. By the late 20th century it appeared that neuro-scientific, genetic, epidemiological, and historical evidence helped to reunify the addiction field in the late twentieth century. A new unifying paradigm emerged, variously called chemical dependency, substance abuse, or simply ATOD – alcohol, tobacco, and other drugs (Courtwright, 2005).

In the next section I will briefly summarise the drug policy environment in Australia and examine the factors that have resulted in important differences from the United States policy environment.

**State and Society – Australia’s Drug Policies**

The influence of United States drug policy responses has continued to have a pervasive effect on Australian drug control efforts since drug prohibition began in 1912 with the creation and implementation of international conventions to which Australia was a signatory (Hamilton, 2001; Jiggens, 2004; D. Manderson, 1993). Until that time drug use in Australia was seen as a matter of personal choice, and the laws that did exist focussed on regulating the production, supply and use of known poisons (D. R. A. Manderson, 1988b). Successive bans on substances, beginning with opium (1905), cannabis and cocaine (1926) and heroin (1953), incrementally increased restrictions on drugs and drug use and meant that by the 1940s and 1950s the use of these illicit drugs was very low (Hamilton, 2001; UNODC, 2008a).

**The Politicisation of Drugs – Epidemics and Moral Panics**

Australia’s drug control regime changed from the 1960s onwards in response to a number of developments. There was an increase in the visibility of illicit drug use, arguably due to the emergence of the 1960s counter-cultural revolution and the increase in the prevalence of young
recreational drug users, as well as the wider availability of illicit drugs (Rowe, 2005). Another factor was an increase in the international movement of people and with them their recreational drugs\textsuperscript{16}, as well as a growth in illicit drug trade, organised crime and official corruption (Hamilton, 2001). In addition to these developments the international drug control regime was consolidated and expanded (see UNODC, 2008a, p. 23).

Australia responded with harsher penalties and increasing police powers, although public opinion was divided on the issue (Hamilton, 2001). One outcome was that the illicit drug issue became highly politicised: ‘to be seen to be doing something about drugs was an essential element of every political platform and a short-cut to popularity’ (D. Manderson, 1993, p. 1993). On the one hand, few Australians at this time had much direct experience or contact with illicit drugs, which enhanced the force of the ‘moral panics’ associated with the increasing drug problem:

\textit{Research has shown that during the period 1965-9 inclusive ... 24 identified smokers had gone directly from cannabis to morphine by intravenous injections, two while under the influence of their first ‘reefer’, thereby indicating the suggestibility of this drug. Another two had jumped off cliffs while ‘high’ on pot (Cited in, (Rowe, 2005, p. 111)).}

On the other hand, academics and critics of the criminalisation of drug use, notably Duncan Chappell, a criminal lawyer at that time, argued that:

\textit{The criminal law is a crude instrument of social control ... the mere fact that crime not only continues to exist, but also increases at an alarming pace in contemporary society, suggests that the instrument [of deterrence] is not terribly effective when tackling ... drug offences ... [and] ... Many of our legislators seem determined to repeat the Americans’ past mistakes by regarding the problem of drug abuse as one to be solved primarily by the resources of the criminal law. Drug taking is seen as immoral, an evil to be suppressed ... I do dispute that we need to threaten and punish those who are dependent upon drugs. Such}

\textsuperscript{16} Australia’s participation in the Vietnam war exposed young Australian soldiers to readily available cannabis and heroin; subsequent research has established a link between the return of soldiers from Vietnam and increase in the demand for opiate abuse treatment. Further, Australia was a base for United States soldiers on leave during the war, who brought with them their drug habits, which led to the creation of a local drug market that eventually diffused into the general population (see UNODC, 2008b, p 24)
people deserve our sympathy and assistance, not our censure and punishment (Cited in, (Rowe, 2005, p. 111)).

Nonetheless, law enforcement was the focus of Australia’s drug policy; however, an important distinction began to emerge between drug users and drug traffickers. By 1970 all States had enacted legislation that made drug trafficking a separate offense to use and possession. Gradually the penalties for trafficking were increased and then a split was made between organised drug traffickers – ‘Mr Big’ – and small-time drug suppliers (D. Manderson, 1993).

As the focus of law enforcement shifted to drug traffickers, attitudes towards dependent drug users began to soften. In the late 1970s and into the 1980s they were increasingly viewed as suffering from a treatable medical disorder17 (Macintosh, 2006; Rowe, 2005):

As the effects of drug dependence became more visible, politicians were moved to distinguish between ‘sick’ drug users and so-called ‘pushers’ who preyed upon the weaknesses of these sick individuals. This was the beginning of a political distinction that allowed policy makers to appear both compassionate (to the sick) and tough (towards the criminal). (Rowe, 2005, p. 112).

Despite the increasing punitiveness of drug laws and their enforcement, which included raising maximum penalties for drug offences, making offences easier to prove and extending surveillance powers of drug law enforcement, illicit drug use continued to increase (Brereton, 2000). A number of Commonwealth and State inquiries into the issue of illicit drug use highlighted the harmful and unintended consequences of punitive drug policy (Australian Royal Commission of Inquiry into Drugs, 1980; Joint Parliamentary Committee Upon Drugs, 1978; Royal Commission into the Non-Medical Use of Drugs, 1979; Senate Select Committee on Drug Trafficking and Drug Abuse, 1971; Senate Standing Committee on Social Welfare, 1977). Briefly, these inquiries found that attempts to

17 During this period important scientific advances in the biopsychosocial, especially neurophysiological, understandings of drug abuse and dependence were being made internationally. This evidence suggested that persistent drug-induced changes in the physical brain may underlie addictive behaviour, consistent with the general notion of addiction as a physical disease (Lyvers, 1998). This scientific development began to be reflected in the changing nosology of the classification of drug dependence in the International Classification of Diseases (ICD) as well as in the ‘gold standard’ of psychiatric diagnosis, the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 1994) also see Room (1998, 2006)
ban substances in high demand had led to the emergence of a ‘black economy’ in illicit drugs. The illicit drug market was highly lucrative, leading to extreme violence as traffickers competed with one another. The amounts of money involved also engendered official corruption. Another consequence was the emergence of criminal syndicates, who took control of a large portion of the drug trade. The unregulated nature of the illicit drug market meant inflated prices, variable purity and potentially dangerous substances introduced to ‘cut’ drugs for sale. These studies also revealed the complex social, economic and physiological factors at play for the dependent user. An important social and scientific problem that was identified was the nature of research into the explanations of drug use and criminal behaviour. Commentators noted that they tended to concentrate on social, economic, psychological and physiological factors in isolation from each other (Wardlaw, 1981).

Harm Minimisation a Break from the Past, 1985

Growing media attention on the drug problem and in particular on organised crime was heightened by the murder of anti-drugs campaigner Donald Mackay in 1977. This high profile and clearly political assassination led to the establishment of a number of Royal Commissions into drug control (D. Manderson, 1993). By 1985 the ‘drug problem’ was a central election issue and the Prime Minister of the day Bob Hawke announced that if re-elected his government would launch a National Campaign Against Drug Abuse (NCADA) (Hamilton, 2001). The central plank of the NCADA was the principle of harm minimisation, which was in effect the adoption of a public health approach to drug policy in Australia. The HIV/AIDS epidemic in the 1980s led to government health services engaging with drug users to provide needle and syringe exchanges, and the establishment of peer support groups to disseminate harm prevention education and support. Funding for epidemiological and other research, and expanded treatment services was also introduced. Renamed in 1995, the National Drug Strategy remained focused on harm minimisation and the definition that was adopted refers to policies and programs aimed at reducing drug-related harm. It aims to improve health, social and economic outcomes for both the community and the individual and encompasses a wide range of approaches .... Harm minimisation is consistent with a comprehensive approach to drug-related harm, involving a balance between demand reduction, supply reduction and harm reduction. (Ministerial Council on Drug Strategy, cited in Hamilton, 2001)

The distinguishing feature of Australia’s drug policy was the explicit incorporation of drug law enforcement within a harm minimisation framework. This policy frame can be best described as a hybrid policy environment to which I now turn.
**AUSTRALIA’S HYBRID DRUG POLICY**

In response to the experience and evidence of the harmful consequences of some drug law enforcement strategies, policing scholars conducted reviews of drug law enforcement (DLE) in Australia in the mid to late 1990s (Sutton & James, 1996). Findings from these inquiries led to calls for police services to address issues of harm minimisation as well as for innovation in the evaluation of drug law enforcement (Sutton & James, 2000)\(^{18}\).

In 2004, the National Drug Law Enforcement Research Fund (NDLERF) commissioned a report on the role of police in preventing and minimising illicit drug use and its harms (Spooner, McPherson, & Hall, 2004). Figure 2.3 presents diagrammatically the hybridization of Australia’s drug policy with the inclusion of drug law enforcement in preventing and minimizing illicit drug use and related harms (Spooner et al., 2004) and

*shows the relationship between the aim and the three integrated approaches of harm minimisation. The overlapping strategic areas of supply reduction, demand reduction, and harm reduction denote that some strategies can affect two or three of the strategic areas (supply, demand and/or harm). (p. 6)*

This was followed in 2006 with a monograph that proposed a performance measurement framework for DLE (Willis, Homel, & Gray, 2006). One of the important issues to emerge from concerns with DLE was the need to evaluate interventions and policy programs and in addition, to apply innovative evaluation frameworks that went beyond the traditional supply/demand approaches to assessing the impact of drug supply effort on illicit drug markets. This issue is central to this thesis and will be taken up in greater detail in Chapter four.

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\(^{18}\) In addition, two Australian Public Service Commission papers have called for innovation in the way policy makers understand how and why people change behaviour (Australian Public Service Commission, 2007a, 2007b) in order to address the limitations of the ‘rational model’ when evaluating ‘wicked problems’.
The aim, objective and three strategic approaches of harm minimisation

**Aim:** Improve health, social and economic outcomes for both the community and the individual

**Objective:** Decrease drug-related harm

**Strategic areas:** target risk factors for drug-related harm

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**Supply reduction**

**Demand reduction**

**Harm reduction**

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**Figure 2.3: Australia’s Hybrid Policy Context**

**DRUG MARKETS AND LAW ENFORCEMENT**

The aim of this section is to describe how different ‘control’ mechanisms are expected to work through the enforcement of the laws and regulations created to control drug markets. Supply side DLE means law enforcement directed at drug producers, importers, distributors and/or suppliers of illicit drugs. Suppressing supply is theorised as impacting the availability of illicit drugs through the price mechanism. The idea is that drug supply and its corollary availability is an important determinant of use (demand) (Reuband, 1998).

Demand side DLE, which is typically aimed at individuals, enforces the laws and regulations that are aimed at controlling demand (consumption). The prohibition of the possession and use of certain substances and the imposition of legal sanctions is theorised as suppressing consumption through the mechanism of general deterrence (Reuband, 1998). The causal mechanism linking macro measures with micro-level outcomes is ‘price’.
Legal regulation is used in two ways to control the supply and demand of drugs. First, a ‘prohibitory’ scheme bans the production and distribution of a substance for non-medical or self-defined uses. Prohibition aims to reduce drug consumption by keeping the price of illicit drugs high and is implemented through supply-side DLE. Supply side DLE means law enforcement directed at drug producers, importers, distributors and/or suppliers (D. Weatherburn, Lind, & Forsythe, 1999).

Second, legal regulation is also used to control demand or consumption. Demand side strategies are typically aimed at the individual. One mechanism theorised as operating on demand is specific deterrence, that is, users exit the market through treatment (D. Weatherburn & Lind, 2001). In addition, legal control also has a general deterrent effect. Drug control is also symbolic of a government’s attitude, that is, it sets a norm and may generate effects on behaviour by influencing attitudes and beliefs, that is, the law has a morally symbolic value (Pentz, Bonnie, & Shopland, 1996).

**Summary**

So far I have reviewed the historical development of the concept of problematic drug use\(^{19}\), and state and societal responses to the problem, specifically attempts to control users through the policing of drug markets. This is an important issue because the ways in which a society and the state (via institutions) understand the use of illicit drugs, and the meanings given to behaviours associated with drug (ab)use, lays the foundation for ‘purposive social action’ (Merton, 1936) or intervention strategies (i.e. policy). Moreover, historically, our view of drug use has been strongly influenced by our attitudes to chronic, dependent use (Rumbold & Hamilton, 1998). The way in which a social issue is problematised is important for which institutions and professions have ‘ownership’ of the problem (Gusfield, 1989). Drug addiction lies at the nexus of a number of competing discourses: moral, medical and legal (Smart, 1984). The relative cultural salience of moral, medical and legal understandings of drug abuse and addiction has varied over time and place (Courtwright, 2001; Gerstein & Harwood, 1990; Musto, 1999; Smart, 1984); however, images of the drug addict are never fully replaced by subsequent concepts and knowledge (see Reasons, 1976). I have argued that these overlapping and interdependent notions of the ‘drug addict’ have interacted

\(^{19}\) Also termed drug abuse, drug dependence and addiction, see (see Room, 1998)
with socio-economic and political structures to produce an intractable (i.e. ‘wicked’) policy problem with attendant unintended (harmful) consequences (see Mushkin, 1975).

**Drug Users, Drug Markets, State & Society: Re-imagining the Crime Square**

The subject of drug control (demand side) is the user, but not all users are problematic; most are recreational. The object of drug control (supply side) is the substance but a substance is not of itself the cause of dependence (addiction). The interaction between the conditions of demand and supply under a prohibitory scheme is what determines the impact of a policy intervention on drug user behaviour such as treatment seeking. Applying the ‘crime square’ to what I have reviewed yields an ‘action–reaction’ model of drug use behaviour (see Figure 2.4, below). This gives us four definitional elements of drug use behaviour: a user, the market, formal (the state) and informal control (society). Realism points to a square of drug use behaviour involving the interaction between DLE and other agencies of social control: the community (including drug using peers and the social networks the drug user is embedded in), the drug market and the drug user. Drug use behaviour is generated not just by the interplay of these four factors, but by *social relationships* between each point on the square. The social context of drug use consists of the immediate social interaction of these four elements and the setting of each of them within the *wider* social structure; namely prohibition in a harm minimisation environment.
Figure 2.4: Explanatory Model of Drug Use Behaviour – the Re-Imagined Crime Square

This model of drug use behaviour helps theorise macro–micro links between state policy and user behaviour. The historical review above reveals social mechanisms that led to change; for example, the invention of the hypodermic needle allowed for the more efficient delivery of drugs to the brain leading to a much higher risk of drug dependence and the transmission of blood-borne diseases. Another mechanism was ‘iatrogenic’, that is, doctors creating epidemics through over prescribing addictive drugs. Policies that criminalised drug use created black markets and the marginalisation of users. So drug control via legislation can restrict supply but also generate unintended consequences. The concentration of a substance to make distribution easier also increases the risk of dependence. Another consequence of prohibiting a substance and suppressing supply is the transition to more harmful practices; for example, the opium ban in China led to the uptake of the intravenous use of heroin (Westermeyer, 1976).

In the next chapter I will examine a specific drug problem that has emerged in contemporary Australia and has become the focus of extensive research and policy interventions. The methamphetamines market grew dramatically in the 1990s in Australia. A drug law enforcement
(DLE) effort to contain and suppress the manufacture and supply of this synthetic drug, and the evaluation of the impact of that effort on drug use behaviour and treatment demand, is the central concern of this thesis. The developments and dynamics of this particular illicit drug market have required that DLE respond in innovative ways; in particular, third party policing partnerships have emerged as crucial to efforts to contain and suppress the supply of this substance.
Chapter 3 RESPONDING TO A DRUG USE PROBLEM

INTRODUCTION

In contemporary Australia methamphetamine is perceived as the number one hard drug of choice:

Here's a frightening statistic for you — ice has now taken over from heroin, well and truly, as the hard drug of choice. It's thought that the number of addicted is now over 70,000 Australians. (Bartlett, 2006)

The perception of amphetamines has transformed over a 20 year period from being a relatively ‘benign’ substance into a ‘hard’ drug with dangerous consequences. This situation, however, is more than just another ‘drug scare’ (Davies & Ditton, 1990; Jenkins, 1994). In the past decade or so there have been important changes in the supply and manufacture of amphetamines and in the structure of the illicit amphetamine-type substances (ATS) market that coalesced to make it an important public health as well as drug law enforcement (DLE) concern in Australia. The aim of this review is to outline those changes and review law enforcement supply reduction responses (in particular, precursor regulations and Project STOP) to the methamphetamine problem in Australia in the late 20th century up to the present day. In addition, I document key social, political and epidemiological events that together provide the context for the various policy responses and interventions. This analysis provides the basis upon which the evaluation problem is articulated in the final section of the chapter.

20 See Appendix A for a discussion on the terminology used when referring to ‘amphetamines’, ‘methamphetamine’, and ‘ice’ throughout this thesis.
A Brief History of Methamphetamine

Amphetamine was first synthesised in 1887 by a German chemist (Anglin, Burke, Perrochet, Stamper, & Dawud-Noursi, 2000) and was patented by U.S. pharmaceutical company Smith, Kline & French (SKF) in 1933. SKF marketed amphetamine sulphate as the Benzedrine inhaler in 1934; it was a capped tube containing 325mg of oily amphetamine base (Rasmussen, 2008b). Methamphetamine, a derivative of amphetamine, was first synthesised by a Japanese pharmacologist Dr. Nagayoshi Nagai in 1893 from alkaloid ephedrine (Suwaki, Fukui, & Knonuma, 1997). It was not widely used until World War II when it was issued to soldiers in Japan, Germany, the United Kingdom and the United States (Anglin et al., 2000; Klee, 1998).

Until the 1970s amphetamines were used as therapeutic drugs for conditions such as asthma, depression, narcolepsy, attention deficit disorder and obesity and were freely available via prescription and in over-the-counter medications (Klee, 1998; Rasmussen, 2008a; Yoshida, 1997). Amphetamines became the drug of choice for the Beat Generation, the ‘drugs that existed before the drug culture’ (Jackson, 1976). In the United Kingdom it was associated with the mods, who grew out of the beatnik subculture (Green, 1988), and who liked Dexedrine and Drinamyl (a combination of amphetamine and a barbiturate known on the streets as ‘Purple Hearts’ (Klee, 1998)). They used them to fuel all night dancing, called ‘all-nighters’. Amphetamine type stimulants became popular in the 1960s because they were cheap and readily available, and were largely used recreationally. This trend ‘was a watershed in social history that saw the start of a relationship between music, dancing, youth culture, and the amphetamines that has persisted ever since’ (Klee, 1998 p. 34).

By the 1960s in the United Kingdom and the United States the use of amphetamines had reached epidemic21 proportions. The misuse of Benzedrine had become a significant problem in the United States during the 1940s and 1950s, when its harmful potential was recognised. During the 1960s an increasing number of countries including Australia, Sweden and the United Kingdom began to experience similar problems due to the abuse of amphetamines. This situation led to the setting up

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21 I am adopting Hando and Hall’s (1997) definition of epidemic for this report: an episodic occurrence with rapid and substantial increases in the prevalence of use, often but not invariably accompanied by an increase in drug-related problems. Both use and problems often equally subside. My use of the term ‘epidemic’ is not meant to imply that illicit amphetamine is a ‘disease’, it is only used to capture the contagious character of the spread of amphetamine use (fn p. 82)
of an international control system for psychotropic drugs (Yoshida, 1997). Until that time narcotic
drugs were the only ones under international control. In 1971 amphetamines were incorporated
into the *Convention on Psychotropic Substances*. Since this time their illicit traffic and misuse has
become widespread globally (Klee, 2001).

**THE AUSTRALIAN CONTEXT**

The review that follows briefly sketches the recent history of amphetamines in Australia beginning in
the 1980s when heroin was still considered the number one illicit drug of concern in Australia, and
amphetamines were still seen as relatively harmless and controllable. At that time amphetamines
did not have the stigma of a ‘hard’ drug, they were cheap and easy to obtain and there was little
demand for treatment for amphetamine abuse or dependence (Klee, 1997).

**DEMAND**

Amphetamine use and abuse is not a recent phenomenon in Australia; however, the use of high
purity methamphetamine such as ‘base’ and ‘ice’ is relatively new. Epidemics of amphetamine use
had been reported since the 1970s (Hando & Hall, 1997), when they were available legally over the
counter or by prescription. They were mostly used orally by middle-aged, middle-class women. The
closure of licit avenues to obtain them was followed by the development of an illicit market for their
production, distribution, and consumption (Schloenhardt, 2007). Subsequently, the use of
amphetamines shifted to mainly younger men who began to administer it by injection (Hall &
Hando, 1993, p. 60). It has been argued that the illicit use of amphetamine initially emerged among
people who worked long hours or night shifts, truck drivers, and students, who consumed
amphetamines to manage the pressures of academic demands (Rasmussen, 2008b). An article
published in 1974 stated:

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22 See Appendix A for a discussion of terminology.
They are the plague of industrialised states, the premier drug of students, the middle class, and the military. They include the tranquilisers and stimulants upon which much of society relies in order to cope with the pressures of urban survival. (cited in Schloenhardt, 2007)

In the last decade or so however, there has been considerable and growing media attention on the issue of the ‘ice epidemic’ (Bartlett, 2006; Carney, 2006). In April 2009, the Courier-Mail in Brisbane began a special investigation on ‘The Drugs Scourge’, focusing on the problem of methamphetamine (Fynes-Clinton, 2009). Accompanying the media attention was a proliferation of research evidence on the prevalence and consequences of amphetamines use in Australia (see, for example, Breen, Roxburgh, & Degenhardt, 2004; Caldicott, Pigou, Beattie, & Edwards, 2005; Crime & Misconduct Commission, 2006; Darke, Kaye, McKetin, & Duflou, 2008; Degenhardt, Roxburgh, & Barker, 2005; Degenhardt, Roxburgh, et al., 2008; Degenhardt, Roxburgh, & McKetin, 2007; Gray, Fatovich, McGoubrie, & Daly, 2007; Hall & Hando, 1993; Hando & Hall, 1997; S. A. Kinner & Degenhardt, 2008; Lynch, Kemp, Krenske, Conroy, & Webster, 2003; McKetin, 2007; McKetin, Kelly, & McLaren, 2006; McKetin & McLaren, 2004; McKetin et al., 2005; McKetin, McLaren, Lubman, & Hides, 2006; McKetin, McLaren, Riddell, & Robins, 2006; McKetin et al., 2008; Queensland Crime Commission, 2000; Roche, Pidd, Bywood, & Freeman, 2008; Roxburgh & Degenhardt, 2008; Topp & Churchill, 2002; Topp et al., 2002).

1980s – The Amphetamines Market

During the 1980s heroin was the main illicit drug problem in Australia with amphetamines largely seen as a relatively non-problematic recreational drug. At this time in Australia the most commonly available form of the psychostimulant was amphetamine sulphate, commonly known as ‘speed’ (Allen, 2003). By the late 1980s the concern over heroin earlier in the decade had given way to a new drug scare from the United States, namely, crack cocaine (Hando & Hall, 1997; Klee, 1998). Consequently, concern over the use of amphetamine sulphate was ignored by policy makers. However, frontline drug workers both in Australia and in the United Kingdom were becoming concerned with an apparent increase in the numbers of people injecting the drug (Klee, 1992; O’Donovan, 1992). Research in the United Kingdom (Klee, 1992) provided evidence of high levels of HIV-related risk behaviour among amphetamine injectors; the situation was similar in Australia although this presumption was based on anecdotal evidence (O’Donovan, 1992). This situation led Klee (1992) to argue that research into amphetamine use was a neglected area, that it was a much more extensive area of drug misuse and ‘one which threatens to assume epidemic proportions ... in particular, the injecting of amphetamine sulphate, has been increasing’. (p. 440)
In Australia, where there was a similar situation with regards to research, Hando & Hall, (1997), noted that the preoccupation with the ‘looming cocaine epidemic’ meant that most of what was known about amphetamine use in this period was collected as part of research conducted on the use of cocaine, or the HIV-related risk behaviour of heroin users. In addition, funding for the systematic research on illicit drug use in Australia only began in 1985 with the establishment of the National Campaign Against Drug Abuse. Nevertheless, by the early 1990s focus had begun to shift to the use of amphetamines.

1990s – The Emergence of Methamphetamine and Ice

In 1991, Australian Customs and the Australian Federal Police warned of a potentially new threat from a drug called ‘Ice’ and began to lobby the Federal government to develop a campaign to stop its spread (Australian Broadcasting Commission, 2006). Other concerns were expressed by the Police Ministers’ Council:

> Because amphetamine is almost exclusively manufactured in Australia, as opposed to other illegal drugs which are often imported, police were first alerted to a growing problem when they encountered an increasing number of illicit laboratories. (Dr Michael MacAvoy, Director of the Drug and Alcohol Directorate, NSW, quoted in O’Donovan, 1992, p. 2)

In addition, drug and alcohol services were beginning to report an increase in the use of amphetamines (O’Donovan, 1992). Moreover, a series of horrific road accidents involving heavy vehicles where some drivers had taken excessive amounts of ephedrine attracted media attention (Hando & Hall, 1997). The Grafton bus crash in 1989 in particular had led to public attention on the issue of amphetamine abuse in Australia.

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23 A pre-dawn collision near Cowper, between a semi-trailer and a coach on the Pacific Highway killed 21 people, including the truck driver, & injured 22. The impact ripped the driver’s side of the bus off, which threw passengers across the highway.... A State coronial inquiry found the semi-trailer driver responsible for the crash. The truck driver was under the influence of a stimulant & had driven onto the wrong site [sic] of the highway, the inquiry found. Blood samples taken after the accident found the deceased semi-trailer driver’s blood level of ephedrine, a "stay-awake" stimulant, was 80 times higher than that of a habitual user. The inquiry recommended that ephedrine & other mind-altering drugs be included as banned substances under the Motor Traffic Act.... (Attorney-General’s Department, 2006).
These factors combined led to a national focus on amphetamine use. In 1991 the Ministerial Council on Drug Strategy (MCDS) approved a plan to address the problems associated with its use (O’Donovan, 1992). By 1993 patterns of use, especially injecting, were perceived as a public health problem in Australia (Hall & Hando, 1993), and in that year a major government report on the state of illicit psychostimulant use was produced at the request of the Ministerial Council on Drug Strategy (MCDS) (Burrows, Flaherty, & MacAvoy, 1993).

Throughout the 1990s there was strong growth in the production and availability of amphetamines in Australia and globally (UNODC, 2003), with a concomitant near doubling in the prevalence of amphetamines abuse from 2.0% in 1993 to 3.6% in 1998 (sourced from the Australian Institute of Health and Welfare [AIHW], cited in UNODC, 2003, p. 107). There were a number of important developments in the structure and dynamics of the methamphetamine market throughout this decade and into the next that contributed to the growth in its use and related harms.

Perhaps most important was the emergence of more potent forms of amphetamines. Until the 1990s the dominant form of the drug that was available was amphetamine sulphate, called ‘speed’. The regulation of its precursor P2P led to the manufacture of its more potent analogue methamphetamine (Wardlaw, 1993). The main precursor necessary for the production of methamphetamine were the widely available over-the-counter medications based on pseudoephedrine (Topp & Churchill, 2002). Seizures of amphetamine sulphate declined steadily throughout the nineties while the seizures of methamphetamine increased and then dominated the market for ATS (Topp & Churchill, 2002; Topp et al., 2002). In addition, the importation of high purity crystal methamphetamine or ‘ice’ from Asia was identified in the late nineties (Topp et al., 2002). Ice is a significantly more potent form of methamphetamine and is smokable, which encouraged the uptake of smoking as a route of administration (National Drug Research Institute & Australian Institute of Criminology, 2007). Since the late nineties ice has become a significant feature of the Australian illicit drug market.

There were demographic changes in the users of methamphetamine with the emergence of a dance party youth subculture, which included a significant proportion of young gay people (Groves & Marmo, 2008-2009). There was the uptake of smoking ice by this young cohort of relatively inexperienced recreational users who did not inject. The new drug use pattern was associated with a doubling of the risk of methamphetamine dependence compared with other non-injecting users (McKetin, Kelly, et al., 2006). Using methamphetamine also put this group of users into contact with
criminal organisations such as outlaw motorcycle gangs and other criminal syndicates which distribute drugs in dance clubs and other entertainment venues (Groves & Marmo, 2008-2009).

**Early 2000s – The Heroin Shortage and the Methamphetamine ‘Epidemic’**

In December of 2000 there was a sudden and dramatic heroin shortage which coincided with the rise of amphetamines use in Australia. Around the time of this market ‘shock’ evidence emerged that the availability of the more potent drug methamphetamine had increased (Bush, Roberts, & Trace, 2004). Further evidence suggested that dependent injecting drug users may have compensated for the shortage of heroin by substituting with methamphetamine (Degenhardt, Day, Hall, & Bewley-Taylor, 2007; Snowball, Moffatt, Weatherburn, & Burgess, 2008).

By the early 2000s the methamphetamine market was entrenched, broad and dynamic, with drug use patterns ranging from irregular recreational use to heavy dependent injecting use (McKetin, 2007). Population surveys conducted between 2004 and 2007 reported a decline in the proportion of recent methamphetamine users who reported ‘using infrequently’ from 73% to 64%, with a corresponding increase in the proportion of recent users who reported weekly and daily use from 10% in 2004 to 14% in 2007 (Australian Institute of Health and Welfare, 2005, 2008). During this period there was also an upward trend in treatment episodes for methamphetamine, and epidemiologists and practitioners observed increasing harms associated with the use of methamphetamine (Fulde & Wodak, 2007). In 2005, McKetin et al. estimated that there were 102,000 regular methamphetamine users and of those, 72,700 were dependent. Dependent methamphetamine use was found to be been associated with a range of adverse mental and physical health problems (Baker et al., 2004; Darke et al., 2008; Degenhardt, Roxburgh, & Black, 2004; Degenhardt, Roxburgh, et al., 2008; Kaye & Darke, 2000; Kaye, McKetin, Duflou, & Darke, 2007; McKetin, McLaren, Lubman, et al., 2006; McKetin et al., 2008). In addition, dependent methamphetamine users tended to exhibit high levels of violent behaviour, criminal involvement, and subsequent contact with the criminal justice system (McKetin et al., 2005).

The increased use of amphetamines throughout the 1990s and methamphetamine from the advent of the heroin shortage in 2000 was also thought to be a consequence of the increased availability of the precursor chemical pseudoephedrine required for its manufacture (Groves & Marmo, 2008-2009; Ransley & McGuffog, 2012). Prior to 2000 precursors were mainly imported from overseas (McKetin et al., 2005). This situation appeared to change, as evidenced by large-scale seizures of illegally diverted precursors (UNODC, 2008a) and a rise in the detection of clandestine laboratories
for the local production of methamphetamine, especially in the state of Queensland (Australian Crime Commission, 2009).

Since 2005 there has been a stabilisation and drop in the prevalence of methamphetamine use in epidemiological and general population surveys (UNODC, 2008b). In a recent ‘scan’ of drug law enforcement issues however, Nicholas (2010) argued that law enforcement differed from the health sector concerning their perceptions of a significant drop in methamphetamine use and related problems and presented three law enforcement perceptions. First, even if the proportion of infrequent users had dropped, this may not have led to a large drop in overall demand because that group were responsible for a relatively small proportion of overall consumption. Second, as a consequence, police were not necessarily seeing a substantial drop in methamphetamine related behavioural problems because infrequent users are not a significant source of these problems. Finally, local production could stay stable or increase if there has been a shift from importation of methamphetamine to the importation of precursors (see pp.108–90). To sum up, there appears to be two concomitant trends in recent years: Alongside the decline in the prevalence of methamphetamine users since 2005 there has been an increase in the problematic use of the drug by a smaller group of dependent users.

**Supply**

Methamphetamine during this time period (from the mid to late 1990s onward) was relatively easy and inexpensive to produce and distribute with the ready availability of precursor products required for manufacture. In addition, for that portion of the market controlled by organised crime, such as outlaw motorcycle gangs, there was integration with their other business interests, including nightclubs and security entities and the trafficking of weapons and other illegal goods (Australian Crime Commission, 2011; Groves & Marmo, 2008-2009; Schloenhardt, 2007). These established importation and trafficking channels, combined with the small size and weight of both methamphetamine and their precursors, facilitated supply.

In Australia, the major source of methamphetamine is local production in clandestine laboratories using precursor chemicals, principally pseudoephedrine, a component in cold and influenza medications (Australian Crime Commission, 2007, 2010). Illicit supplies of pseudoephedrine are obtained by the diversion of legal products, bought or stolen from pharmacies. Furthermore, only the more highly concentrated forms of crystallised methamphetamine, ‘ice’, is imported, with around 90% of methamphetamine (base) and amphetamine powder (speed) produced locally (UNODC, 2008a). This fits with international patterns, where most methamphetamine is produced
close to where it is to be consumed (UNODC, 2008a). Within Australia the production of methamphetamine has been concentrated in Queensland, especially in the southeast corner of the state around Brisbane and the Gold Coast (Schloenhardt, 2007).

Local production depends on the trafficking of precursors, principally ephedrine and pseudoephedrine, also predominantly from local sources. As availability of methamphetamine products has become more regulated, efforts to further restrict the precursors that can be used to manufacture them has created a black market for them as well as for the end products (Cherney, O'Reilly, & Grabosky, 2005) and an increasing role for organised crime (Schloenhardt, 2007).

Adaptive criminal responses to increased law enforcement led to innovations, including pharmacy break-ins, use of false identities to obtain products from multiple pharmacies (pseudo-running), doctor-shopping to obtain bulk products by prescription, disguising imported precursor chemicals as non-controlled products, and developing new manufacturing methods using different substances (Australian Crime Commission, 2011).

Clandestine drug laboratories also cause significant health and environmental effects, particularly to children who come into contact with them. There are two common forms of laboratory – ‘superlabs’, associated with organised crime and the production of large quantities of end product, predominantly found in North America and associated with Mexican crime gangs, and small scale laboratories, small toxic ‘Mom and Pop labs’ in the American parlance, producing small amounts for local consumption. The period from 1996 to 2006 saw a rapid growth in the numbers of clandestine laboratories detected and seized by law enforcement agencies nationally, so that by 2006 there were seizures of 280 laboratories associated with methamphetamine, a further 22 related to the production of precursors, and 75 where equipment and chemicals were associated with both methamphetamine and ecstasy (Room, Babor, & Rehm, 2005).

This high number of detections has been sustained in current times. The latest Australian Crime Commission Illicit Drug Data Report (2010) reported that 449 clandestine laboratories were detected in Australia in 2008-09 (Australian Crime Commission, 2010). Within Australia, Queensland continues to be the most popular site for local methamphetamine production, based on the number of clandestine laboratories that were detected there (Australian Crime Commission, 2010). In 1997–
1998, 55 clandestine laboratories were detected in Queensland (Australian Bureau of Crime Intelligence, 1999); that number peaked in 2003–2004 at 209\(^{24}\), then fell by almost 30% to 148 in 2008–2009 (Australian Crime Commission, 2010). However, the latest Queensland Police Service (QPS) Annual Report shows that in 2009–10, there were 297 clandestine drug laboratories seized in Queensland. This represents an increase of 149 laboratories (over 100%) on the number seized during 2008-09\(^{25}\) (Australian Crime Commission, 2011).

Attempts to accurately measure levels of production and importation of methamphetamine and precursors are problematic, because of the paucity and fragmentation of data. The most common measures are seizures from border interdiction, for importation, and of clandestine laboratories, for domestic production. However, as Schloenhardt (2007) points out, even this data has severe limitations – for example, while numbers of seized laboratories are counted, there is no systematic data collection on their size or production capacity, and there is disparity between jurisdictions in reporting all ATS seizures, or in breaking totals down between methamphetamine and ecstasy laboratories (Schloenhardt, 2007, p. 16). The data for precursors is even more problematic, there being variations as to what substances are reported for what periods (Schloenhardt, 2007).

**SUMMARY**

Overall, the picture has been one of rapidly rising popularity and availability of methamphetamine, especially in developed countries including Australia and North America. The last five years have seen that market stabilise in terms of overall consumption, but adapt in terms of the variants of the products in popular use, and their methods of ingestion, and this seems associated with rising harm levels. However, reliable data on the scale of the problem is scarce and fragmented, and largely dependent on successful law enforcement outcomes (clandestine laboratory detections). There are

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\(^{24}\) The corresponding number of clandestine laboratory seizures reported by the QPS and presented in Figure 1.1 on page 23 is 189, not 209 as reported by the Australian Crime commission in 2010.

\(^{25}\) Since the research for this thesis was completed the most recent Illicit Drug Report (Australian Crime Commission, 2011) reported that following a relatively stable period between 2003–04 and 2007–08, Australia has seen increases in the number of clandestine laboratories detected nationally. In 2010–11, a record 703 clandestine laboratories were detected; 293 of those were found in Queensland, which continues to account for the highest number of clan labs.
little data available on undetected production and distribution, or unproblematic usage, apart from prevalence and user surveys (Ransley & McGuffog, 2012).

Methamphetamine remains an important and difficult law enforcement issue. The unique features of the methamphetamine market have required innovative responses from DLE (Cherney et al., 2005). Drug law enforcement is an increasingly important factor for ongoing supply reduction efforts in order to contain a highly resilient and adaptable illicit drug market. The development of responses to the methamphetamine problem is covered in the next section.

**RESPONSES TO THE METHAMPHETAMINE PROBLEM**

Global responses to the increased availability of amphetamines have been driven by the framework of international drug control conventions; in particular, the *Convention on Psychotropic Substances 1971* and the *Convention Against the Illicit Traffic in Narcotic Drugs and Psychotropic Substances, 1988*. Together these treaties established a comprehensive framework for law enforcement and judicial cooperation and criminalised a range of activities related to the production, trafficking and possession of amphetamines including the prevention of the diversion of chemicals into illicit markets (Cherney et al., 2005). In particular, the 1988 convention was aimed at combating the involvement of criminal organisations in the illicit drug trade, given their involvement in the manufacture and trafficking of methamphetamine (Schloenhardt, 2007). This convention obligated signatories to monitor and control the availability of precursor chemicals that can be used to manufacture illicit methamphetamines.

What follows is a review of the available international evidence on the impact of regulations introduced to prevent the diversion of precursors to the illicit market. I will then outline the development of the regulatory framework that was developed in Australia at the Federal level and detail the evolution of precursor regulations in the state of Queensland. The distinguishing feature of the Queensland case is the coercive nature of the regulatory and legal web that was developed in response to the problem of the diversion of over-the-counter (OTC) medicines to the illicit drug market for manufacture into methamphetamine. The Pharmacy Guild in that state developed their own electronic medication recording system (*Project STOP*) in an effort to comply with the regulatory burden placed upon them by the law. I turn now to the available international evidence on the impact of precursor regulation on methamphetamine outcomes.
A recent systematic review of the available evidence on methamphetamine precursor regulations identified significant impacts from the introduction of precursor regulations and two enforcement efforts on various methamphetamine outcome indicators (McKetin, Sutherland, Bright, & Norberg, 2011). There were only seven studies that met the Effective Practice and Organisation of Care Group (EPOC) guidelines of the Cochrane Collaboration (The Cochrane Effective Practice and Organisation of Care Review Group (EPOC), 2002). The EPOC quality guidelines for inclusion into a systematic review specify that the data are long time-series with narrow time intervals that allow for various shaped interventions to be tested (i.e. gradual, abrupt, lagged) and that are sensitive to transient intervention effects. The seven studies that met these criteria were all conducted by the same group of researchers in North America (the United States, Canada and Mexico) (Cunningham, Bojorquez, Campollo, Liu, & Maxwell, 2010; Cunningham & Liu, 2003a, 2003b, 2005, 2008; Cunningham, Liu, & Callaghan, 2009; Cunningham, Liu, & Muramoto, 2008). The methamphetamine outcomes examined by these researchers included drug treatment demand, route of administration, hospital admissions, arrests and drug purity. The interventions examined by Cunningham and colleagues included Federal and State level regulations that covered import/export, wholesale and retail restrictions of the supply of products containing precursor chemicals. None of these interventions included the impact of an electronic medication recording system such as Project STOP.

The evaluation of regulations that were aimed at the retail distribution of pharmaceutical products had mixed results. The three retail level regulations that were implemented at the Federal level in the United States were the Comprehensive Methamphetamine Control Act – ephedrine regulation (1995), the Comprehensive Methamphetamine Control Act – pseudoephedrine regulation (1997), and the Methamphetamine Anti-Proliferation Act (2001). The pseudoephedrine regulation introduced in 1997 was effective in reducing a range of methamphetamine indicators including treatment and hospital admissions, and arrests (Cunningham et al., 2010; Cunningham & Liu, 2003b, 2005, 2008). The two other Federal acts did not have an impact on hospital admissions, routes of administration, arrests or drug purity (Cunningham & Liu, 2003b, 2005; Cunningham et al., 2009; Cunningham et al., 2008). One state level retail regulation (Texas) was examined and no impact was found on treatment admissions (Cunningham et al., 2010). Finally, the requirement for prescriptions in order to purchase pseudoephedrine introduced in Mexico in 2008 did not impact treatment admissions (Cunningham et al., 2010).
There were three studies that specifically examined the impact of precursor regulations on treatment admissions, including route of administration (Cunningham et al., 2010; Cunningham & Liu, 2008; Cunningham et al., 2008). Voluntary treatment admissions in the state of California initially declined for two years following the introduction of the 1995 precursor regulation, before resurging, but declined again with the introduction of the 1997 regulation for four years (Cunningham & Liu, 2008). By 2001, treatment admissions had grown and then surpassed pre-intervention levels in 2002; this was likely due to a new source of methamphetamine supply that opened up in neighbouring Mexico.

In a study of the Mexican response to the methamphetamine problem, Cunningham et al. (2010) detailed the changes that occurred, beginning with the reduction of imports of pseudoephedrine in November 2005 and expanding retail restrictions on the supply, recording and reporting of pseudoephedrine sales in February 2006. In March 2007 there was a rogue precursor chemical company closure. In September 2007 Mexico introduced a requirement for prescriptions to obtain pseudoephedrine, and in July 2008 there was a complete ban of pseudoephedrine. Other possible interventions that were considered were United States and Canadian Federal regulations. The study examined the impact of these multiple interventions on treatment admissions in Mexico. The only significant impacts on treatment admissions were found for the 2005/06 precursor restrictions, the rogue chemical company closure in 2007, and the ban on precursors in 2008. Overall there was a decrease in treatment admissions associated with these interventions. This study, together with the previous, indicates that U.S. and Mexican precursor controls positively impacted treatment admissions (a decrease in treatment seeking is assumed to indicate a decrease in drug related problems and harm) (McKetin et al., 2011).

The third study of treatment admissions examined the impact of precursor regulations on the route of administration of methamphetamine; note however, that it was conducted prior to the introduction of precursor restrictions in Mexico (Cunningham et al., 2008). Different routes of administration of a drug are associated with different levels of harm. Injecting is of particular concern as it is associated with the risk of blood borne viruses such as human immunodeficiency (HIV), hepatitis B and C and damage to veins (Strang, Bearn, Farrell, Finch, & et al., 1998). Both injecting and smoking are associated with a higher risk of dependence when compared with ingesting and snorting. Smoking methamphetamine was found to be associated with supply from Mexico as the market adapted to the regulations introduced in the United States (and discussed above). This study found that while overall admissions dropped in response to the 1995 and 1996 regulations, it was temporary and admissions began to rise to higher levels by the end of the study.
period in 2004. This return to pre-intervention levels, however, was due to the rise of smoking (with its relatively high risk for dependency) associated with Mexican production and supply of methamphetamine to the United States. This study highlights the importance of the potential public health impacts of drug suppression and arguably the need for health researchers’ input into drug law enforcement policy (Cunningham et al., 2008, p. 103).

Taken together these seven studies provide evidence that precursor regulations across the United States and Mexico have had a positive impact on treatment admissions, hospital admissions, arrests and purity. However, they do highlight the importance of imports of precursors and/or methamphetamine from other sources as a prime factor undermining the impact of regulations. In addition, a new supply source was associated with the potentially harmful uptake of a new route of administration (i.e. smoking) and is an example of an unintended (harmful) consequence of drug supply restriction. There was, however, no evidence of significant switching to other drug types or a shift to injecting drug use to compensate for lower purity (Cunningham & Liu, 2008; Cunningham et al., 2008).

McKetin et al. (2011) conclude in their evaluation of this evidence that the question for future research is ‘not so much whether precursor regulations work, but which regulations work best and in what context’ (p. 11, emphasis added). The regulations examined by the studies covered different aspects of precursor diversion (i.e. import, wholesale and retail levels) often coinciding with broader drug control laws that were tailored to local trends in drug manufacture. They conclude by stating that precursor regulations can reduce indicators of supply and use of methamphetamine but their impact is contingent upon the context in which they are implemented and I would argue, in addition, the context of the drug user as well. I turn now to Australia’s response to the problem of the diversion of precursor chemicals to the illicit market.

**The Australian Experience**

Australia’s criminal law and regulations pertaining to amphetamines and their precursor chemicals are defined largely by the obligations it has as a signatory to the relevant international drug conventions. The Federal government enacts laws relating to the import, export and commercial manufacture of these drugs and the State and Territory laws relate to the manufacture, selling, supplying and possession of amphetamines (Schloenhartd, 2007). Precursor chemicals are also used for the manufacture of legal medicines that are supplied through community pharmacies. Preventing the diversion of these medicines to the illicit market has resulted in voluntary codes of conduct enacted in the pharmaceutical industry in an attempt to prevent more punitive criminal
legislation being introduced. The scope and development of laws and regulations by governments were not uniform across the States and Territories despite Australia’s ratifying of the relevant international treaties. Queensland had the most coercive regulatory framework in Australia and led the other states in the development of the electronic medication recording system (Project STOP) and its partnership with law enforcement in response to the problem of the diversion of precursor chemicals. The use of Project STOP and the recording and reporting of the sales of pseudoephedrine products is now mandated in several other states, although not the largest states of Victoria and New South Wales (Ransley, 2012). Even so, Queensland’s scheme continues to be more coercive than anywhere else in Australia because only there are purchasers required to produce photographic identification which is then subject to mandatory end-use reporting to police. What follows is a review of these developments which occurred alongside the growth in use of amphetamines in the 1990s and the uptake of the highly addictive and harmful substance methamphetamine since the year 2000, which was documented in the first half of this chapter.

The International Drug Control Regime

Australia is a signatory to the Convention on Psychotropic Substances, 1971 and the Convention Against the Illicit Traffic in Narcotic Drugs and Psychotropic Substances, 1988, which obligates it to monitor and control the availability of precursor chemicals that can be used to manufacture illicit methamphetamines. The 1971 convention was modelled on the Single Convention on Narcotic Drugs, 1961. Psychotropic drugs are synthetically derived and include amphetamines, barbiturates, benzodiazepines and psychedelics (Jalsma, 2011). It was a weaker convention that the 1961 single convention due to concerns from the large chemical and pharmaceutical industries, who were reluctant to be subject to the stringent controls under the single 1961 convention (Schloenhardt, 2007). The two treaties (1961 and 1971) were placed under the administrative mandate of the International Narcotics Control Board (INCB). The narcotic and psychotropic drugs listed in these treaties were not prohibited as such, instead their production and supply were placed under strict controls in order to limit their use for scientific and medical purposes (Jalsma, 2011).

The 1970s and 1980s saw the rise of criminal involvement in the international drug trade and it became clear that the existing international drug control framework was not working in terms of controlling the supply of and demand for illicit drugs (Schloenhardt, 2007). The 1988 convention was aimed at combating the involvement of criminal organisations in the illicit drug trade. In the preamble the problem was stated thus:
The magnitude of and rising trend in the illicit production of, demand for and traffic in narcotic drugs and psychotropic substances, which pose a serious threat to the health and welfare of human beings and adversely affect the economic, cultural and political foundations of society, (United Nations, Preamble).

The 1988 convention was a response to this concern and was aimed at fighting organised crime that was profiting from the manufacture and trafficking of illicit synthetic drugs. Article 3 requires signatories to criminalise a range of activities including ‘the production, manufacture, extraction, [and] preparation’ of psychotropic substances (Article 3(1) (a) (i)). The application of this convention applies to all the substances listed in the 1961 and 1971 Conventions, and was extended to precursor chemicals including ephedrine, P2P and pseudoephedrine. Article 12 relates to the prevention of the diversion of the precursor chemicals listed in the Tables and Article 3 criminalises their possession (United Nations). Australia signed the 1988 convention in February 1989 and it came into force in February 1993 (Schloenhardt, 2007, p. 93).

The 1971 and 1988 conventions were enacted into Federal law in the Psychotropic Substances (Act) 1976 (Cth) and Crimes (Trafficking in Narcotic Drugs and Psychotropic Substances) Act 1990 (Cth) (Schloenhardt, 2007). In Australia, as mentioned previously, Federal drug offences are concerned with conduct related to the import and export of illicit drugs and the States and Territories legislate offences related to the manufacture, selling, supplying and possessing of illicit drugs. In addition to the criminal law all States have enacted regulations to monitor and restrict the retail sales of licit substances that contain precursor chemicals and that are available from community pharmacies, although as discussed, there are significant differences between the States in the way that they do this.

The State of Queensland is taken as a case study in this regard because the Pharmacy Guild there developed and introduced the electronic medication record system known as Project STOP and developed a partnership with the Queensland Police Service (QPS). The driver of this proactive policing partnership was the fact that Queensland had the most coercive regulatory framework in Australia at the time when Project STOP was introduced (November 2005), and continues to have a more coercive scheme than any other State or Territory, whereby pharmacists are criminalised if they fail to comply with their ‘statutory obligations of controlling access to suspicious purchasers of pseudoephedrine’ (Ransley, 2012, p. 22). The regulation in that State effectively made Project STOP a third party policing intervention because pharmacists were co-opted into undertaking crime control activities (Webster, 2012).
The Development of the Precursor Regulatory Framework in Australia and Queensland

A ‘regulatory’ regime permits a substance to be lawfully available for nonmedical or self-defined uses but may regulate the product, its price and conditions of access (Ransley, 2012). All the States and Territories in Australia have regulatory frameworks but they vary remarkably in their scope and penalties (Schloenhardt, 2007). My focus here is on Queensland regulations and laws, and the Federal ones that pertain to precursor control. Recall that the Convention Against the Illicit Traffic in Narcotic Drugs and Psychotropic Substances, 1988 was ratified in Australia in 1993 and was concerned with all aspects of the manufacture and supply of amphetamines and their precursors. In the following year, 1994, the first voluntary code between industry and law enforcement was developed regarding the diversion of chemicals and equipment for the illicit manufacture of amphetamines. It was adopted by members of the Plastics and Chemicals Industries Association (PACIA) and Science Industry Australia (SIA) (Hughes, 2012). The first Chemical Diversion Conference was held at the Australian Bureau of Criminal Intelligence in August 1997 and brought together law enforcement investigators, chemical diversion officers, forensic chemists and other delegates from external agencies to develop strategies to facilitate a better exchange of information and intelligence between agencies (Australian Bureau of Crime Intelligence, 1999).

The Therapeutic Goods Administration was established in 1989 with the passing of the Therapeutic Goods Act; the aim of the Act was to establish a uniform national registration scheme for pharmaceuticals (McEwan, 2007). In 1999 the Object of the Act was broadened and amended to include section 4(1)(a) ‘to provide a framework for the States and Territories to adopt a uniform approach to control the availability and accessibility, and ensure the safe handling of poisons in Australia’ (McEwan, 2007, p. 160). In 2001, the National Drugs and Poisons Scheduling Committee (NDPSC) met and rescheduled single active ingredient products (i.e. pseudoephedrine only). This meant that packets of 60 and 90 pseudoephedrine tablets were restricted to prescription only.

26 Until 30 June 2010, scheduling decisions were made by the National Drugs and Poisons Schedule Committee (NDPSC), an independent expert committee established under now repealed provisions of the Therapeutic Goods Act 1989 (the Act). New provisions of the Act authorise the Secretary to the Department of Health and Ageing, or a delegate, to make scheduling decisions. The NDPSC was established under then section 528 of the Therapeutic Goods Act 1989 and consisted of State and Territory government members and other persons appointed by the Minister such as technical experts and representatives of various sectional interests (Therapeutic Goods Administration, 2011).
(Schedule 4) and packets of 30 tablets were restricted to Schedule 3, or pharmacist only (Costa, 2008; Therapeutic Goods Administration, 2002). This rescheduling came into effect in 2002. The Standard for the Uniform Scheduling of Medicines and Poisons (the SUSMP) also called ‘The Standard’ is a legislative instrument which consists of decisions regarding the regulation of drugs and poisons in Australia (see Appendix C for details of the Schedule of drugs and poisons). The SUSMP is only a recommendation to the States and Territories, however, which vary in terms of their regulations of drugs and poisons (Department of Health and Ageing).

During a meeting in 2005 the NDPSC decided to further reschedule medicines containing pseudoephedrine (Therapeutic Goods Administration, 2005b); this step was taken in conjunction with projects being run such as Pseudo Watch and Pseudo Stop in an effort to reduce the acquisition of pseudoephedrine-containing medicines for the illicit manufacture of methamphetamine (Queensland Branch, 2005; The Pharmacy Guild of Australia, 2006). The first stage of the rescheduling came into effect on 1 January, 2006. This placed all current pseudoephedrine products (slow-release, combination and undivided preparations) in all pack sizes into Schedule 3. The second stage of rescheduling came into effect on 1 April, 2006 and moved all liquid formulations containing more than 800mg of pseudoephedrine, and all combination or single ingredient products, such as capsules and tablets, containing more than 720mg of pseudoephedrine to Schedule 4. In 2005, these provisions were introduced into the health regulation (Health (Drugs and Poisons) Amendment Regulation (No. 3) 2005, QLD).

The regulation of precursors in Queensland is governed by two statutory schemes: the first is the drugs misuse legislation and the second is the health regulation (under the Health Act 1937). Together these statutory schemes provide the framework under which Queensland controls the sale of precursor chemicals and the production and trafficking of amphetamines. The first provides for criminal sanctions under drugs misuse legislation: the Drugs Misuse Act 1986 (QLD) and Drugs Misuse Regulation 1987 (QLD) (Ransley, 2012). This Act, which deals mainly with the trafficking, supply, production and possession of dangerous drugs, was amended in 1995 to include pseudoephedrine as a controlled substance. The provision of controlled substances by suppliers

\[27\] See Appendix C for details of the Schedule.
required that the recipient provide photographic identification as well as their name, address, date, and name and quantity of the substance supplied (Ransley et al., 2012).

The second statutory scheme occurs under the *Health Act (1996) (Qld)* and provides the framework for the manufacture and sale of legal drugs. Those who may sell pseudoephedrine products are restricted and there are requirements for their labelling and storage (Ransley et al., 2012). There were two significant amendments made to this framework which was originally introduced in 1996. An amendment in 2002 inserted Section 285A which requires records of Schedule 3 pseudoephedrine sales to be kept. Sellers must record the date of sale, brand and quantity of product, purchaser’s name and address, and identity document details. The record can be kept in any appropriate form, including electronically, and must be kept for two years after the sale (Ransley, 2012). The second important amendment is discussed below.

Law enforcement agencies estimated in 2004 that around 90% of pseudoephedrine used in illicit laboratories in Australia was sourced from community pharmacies (Siggins Miller, 2009). As discussed above, in 2005 all Australian governments agreed to restrict the availability and sale of therapeutic products containing pseudoephedrine (Therapeutic Goods Administration, 2005a). The decision had the effect of removing all pseudoephedrine-containing medicines from Schedule 2 of the *Standard for the Uniform Scheduling of Drugs and Poisons* and shifting them to Schedule 3. In a second stage of the process, all such products containing more than specified amounts of pseudoephedrine were shifted to Schedule 4. Schedule 3 products are restricted to pharmacy sales, and Schedule 4 products must be prescribed by a medical practitioner. For the appropriate sale of Schedule 3 pseudoephedrine, the *Health (Drugs and Poisons) Regulation 1996* was amended to include Section 277(1) (a), which referred specifically to the sale of Schedule 3 pseudoephedrine and required the following: that the sale must be made under a pharmacist’s direction and personal supervision; that the sale could be made only if the seller was reasonably satisfied the purchaser had a therapeutic need for the product; and that where the seller does not know the purchaser’s identity, the purchaser must provide an acceptable form of identification, defined to include a document issued by a Commonwealth or State government entity that shows the purchaser’s photograph. These requirements were introduced by amendment in 2005, and commenced in January 2006. These measures combined meant that pharmacies became the only legal point of sale of pseudoephedrine products (Ransley, 2012).

From 2005, all States and Territories introduced legislation to reschedule pseudoephedrine products. This was combined with a further agreement among the jurisdictions to tighten
regulations regarding the storage, packaging and display of pseudoephedrine products. For example, security requirements have been increased to make theft from pharmacies more difficult and dispensing standards require the sale of smaller amounts of the product at any one time (Ransley, 2012).

At around the same time, the Queensland Branch of the Australian Pharmacy Guild (a large, well organised, voluntary trade organisation to which many community pharmacists belong), together with the Chemical Diversion Desk of the Queensland Police Service, built on the success of the Guild’s existing *Pseudo Watch* program\(^28\), and developed a real-time online database (known as *Project STOP*). The aim of this electronic medication monitoring system was to assist pharmacists comply with the new regulatory changes, and specifically, to help to determine a customer’s legitimate therapeutic need for a pseudoephedrine product, and to record details of sales including the requirement of photo identification. *Project STOP* also has a preventive focus, aimed principally at preventing diversion from occurring in the first place by improving pharmacists’ knowledge and ability to refuse suspect sales.

The database was developed with an investment from the Guild of about $500,000 for support staff and the development of the web-based database (Siggins Miller, 2009). *Project STOP* was initially launched in Queensland in November 2005. The objectives of *Project STOP* are to reduce the diversion of pseudoephedrine-based products into illicit drug manufacture; first, by enhancing pharmacists’ ability to identify suspicious requests for pseudoephedrine products; second, by assisting pharmacists to determine whether customers are legitimate or illegitimate users; and third, by providing intelligence to police and health agencies regarding illicit activities by ‘pseudo runners’ and ‘rogue’ pharmacies (Pharmacy Guild of Australia, 2009; Siggins Miller, 2009).

The *Project STOP* database enables pharmacists to record three types of transactions: sales, non-sales, and sales under duress, and also detects where a transaction has been begun but the entry has not been completed. The database has the capacity to track purchases by individuals, based on their proof of identification, and allows all pharmacists with access to the system to see those

\(^{28}\) *Pseudo Watch* is an awareness strategy to educate pharmacy staff and consumers about the extent and possible dangers of drug runners, posing as genuine customers, purchasing and diverting pseudoephedrine into methamphetamine (The Pharmacy Guild of Australia, 2006).
purchases over a 24-hour period. The database interface also prompts pharmacists to request information about the customer’s symptoms, as well as their previous purchases of similar products. This data is immediately made available to other pharmacists, regulatory agencies and police, who can use it for surveillance and tracking purposes. The data can be readily manipulated to identify hotspots of sales activity, identify customers engaged in repeat purchases, and identify pharmacies engaged in suspicious quantities or patterns of sales. Mapping functions attached to the database can produce reports in a format readily usable for investigation and follow-up (Ransley & McGuffog, 2012).

The initial uptake of Project STOP by Queensland pharmacies was very high (initially 85% of community pharmacies which grew to 90% within the first year), assisted by the fact that the Guild provided it to them free of charge and regardless of whether they were Guild members (Pharmacy Guild of Australia, 2009). After the initial success of Project STOP in Queensland, as reported by law enforcement agencies to the State government29 (Queensland Health, 2007), Project STOP received Federal funding in April 2007 to support a national rollout, which occurred in August of that year. The introduction of Project STOP was followed up by activities undertaken by the Pharmacy Guild of Australia after August 2007, to further encourage the uptake of the system by pharmacists (Siggins Miller, 2009).

In 2007 in Queensland the State government established an Ice Breaker Task Force in response to a Commonwealth Government announcement of additional funding of $150 million to 2010–11 to provide drug prevention education for young people and support to their parents, to increase law enforcement efforts and to enhance drug rehabilitation services provided by the non-government sector (Queensland Health, 2007). A key initiative undertaken by the task force was the drafting of an amendment of the Tobacco and Other Smoking Products Act (1998) (Qld) to prohibit the display and sale of ‘ice’ pipes and bongs (Gastaldon Renee, 2007). The ban on ice pipes commenced in July 2007.

29 The introduction of Project STOP reportedly resulted in the improved detection of people involved in the manufacture of illicit drugs by the QPS. As a direct result of information obtained from Project STOP in the first year 297 suspect crime files were created. In addition, 267 criminal charges were laid, including the serious drug offences of trafficking, supply and production of dangerous drugs, and seven clandestine laboratories were located throughout Queensland (Queensland Health, 2007, p. 7).
In 2008 there were two further legislative changes which directly impacted on the supply of methamphetamine in Queensland. The *Drugs Misuse Amendment Bill 2008 (Qld)* was introduced and made a number of important amendment to the *Drugs Misuse Regulation (1987) (Qld)*. Since 2005 the regulation required that the supply of a controlled substance by pharmacists was recorded in a register and maintained by the business, and that copies of identification documentation were obtained from the person purchasing the controlled substance. The register could be inspected at any time by an environmental health officer (as set down in S 137 of the *Health Act (1996)(Qld)* (Ransley, 2012), but there was no requirement that the details kept on the register be provided to or lodged with any central agency. In practice, this meant that the industry that manufactures and sells pseudoephedrine products provided copies of relevant transactions, including identity documentation, to the QPS, but *on a voluntary basis* (Dixon, 2008). The amendment added a new section 6(a) ‘End user declaration to be given to commissioner of police service—Act, s 43D (1) (d)’. This Amendment commenced in June 2008 and in effect required the *mandatory* reporting of pseudoephedrine sales. The second change introduced by this legislation was the inclusion of information requirements for ‘controlled things’. The reference to controlled things was defined to include things specified in Schedule 8B of the *Drugs Misuse Regulation (1987)(Qld)*, which included items such as pill presses, evaporators and reaction vessels (Ransley, 2012). The amendment made it an offence to supply or possess a combination of ‘controlled substances’ and ‘things’ that could be used to manufacture methamphetamine.

The Queensland regulatory scheme imposes a complex criminal and regulatory web around the sale of pseudoephedrine products. Significant responsibilities have been imposed on pharmacists, not only to verify the therapeutic needs of their customers, but also to check and record their identity. This information must be kept both in a register and routinely passed on to two separate government agencies – the police service and health regulators. Agents of both are authorised with coercive powers to check on pharmacists’ compliance with their statutory responsibilities. Sanctions for non-compliance can be imposed both under criminal law, and under the registration and disciplinary system applying to pharmacists (Ransley, 2012).

**The Role of the Police**

The police play an especially important role in the regulation of precursors in this context. Third party policing is a theoretical construct that has developed as a way of understanding how law enforcement can develop and steer crime control networks and partnerships, by mobilising (and
coercing) other parties and using their resources (L. G. Mazerolle & Ransley, 2005; Ransley et al., 2012). A distinguishing feature of third party policing is the leveraging of legal mechanisms outside criminal law; moreover they co-opt crime control partners to take responsibility of local problems (Ransley et al., 2012).

A distinctive challenge for DLE efforts at controlling methamphetamine production is that it has a double supply-side system. Production is dependent upon diversions from licit pharmaceutical and chemical retailers as well as illicit manufacture (Cherney et al., 2005). Cherney et al. (2005) argue that the interface between the licit and illicit drug markets has meant that supply reduction cannot simply be based on a strict law enforcement framework ... but requires preventative and regulatory approaches. The aim is to increase the effort, increase the risks and reduce the rewards associated with the manufacture and trafficking of ATS. Meshing this situational approach with a ‘factors of production’ model helps to identify ways of reducing the opportunities and the capacity of groups, organisations and networks to manufacture and traffic in ATS. (p. 14)

Policing scholars have argued that due to the nature of the production and distribution of methamphetamines their control requires innovative law enforcement responses (Cherney, Reilly, & Grabosky, 2006a, 2006b). Traditional methods of law enforcement are reactive and typically focus on after the event investigation and prosecution of people involved in production, trafficking and consumption of illicit drugs. The methods used by street-level law enforcement (including undercover operations, crackdowns, drug-free zones, intensive street policing and raids) have been well documented as associated with an increase in drug-related harm, particularly for dependent injecting drug users (Fitzgerald, 2005; Kerr, Small, & Wood, 2005; Maher & Dixon, 1999; Small, Kerr, Charette, Schechter, & Spittal, 2006; D. Weatherburn & Lind, 1997, 2001) The specific requirements for controlling the supply of methamphetamines has led DLE to develop new responses targeted at higher levels of the drug supply chain (i.e. at the State or jurisdictional level). These responses have involved co-opting third parties in the regulatory modes of the governance of precursor diversion (Cherney et al., 2006b; L. G. Mazerolle & Ransley, 2005).

30 When compared with problem-oriented or partnership policing (see L. G. Mazerolle & Ransley, 2005).
Summary

In the context of the previous discussion about innovations in policing, the shift to involve pharmacies in the prevention of pseudoephedrine diversion, including the use of the electronic medication recording scheme Project STOP, can be seen as part of a new regulatory mechanism that shifts responsibility for part of the policing function to third parties. It does this by requiring pharmacists to gather information and pass it on to police, with the Project STOP database providing a convenient way for this to occur. Pharmacists are enlisted both formally and informally to help police achieve this goal. Regulation is used as a tool for the State government’s departments of Health and Police to gain this third party cooperation.

This constitutes, when voluntary, partnership policing, in that police and pharmacists partner in efforts to reduce the problem of pseudoephedrine diversion to illicit methamphetamines manufacture. When pharmacists’ cooperation is mandated, as is the case in Queensland, and non-cooperation sanctioned, Project STOP is in effect a third party policing initiative. The legal levers being used are both the pharmacists’ legislative duty to record and pass on information to police and the sanctions available to discipline pharmacists who fail to cooperate. This mandating of policing functions by third parties has also been extended to other bodies, such as chemical wholesalers and retailers (Cherney et al., 2006a)

The involvement of pharmacies in preventing pseudoephedrine diversion, including the use of technology such as Project STOP, therefore represents a major expansion in law enforcement efforts directed at the problem of methamphetamines (Ransley, 2012). The imposition of recording and reporting responsibilities has imposed significant compliance costs on non-police burden bearers, especially pharmacists and their associations, and the health agencies that regulate them. In addition, it has resulted in extra burdens for the public who face hurdles in accessing medications needed for legitimate reasons. This has occurred without any evaluation of either the impact of the system of recording and reporting pseudoephedrine sales on the problem it seeks to address, or its cost effectiveness in doing so31 (Ransley, 2012).

31 Since the research for this thesis was completed, another major development in the roll-out of Project STOP has occurred. In three states, Queensland, Western Australia and South Australia, its use has been mandated
An emerging theme from the review of the international evidence that evaluated the impact of precursor regulations on methamphetamine supply and demand outcomes, and from policing scholars, is that of integration among the various stakeholders in the creation and implementation of drug policy. Cunningham (et al, 2008) refers to Westermeyer’s (1976) seminal study The pro-heroin effects of anti-opium laws in Asia when concluding that law enforcement and public health sectors need to collaborate in the design and implementation of drug suppression policies:

This study underscores the potential public health impacts of drug suppression and, consequently, the need for health experts’ input on the design and implementation of suppression policies—input that was generally not sought in the case of precursor regulation. Approximately 30 years ago, Westermeyer called for the integration of law enforcement and public health to better prepare for the impacts of suppression on routes of administration. His call is just as relevant today. (p. 1184)

Indeed, Cherney (et al, 2006b) also highlight the need for law enforcement to engage in preventative efforts with non-police partners. In Australia, drug policy is characterised as consisting of four pillars: law enforcement, treatment, prevention and harm reduction (Ritter & McDonald, 2008). In addition to a general lack of policy integration across these pillars, there is a lack of evaluation of the dynamics between the pillars. My research attempts to address at least part of this gap by examining some of the broader public health impacts of precursor regulation, a law enforcement policy, on the treatment seeking and drug use behaviour of dependent users of methamphetamine.

meaning that pharmacists are required to install and use the program in order to meet their regulatory obligations. However, as discussed, the regulations still differ in relation to the proof of identity required for the purchase, and the provision of details to police (Ransley, 2012).
<table>
<thead>
<tr>
<th>Date</th>
<th>Epidemic timeline</th>
<th>Federal policy responses</th>
<th>Queensland policy responses</th>
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<tr>
<td>1985</td>
<td>The National Campaign Against Drug Abuse established.</td>
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<td>1994</td>
<td></td>
<td>Precursor 1-P2P restricted.</td>
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<td>1995</td>
<td></td>
<td><em>Drugs Misuse Act (1986)(Qld)</em> amended to include pseudoephedrine as a controlled substance.</td>
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<td>1996</td>
<td></td>
<td><em>Health Act (1996) (Qld)</em> introduced and provides the framework for the manufacture and supply of controlled substances.</td>
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<td>1997</td>
<td></td>
<td>John Howard releases his government’s <em>Tough on Drugs Strategy</em>.</td>
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<td>1998</td>
<td></td>
<td>Christmas beginning of heroin drought.</td>
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<td>2000</td>
<td></td>
<td>Clan lab seizures in Qld, 55 (ACC).</td>
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<td>2001</td>
<td>The new more potent drug methamphetamine &amp; ‘ice’ comes to the attention of health and law enforcement</td>
<td>National Drugs and Poisons Scheduling Committee (NDPSC) met and rescheduled single active ingredient products (i.e. pseudoephedrine only): packets of 60 and 90 tablets are now prescription only (S4), &amp; packets of 30 tablets are restricted to S3, pharmacy only. <em>Drugs Misuse (Amphetamine Offences) Amendment Act (2001)</em> Amphetamine and methamphetamine rescheduled to S2 to S1 drugs, increased penalties for possession and manufacturing.</td>
<td></td>
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<tr>
<td>Date</td>
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| 2002  | Publication of Topp et al The emergence of potent forms of methamphetamine in Australia (NDARC) | A National Working Group on the Diversion of Precursor Chemicals is established to prevent the diversion of over the counter medicines  
The Federal government commits $5.4 million to the National Strategy to Prevent the Diversion of Precursor Chemicals into Illicit Drug Manufacture | Health Act (1996)(Qld) amended to require suppliers to record details of purchase of controlled substances including the buyers name, address and they must produce a valid ID (Sep) |
| 2003  | Publication of McKeating & McLaren The Methamphetamine situation in Australia (NDARC) |                                                                                         | Publication of Crime & Misconduct Commission  
Amphetamine : still Queensland's no. 1 drug threat  
Illicit Drug Court Diversion Program introduced (Mar) |
| 2004  | Publication of McKeating et al Estimating the number of regular and dependent methamphetamine users in Australia (NDARC) | Parliamentary Joint Committee on the Australian Crime Commission establishes an Inquiry into the Manufacture, Importation and Use of Amphetamines and Other Synthetic Drugs in Australia  
NDPSC decided to amend the Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP) and reschedules medicines containing pseudoephedrine in two stages to commence in 2006 | Clan lab seizures in Qld 209 (ACC) |
| 2005  | Four Corners broadcasts The Ice Age on ABC                                         | SUSMP rescheduling of pseudoephedrine products commences: first stage all current pseudoephedrine products in all pack sizes into Schedule 3 (Jan); second stage of rescheduling moves all liquid formulations containing more than 800mg of pseudoephedrine, and all combination or single ingredient products, such as capsules and tablets, containing more than 720mg of pseudoephedrine to Schedule 4 (Apr)  
Ministerial Council on Drug Strategy (MCDS) agrees to the development of a National Amphetamine-Type Stimulant | Project STOP rolled out in QLD (Nov) |
<p>| 2006  |                                                                                  | Health (Drugs &amp; Poisons) Amendment Act Reschedules pseudoephedrine products in line with the NDPSC amendments to the SUSMP: the first stage was introduced in January &amp; the second stage in April Amendment of the Health Regulation (1996)(Qld) Section 277(1)(a) requirement for the production of a suitable photographic ID and pseudo sale made under the direct supervision of a pharmacist commenced (Jan) |                                                                                  |</p>
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<th>Date</th>
<th>Epidemic timeline</th>
<th>Federal policy responses</th>
<th>Queensland policy responses</th>
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<td></td>
<td>Highlights the increasing harms observed from using methamphetamine &amp; ice National Drug Strategy Household Survey (NDSHS): population use of methamphetamine increases from 5.5% (2004) to 16.4%</td>
<td>Federal government commits significant budget resources to the ‘ice epidemic’: $37.9 million to law enforcement; $1.1 million to the National Strategy to Prevent the Diversion of Precursor Chemicals; $22.9 million through the Amphetamine-Type Stimulant Treatment Grants Program; $9.2 million to expand the National Drugs Campaign to include a focus on ‘ice’. Federal government provides funding for the rollout of Project STOP nationally (Apr), rolls out nationally (Aug)</td>
<td></td>
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<td>2008</td>
<td>Degenhardt et al <em>The Epidemiology of Methamphetamine Use and Harm in Australia Drug &amp; Alcohol Review</em></td>
<td>The MCDS endorses the first National Amphetamine-Type Strategy National Strategy to Prevent the Diversion of Precursor Chemicals into Illicit Drug Manufacture (National Precursor Strategy) receives recurrent funding of $1.068 million National rollout of the Clandestine Laboratory Database (funded by the National Precursor Strategy)</td>
<td>Drugs Misuse Amendment Act (2008)(Qld) amends the Drugs Misuse Regulation (1989)(Qld) to make it mandatory for end user declarations to be forwarded to the Commissioner of police; and the possession of a combination of controlled ‘substances’ and ‘things’ is prohibited. (Jun) Clan lab seizures in Qld (2008-09), 148 (ACC)</td>
</tr>
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<td>2010</td>
<td></td>
<td>The use of Project STOP becomes mandatory in QLD,SA, WA, and the Territories – (Jul) (still voluntary in NSW &amp; VIC) Clan lab seizures in Qld, 297 (ACC)</td>
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THE EVALUATION PROBLEM – ESTABLISHING MACRO-MICRO IMPACTS

A number of evaluation issues emerge from the literature examining illicit drug policy. Roberts, et al. (2004) argue that it is hard to find solid evidence for a straightforward link between supply reduction initiatives and sustained falls in the consumption or availability of illegal drugs. Even where there is evidence of a fall in the use or availability of drugs, this will not necessarily be correlated to a reduction in drug-related harm (Roberts et al., 2004). A consistent theme that emerges from the literature is the lack of evaluation of supply side drug law enforcement (L. G. Mazerolle et al., 2007; Sutton & James, 1996; D. Weatherburn, Topp, Midford, & Allsopp, 2000). There is also a lack of focus on the measurement of impacts of the outcomes of interventions; instead, the emphasis is on evaluating program outputs (Willis et al., 2006). Furthermore, methamphetamine precursor chemical regulations are a new topic in drug law enforcement research (Cunningham & Liu, 2003a), and by implication so is the evaluation of these efforts. Law enforcement and health researchers often have opposing views and theoretical foci (James & Sutton, 2000) and there is a need for some integration of these differing perspectives in order for theoretical development to occur.

The third party policing partnership aimed at preventing the diversion of precursor chemicals in Queensland was rolled out through a series of legislative acts, in addition to the introduction of the electronic medical recording system known as Project STOP. Five relevant interventions that commenced within the time-frame of the study (2003–2009) were identified from the preceding review. Two are intervention points related to the introduction of Project STOP (first in Queensland and then rolled out nationally), the remaining three are time points when laws and/or regulations directly related to the prevention of diversion of precursors commenced in Queensland. They are as follows:

1. *Project STOP* rolled out in Queensland – November 2005;
2. *Stage 1* Pseudoephedrine reschedule (& the health regulation is amended to require photo ID) – January 2006;
3. *Stage 2* Pseudoephedrine reschedule April 2006;
4. *Project STOP* – national roll out – August 2007;

These five intervention points collectively represent the regulatory framework that was introduced in Queensland and will be referred to as the third party policing intervention, or ‘the intervention’. The evaluation issue is one of establishing macro-micro links between this intervention, and treatment admissions and drug user behaviour. Achieving this will require the development of a
theoretically driven evaluative frame that will allow the theoretical assessment of hypothesised causal mechanisms and the empirical testing of observed behavioural trends. These issues are addressed in the next chapter.
Chapter 4 Evaluating Drug Control Responses

Introduction

The thesis aims are twofold: first, to evaluate the overall effectiveness of a third party policing (TPP) intervention, and second, to develop and use a theory-driven evaluation framework, one that goes beyond the traditional drug supply and demand evaluation paradigm. I will use this framework to assess, in an innovative way, the range of mechanisms that influence changes in methamphetamine treatment seeking behaviour. The theoretical challenge is to integrate at times contradictory evidence on the issue of drug law enforcement (DLE) outcomes. Meeting this challenge requires an understanding of the current theoretical orientation of DLE evaluation and its shortcomings. In addition, consideration will be given to the evidence from epidemiological research that focuses on trends and patterns of drug use behaviour that highlight the sometimes unintended consequences of law enforcement interventions. Important omissions to these current approaches that could provide potentially useful insights can be drawn from sociological theory and criminology. Insights from each of these perspectives will be used to construct a theory-based evaluation framework. This framework will be applied in an empirical test of the impact of the macro level TPP intervention on micro level theoretically and empirically derived mechanisms in order to construct an impact theory.

The structure of this chapter is as follows. The next section will outline the supply/demand approach of DLE and its underlying theory, the prices/risks framework. Next I will briefly consider evidence that has emerged from epidemiological research on the impact of the sudden supply reduction in the heroin market on drug use behaviour and treatment outcomes in Australia. Then I will report on the only evaluation studies conducted to date on the impact of precursor controls in Australia. I will then introduce Coleman’s model of social science explanation and other work that has proposed a typology of mechanisms and applied them in way that allows the evaluator to ‘reconstruct’ the impact of an intervention (Peter Hedström & Swedberg, 1996; Stinchcombe, 1991; Vaessen & Leeuw, 2010). I will conclude with a specification of the research questions that will be examined using the context-mechanism-outcomes model from realist evaluation (Pawson & Tilley, 1994, 1997, 2006).
EVALUATING DRUG LAW ENFORCEMENT – THE PRICES AND RISKS PARADIGM

The dominant approach to evaluating DLE interventions is based on the rational (classical economic) model which is underpinned by the ‘price and risks’ theory of drug markets (Reuter & Kleiman, 1986). The causal mechanism linking macro measures with micro level outcomes is ‘price’ which is generally not measured well and available evidence shows it does not work well at accounting for unintended consequences (J.P. Caulkins & MacCoun, 2003).

One of the aims of drug law enforcement is to inflate the price of illicit drugs through the constraint of drug supply which is expected to drive a decrease in consumption (Moore, 1990). The theoretical relationship between drug consumption and retail price has promoted the use of retail price as a surrogate measure for consumption. Bright & Ritter (2010) examined retail price as a potential outcome measure for the effectiveness of law enforcement. The predictions regarding the relationship between law enforcement intensity and price are only partially supported by research. Explanations for the disconnect between the DLE activity and retail price include rapid adaptation by market players, enforcement swamping, assumptions of rational actors, short-run versus long-run effects, structure of the illicit market, simultaneous changes that affect price in perverse ways, the role of violence in markets, and data limitations (J.P. Caulkins, 2007; J.P. Caulkins & MacCoun, 2003; J.P. Caulkins & Reuter, 1998; Poret, 2002; Ritter, 2006). Bright & Ritter (2010) argue that researchers who use retail price as an outcome measure need to take into account the complex relationship between DLE interventions and the retail price of illicit drugs. Viable outcome measures which can be used as complements to retail price are worth investigation (Bright & Ritter, 2010): such investigation is one of the objectives of this thesis.

The development of the crime square re-imagined on the basis of the review in Chapter 2 implies that while useful, a focus on the prices and risks framework alone will not provide insights into other possible mechanisms of change, as illustrated in Chapter 2.

THE IMPACT OF HEROIN SUPPLY REDUCTION ON DRUG USE BEHAVIOUR

The Australian heroin shortage and the work examining its consequences has produced important knowledge about the effects of drug supply reductions on drug user behaviour (Darke, 2004; Day et al., 2006; Degenhardt & Day, 2006; Degenhardt, Day, Dietze, et al., 2005; Degenhardt, Day, & Hall, 2004; Longo et al., 2004). The available evidence has suggested that a significant reduction in heroin supply (whatever its cause) did increase drug prices and decrease purity and availability. In such situations, dependent heroin users changed their drug use patterns. This suggested that demand for
heroin is price-elastic, that is, heroin consumption and expenditure were reduced when the average price increased (D. Weatherburn, Jones, Freeman, & Makkai, 2003). The effects of the reduction in heroin use were modified by changes in the availability of other drugs (especially methamphetamine), increased treatment uptake and retention, and drug substitution (Degenhardt, Conroy, Day, Gilmour, & Hall, 2005; Roxburgh, Degenhardt, & Breen, 2004; Topp et al., 2003).

The changes in the Australian heroin market produced some public health benefits, most clearly and importantly substantially reduced opioid overdose deaths and, Degenhardt, Day, et al. (2007) argued, a reduction in injecting drug use and hepatitis C infections. They suggested that the public health benefits of the Australian heroin shortage needed to be interpreted in the context of harm and demand reduction initiatives that may have ameliorated its impact on heroin users. Deaths attributable to opioid overdose may have remained at the same level for four years post-shortage, but harms related to increased use of methamphetamine and people engaging in riskier patterns of injecting, offset decreases in harms (Degenhardt & Roxburgh, 2007).

These findings are consistent with what is known about the effects of supply and control of legal drugs such as alcohol (Degenhardt, Day, et al., 2007). Changing legal controls on the availability and cost (via changes in taxation) can significantly affect alcohol-related harm in communities. For example, limiting alcohol availability through reducing the number of outlets providing it is related to reduced harms; increasing taxation of alcohol is also related to reduced harm, presumably through consumption being suppressed via the price mechanism (Gibson, Day, & Degenhardt, 2005). The alcohol literature also suggests that some groups are less affected by changes in alcohol availability than others (Room et al., 2005), and this appears to have been the case with the Australian heroin shortage. In the case of the shortage, there were greater reductions in heroin related harms at the population level among younger age groups (Degenhardt, Day, Conroy, Gilmour, & Hall, 2005).

As discussed above, there was also clear documentation of increased risk and harm among more disadvantaged injecting drug users (IDU), some of whom switched to benzodiazepine injection, or heavy cocaine injection, and there were increased problems related to heavy and dependent methamphetamine use. The Australian experience also suggests that combining initiatives that aim to reduce supply, demand and harm can substantially reduce the harmful effects of injecting heroin use, and minimise the harms that result when some users switch to other drug use. Having said that, there was evidence that the shifts were difficult for treatment and harm reduction services to respond to quickly (Single & Rohl, 1997). The flexibility and responsiveness of such services needs to
be supported by sufficient and timely funding for alternative interventions, and the development of new methods for dealing with emerging drug problems among existing and new cohorts of drug users (Degenhardt & Day, 2006). This evidence reveals consistent patterns of drug substitution, with dependent users switching to methamphetamine injecting. So despite the well-established treatment and harm reduction modalities for heroin, harms due to methamphetamine use rose.

The reduction in heroin supply in Australia occurred in a setting in which harm reduction measures were well integrated with supply and demand reduction initiatives. Australia’s illicit drug policy includes both harm and demand reduction measures (Box & Jenkins, 1976) such as increasing treatment places for opioid dependence and providing ready access to needle and syringe programs. The benefits of the reduction in heroin supply in Australia therefore occurred against a background of harm and demand reduction initiatives that probably reduced the severity of some of the negative consequences of reduced heroin supply for IDU.

The finding that high-level law enforcement operations were a contributory cause of the Australian heroin shortage (Degenhardt, Reuter, et al., 2005) does not contradict other research documenting the negative effects that law enforcement activities directed at the lowest levels of the drug market may have on IDU (Kerr et al., 2005; Maher & Dixon, 1999). For example, there is good evidence that highly visible and aggressive police activity at the local level may well result in riskier, public, and hurried injecting, and may simply displace the drug market being targeted to a nearby area (Wood, Spittal, Small, Kerr, & et al., 2004). A contributory role of high level seizures is also not at odds with evidence that routine heroin seizures have little or no effect on street heroin prices, heroin use or heroin-related harm (D. Weatherburn & Lind, 1997; Wood et al., 2003). Thanks to disruption of large scale importation, heroin seized and thought to be destined for Australia during 2000 comprised perhaps 30% of the estimated annual heroin consumption (Degenhardt, Day, et al., 2004). This compares with 10% found in studies of the effects of routine seizures on heroin price and availability. In addition, key persons arrested in these operations came from the small number of centralised drug trafficking networks that controlled the heroin market.

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32 This assertion is not universally accepted. Another account asserts that the cause of the shortage were failures in opium production which resulted in a structural realignment in drug cartels in southeast Asia who shifted from supplying heroin to supplying methamphetamine to markets such as in Australia (Degenhardt, Reuter, Collins, & Hall, 2005)
Some important points arising from this evidence are that the level of drug market that is targeted for drug supply reduction efforts matters in terms of harmful consequences, the magnitude of the supply disruption is an important factor for the impact of supply reduction on price, and the type of drug being targeted is important. Heroin is a long established illicit drug in Australia and consequently health services have developed in response to the specific needs of dependent heroin users in treatment. While effective treatment modalities for methamphetamine dependence are emerging, dependent users are typically reluctant to seek treatment and perceive that existing treatment is not suitable (Degenhardt, Baker, & Maher, 2008)

**SUMMARY AND GAPS IN THE RESEARCH**

What do we know about precursor regulation within the context of drug supply control? The best evidence to date is from the United States and Canada and was reviewed in Chapter 3. (McKetin, 2009) have argued that the studies by Cunningham and colleagues represent the most compelling evidence to date that

> precursor regulations, or indeed any supply control strategy, can have significant impacts on the retail market for illicit drugs. This research is groundbreaking, in that it paves the way towards a more sophisticated analysis of how supply reduction interventions impact on harms from illicit drug use. (p. 455)

McKetin et al. (2011) argued in their systematic review of this evidence that the question for future research is ‘not so much whether precursor regulations work, but which regulations work best and in what context’ (p.11, emphasis added). The regulations examined by the studies covered different aspects of precursor diversion (i.e. import, wholesale and retail levels) often coinciding with broader drug control laws that were tailored to local trends in drug manufacture. They conclude by stating that precursor regulations can reduce indicators of supply and use of methamphetamine but their impact is contingent upon the context in which they are implemented and I would argue, in addition, the context of the drug user as well.

There a number of gaps in the research that this thesis seeks to address. The first is theoretical: Cunningham (et al. 2008) stopped short of developing a causal account of the impact of precursor regulations. My aim is to build on this work and, using a systems approach based on my model of drug use behaviour (see Figure 4.2: An Explanatory Model of Drug Use Behaviour) and, by integrating social science theories and research evidence, identify possible mechanisms that could account for the impacts of drug supply suppression on drug use behaviour. Another gap relates to
the type of evaluation that is conducted: Evaluation based on rational choice theories of behaviour change and micro economic supply/demand cost-benefit analysis are inadequate for evaluating non-conforming behaviour – how do we account for those dependent users who do not act as expected? The other important limitation of the economic research available is that the explanandum is at the micro-individual level and thus cannot illuminate broader societal structures and processes (Bunge, 1997; Bunge, 2000a). Another limitation of the available research is the lack of evaluation of crime prevention interventions and the integration of findings across policy areas. With regards to drug policy for example, drug law enforcement and drug treatment are two policy pillars that are typically examined separately. Indeed Cunningham (et al, 2008) argued for the integration of law enforcement and health in drug policy because of the impact they found from law enforcement interventions on treatment.

Evaluation research needs to be able to deal with the ‘black box’ problem in order to unpack the complex causal processes that link the macro level of policy implementation to the micro level of effect at the individual level. This research, therefore, needs to go beyond establishing statistical association or intervening variable analysis. The analysis needs to propose and explore underlying mechanisms in order to develop an explanation of the impact.

**Theory-Based Evaluation**

The objective of the rest of this chapter is to develop a theory driven evaluation framework. The rationale for using this type of framework is outlined in the next section and highlights the need to use theoretical thinking to account for what happens between program outputs and outcomes: the evaluation ‘black box’. This is followed by a brief discussion of the criminological perspective I use as the theoretical foundation of the evaluation framework that I will then develop in the third section. The central aim of the thesis is to focus on developing and using a theory-driven evaluation framework to assess, in an innovative way, the range of mechanisms that influence changes in methamphetamine treatment seeking behaviour. I propose to achieve this aim by creating a framework that integrates two approaches. First, I will examine James S. Coleman’s model of general social science explanation which decomposes macro-macro analysis into a macro-micro-micro-macro explanation (Coleman, 1986, 1990). Vaessen & Leeuw (2010) present an evaluation approach that builds on Coleman’s model and on Hedström and Swedburg’s typology of mechanisms. Vaessen & Leeuw call their approach ‘reconstructing the impact’ and it is based on the decomposition of the macro–macro association via a series of mechanisms. The second approach is Pawson & Tilley’s (1997) realistic evaluation perspective, specifically their CMO (context-mechanism-
outcome) configuration. I will apply the typology of mechanisms to the CMO framework in order to then propose my research questions.

**Rationale for Theory-Based Evaluation**

Evaluation began in the 1950s and 60s in the United States with the introduction of the ‘War on Poverty’, and ever since then evaluation has ‘been plagued with the “black box”’ problem (Stame, 2004). The black box is traditionally the space between the actual input and the expected output of a programme. In the case of my investigation the black box is the space between the output (*Project STOP*) and treatment outcomes. Method driven approaches typically focus on measuring outputs and outcomes by observing changes in the outcome (Y) and attributing change to the output (X). What is missing is an understanding of the processes or mechanisms that explain how X ‘caused’ Y. Mainstream evaluation has been critiqued for its focus on developing methodology for verifying the internal validity (reliability) and external validity (generalisability) of programmes to the detriment of developing theoretical implications of programmes. I will be using a quasi-experimental method and so will address these important issues in addition to focusing upon the need for causal explanation.

Alternatives to the so-called ‘method-driven’ approach were developed and are grouped together as ‘theory-driven’ evaluation, notably Chen and Rossi (1989), who first flagged the notion of theory driven evaluation and whose main tenet was that black box evaluations were such because they had ‘no theory’. Theory-driven evaluations should provide good social science theory (Chen & Rossi, 1989). The framework I am proposing will integrate the strength of a quasi-experimental design with the insights of a theory-driven approach in order to answer ‘how’ and ‘why’ the intervention works or not. A characteristic of theory-based evaluation is using substantive theory from social science and applying it in an evaluation context. I will draw on sociological and criminological theories and empirical research, and propose mechanisms which can then be empirically tested.

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[^33]: I am concerned with the issue of integrating the sometimes criticised, ‘gold standard’ approach of the Campbell Collaboration with concerns for the need to develop causal explanation (Hough, 2010; Lipsey, Petrie, Weisburd, & Gottfredson, 2006; van der Knaap et al., 2008; Weisburd, 2010; Wilson, 2006). This is an ongoing research interest of mine and this thesis represents a beginning.
using the context-mechanism-outcome configuration (CMOC) approach (Pawson & Tilley, 1994; Stame, 2004, 2010).

A beginning point for addressing the research problem is to look at Left Realist criminology, which theorised how crime emerges through an action-reaction model of macro-micro ‘actors’.

**LEFT REALIST CRIMINOLOGY: THE CRIME SQUARE**

I introduced the crime square in Chapter 2 and will it summarise here. Left Realism emerged in the 1980s in the United Kingdom in response to conditions in which criminality and other social problems facing the working class were worsening. The contribution of Left Realism was the development of a framework in which crime (the outcome) is analysed in terms of the interaction of four key factors: the state, social structure, offenders and victims (see Figure 4.1, Lea, 1991). The relations between the components of the square were framed as relations of ‘action’ and ‘reaction’ in which the state and the system of social control are structures which ‘react’ to the ‘action’ of offenders and victims by redefining their activities, devoting resources to their containment and thereby playing an active role in the ‘production’ of the final level of crime in society.

![Figure 4.1: The Crime Square](image)

The dynamics between the state, society, victim and offender were reviewed in Chapter 2. In that chapter I presented my theoretical model of drug use behaviour and used it to structure my historical review of the development of drug use behaviour as a social problem and the drug control
policies introduced to ameliorate the problem. I created the model by transposing the components of the crime square into an explanatory model I could use to frame my review of drug use and drug control where the ‘offender’ was replaced by the ‘drug market’ and the victim was replaced by the ‘dependent drug user’, which then yielded the model depicted in Figure 4.2.

Applying this frame to what I have already reviewed yields an ‘action-reaction’ model of drug use behaviour. Drug use behaviour is generated not just by the interplay of these four factors, but as social relationships between each point of the square. The social context of drug use consists of the immediate social interaction of these four elements and the setting of each of them within the wider social structure; namely drug prohibition in a harm minimisation environment.

Figure 4.2: An Explanatory Model of Drug Use Behaviour
The crime square and my model of drug use behaviour embed individual behaviour in a complex social system. This model is explanatory (causal) in the sense that it is based on an emergent theory of causation\(^{34}\). In developing this model I draw on the work of Mario Bunge, a philosopher of science who argues for the superiority of systems theorising over individualist (for example classic micro-economic theory) and holistic (grand-) theorising. The philosophy of science underpinning Left Realism in criminology is scientific realism (Archer et al., 1998; Bhaksar, 2008) and it also underpins the realist evaluation perspective I utilise in my impact evaluation. I briefly outline the assumptions of this approach in the next section. It forms the basis of the (meta-) theoretical evaluation approach I am adopting.

**Coleman’s Social Mechanisms**

Coleman’s work on social mechanisms grew out of his critique of the grand theorising of Talcott Parsons, that is, Talcott’s lack of a theory of purposive social action (Coleman, 1986). Although Coleman refers to himself as a methodological individualist, an examination of his model of social science explanation seen in Figure 4.3 (Abell, Felin, & Foss, 2008, p. 491) demonstrates that he is a systems theorist (Bunge, 2000a). Coleman’s theory of social mechanisms essentially decomposes the macro-macro relationship (arrow 4 in Figure 4.3) into a macro-micro (arrow 1), micro-micro (arrow 2) and micro-macro (arrow 4) explanation. In other words, ‘each change in the “macro” environment can be logically related to individual reactions, which in turn are connected to collective outcomes’, (Vaessen & Leeuw, 2010, p. 153). The essential element lacking in macro-macro analyses is a theory of action, that is, statistical association is an inadequate basis for the development of a causal explanation. Coleman’s model captures how to conceptualise social action.

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\(^{34}\) ‘Emergent causation’ is a concept from scientific realism which emerged from a tradition of thought in philosophy of science and entreats social scientists to ‘identify the entities that possess [emergent causal powers] and the mechanisms that produce them’ (Elder-Vass, pp. 8-9). Scientific realism provides a critique of many positivist assumptions, in particular, scientific realists have rejected the assumption that all scientific knowledge takes the form of empirical regularities; the assumption that the ultimate goal of scientific research is the formulation of law-like generalizations; and, to some extent, the assumption that the hypothetico-deductive model is the unavoidable foundation of empirical reasoning in the sciences (Archer, Bhaskar, Collier, Lawson, & Lorrie, 1998; Bhaksar, 2008). Mario Bunge argues that scientific realism is an appropriate methodology for the social sciences (Bunge, 1999). This particular branch of the philosophy of science underpins the ontology and epistemology that I adopt, it is compatible with the social mechanisms approach of Hedström & Swedberg (1996) and underpins both left realist criminology (Young, 1997) and realistic evaluation (Pawson & Tilley, 1997).
Systems consist of composition and structure (the set of ties, or relationships among the components of the system), and developing an understanding of a system requires knowledge about both; that is, embedding individual behaviour in its social matrix (Bunge, 2000b). The failure of methodological individualism – that explanation can be derived by studying composition and not structures – as argued by Bunge has an important consequence for scientific explanation. According to the positivist model of scientific explanation, to explain a fact is to show that it fits a pattern: in other words they develop law-like statements. On the other hand, he argues that scientists do not call this an explanation:

*they want to know how things work, that is, what makes them tick. This accounts for their preference for laws that sketch some mechanism ... for the occurrence of the fact to be explained. (Bunge, 2000b, p. 395)*

Causality is different from that typically assumed in positivist science; whereby a change in Y is assumed to be caused by X (net of covarying confounding variables). In a systems approach ‘systems have systematic (emergent) features that their components lack’ (Bunge, 2000a)

Vaessen & Leeuw (2010) are concerned with how social science theory and evaluation could be brought together. They provide a concrete example of how by integrating Coleman’s model of social science explanation (Coleman, 1986) and Hedström and Swedburg’s (1996) work outlining a typology of mechanisms, and developed an approach they call ‘reconstructing the impact’. Impact
theory is concerned with the set of assumptions on how outputs induce processes of change that lead to certain impacts (Vaessen & Leeuw, 2010).

They outline a classic impact evaluation problem, that is, how an intervention can lead to collective outcomes. Interventions all aim at some particular change at the aggregate level and looking for mere statistical association between the policy intervention and a collective outcome (e.g. prevalence) is inadequate for making inferences about the effectiveness of the intervention. The potential complexity of causal processes between an intervention and outcomes highlights the importance of constructing an explanatory model. Coleman’s model of social mechanisms rests on the decomposition of macro-macro relationships into a macro-micro, a micro-micro, and a micro-macro explanation. Put simply, each change in the ‘macro’ environment can be logically related to individual reactions, which in turn are connected to collective outcomes (Vaessen & Leeuw, 2010).

Coleman’s model was aimed at providing a means of explaining how changes in social phenomena can lead to changes in collective social behaviour. Vaessen & Leeuw (2010) broaden Coleman’s structure of an explanatory model that meaningfully connects macro-sociological events to collective social outcomes, to one that can further understanding of causal relationships between any type of policy change at any level of environment and collective outcomes. The core of the social mechanisms model is based on three types of mechanisms (see Figure 4.6 below, Vaessen & Leeuw, 2010, p. 155).

**A Typology of Mechanisms**

Developing a causal explanation based on ‘emergence’ requires postulating mechanisms that are assumed to have generated the relationship. An explanation is obtained by hypothesising the underlying generative mechanisms that link one event with another, and in social science ‘actions’ constitute that link (Peter Hedström & Swedberg, 1996; P. Hedström & Ylikoski, 2010). Hedström & Swedberg (1996) note that explanatory mechanisms are typically unobserved and only observable in their *effects*, that is, patterns of outcomes. Coleman’s model offers a way of conceptualising how macro-level events or conditions affect the individual (mechanism 1), how the individual assimilates the impact of these macro-level events at the micro level (mechanism 2), and how a number of individuals, by their actions and interactions generate macro-level outcomes (mechanism 3) (Peter Hedström & Swedberg, 1996). I briefly describe each mechanism below.
1 Situational Mechanism (‘macro-micro’)

A situational mechanism captures the macro-micro transition of how a change in the environment affects the beliefs, desires or opportunity structures of individuals (Peter Hedström & Swedberg, 1996). The environment in the evaluation context is operationalised as the introduction of an intervention designed to interrupt the supply of drugs. The general social mechanism at work here is ‘general deterrence’, which operates to prevent the diversion of precursors to the illicit market for the manufacture and supply of methamphetamine. The opportunity structure in this study is the illicit drug market.

2 Action-Formation Mechanism (‘micro-micro’)

An action-formation mechanism shows how a specific combination of beliefs and opportunities (including a change in the policy environment) triggers individual action (Peter Hedström & Swedberg, 1996; Vaessen & Leeuw, 2010). Some types of action-formation mechanisms include shared norms of reciprocity in a community which encourages individuals to share information and resources (Coleman, 1990). ‘Discounting’ and ‘cognitive dissonance’ are general decision theories and are different examples of types of action-theories (Peter Hedström & Swedberg, 1996). In our case, a drug market provides the opportunity structure for individuals to procure an illicit drug. Market mechanisms operate at this micro level to block the opportunity to consume illicit drugs through the increase of prices and decreases in purity (J.P. Caulkins & Reuter, 1998; Pacula & Chaloupka, 2001).

3 Transformational Mechanism (‘micro-macro’)

This mechanism offers an explanation of how changes in individual behaviour translate into collective outcomes. An explanation of these micro-macro processes starts with an understanding of how people are linked together (e.g. through the illicit drug market). The action-formation mechanisms operate to constrain the supply of drugs in a market. A drug market is a collective of individuals who interact to buy and sell and this ‘action opportunity’ triggers specific behavioural adaptations to changes in price and/or purity. These behavioural adaptations translate into

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35 In the context of the discussion here situational mechanism refers to how a change in the environment (macro level) affects the opportunity structure of the individual. It does not refer to situational crime prevention which is another theoretical frame that I do not deal with here.
observable changes in the aggregate outcome, demand for drug treatment, and will be discussed further below.

Figure 4.4: Typology of Mechanisms

I will transpose this typology of mechanisms into the context-mechanism-outcomes (CMO) framework proposed by Pawson & Tilley (1997) and discuss below.

**Realistic Evaluation**

Realistic evaluation is based on realist philosophy of social science. Pawson & Tilley’s (1997) seminal text *Realistic Evaluation* addresses the ‘black box’ issue through the development of the context-mechanism-outcome (CMO) approach to evaluation. Bunge (1997) argues that three types of scientific hypothesis or theory can be distinguished with regard to explanatory power. First is ‘black box’ theory, which is descriptive or phenomenological and answers ‘What is it?’ This type of theory interrelates two types of variables; inputs and outputs. Second is ‘gray box’ theory, which is semi-phenomenological or ‘semitranslucent’ and can answer ‘shallow questions’ such as ‘how does it
work?’ Typically, this type of analysis introduces intervening variables without describing causal mechanisms. Third is ‘translucent box’ or mechanistic theory, which answers in detail ‘How does it work?’ Examples of ‘translucent box’ or what (Bunge, 1997) terms ‘deep’ theory are: Merton’s theory of ‘self-fulfilling prophecy’; James Coleman’s theory of ‘network diffusion’; and Mark Granovetter’s theory of ‘threshold behaviour’ (see Peter Hedström & Swedberg, 1996 for details).

Pawson & Tilley’s (1997) ‘realistic evaluation’ approach stresses what the components of good programme theory should be a context (C) and mechanism (M), which account for outcome (O). Causal outcomes follow from mechanisms acting in contexts (Figure 4.5). It is the mechanism that does the explanatory work; that is, an action (intervention) is causal only if its outcome is triggered by a mechanism acting in context (Pawson & Tilley, 1994, p. 58). Realist evaluation is about testing propositions that bring together mechanism variation and context variation that explain outcome pattern variation, thus producing context-mechanism-outcome pattern configurations (CMOCs). These configurations are models that indicate how interventions activate mechanisms, among whom, and in what conditions to bring about changes in behaviour, and realist evaluation develops and tests CMOC conjectures empirically (Pawson & Tilley, 2006).

Figure 4.5: Pawson & Tilley’s CMO Configuration
**Mechanisms**

Mechanisms describe what it is about the intervention that brings about any effects. In other words, an intervention mechanism is the *process*, (the ‘transformational mechanism’) of *how* the individual acts in response to the intervention (the ‘situational mechanism’) impact on their opportunity structure (‘action formation’ mechanism). It is important to distinguish the intervention from the behavioural action that is triggered by the change. Hence the applications of the typology of mechanisms which enable me to capture some of the complexity of processes lie between the programme output and the outcomes. Thus an intervention may trigger different mechanisms, and interventions can trigger intended and unintended outcomes. The mechanisms hypothesised in this study are presented below.

**Deterrence**

Behavioural adaptation that conforms to societal expectations of deterrence and desistence in the face of an interruption of drug supply is conceptualised as ‘rational’. Rational choice theory maintains that the individual will always choose to maximise the utility benefit of their choices, unless risks and disincentives operate. A related theoretical concept is ‘desistance’ which is understood as a causal process which supports the eventual cessation of criminal behaviour, (including illicit drug use) (Laub & Sampson, 2001). In the context of changes in drug markets, the user may be encouraged to seek treatment which then supports the process of desistance from illicit drug use. In the context of this study, desistance or exiting the drug market is viewed as a desirable adaptation.

**Deviant Adaptation**

Accounting for the possible non-conforming behaviour of dependent drug users is an important focus of this research because the *unintended* consequences of supply reduction efforts are conceptualised as drug-related harm\(^{36}\) and have negative implications for society (in the form of

\(^{36}\) Drug related harm is conceptualised as either ‘macro harms’ or ‘micro harms’. Macro-level harm is defined as the harm done to society by the drug user’s pursuit of their lifestyle, namely crime, including offences against the person (violence), offences against property (e.g.) and public disorder offences. Micro-level harm refers to the harm the individual does to themselves through their behaviour (e.g. acquiring blood borne viruses, developing mental health issues, social and economic marginalisation through a loss of ability to

Footnote continues next page
crime) and the individuals’ health and wellbeing. Merton’s typology of individual adaptation offers possible mechanisms for non-conforming drug user behaviour (Vold, Bernard, & Snipes, 1998). The way in which these ‘transformational mechanisms’ would operate in this context would be through the frustration (or ‘strain’) that a drug dependent individual may experience if the opportunity structure through which they meet their goal of attaining drugs is blocked. The action formation mechanism is supply suppression, diminished availability and increased price. In the face of blocked opportunity the individual may adapt their behaviour by substituting drugs (Smithson, McFadden, Mwesigye, & Casey, 2004), adopting more efficient means of administering the drug (e.g. transitioning to injecting drug use) (Westermeyer, 1976), committing crime or finding other means to fund their habit (J. P. Caulkins, Dworak, Feichtinger, & Tragler, 2000); or the market (suppliers) may adapt by finding other sources of supply of precursor chemicals or the drug (Australian Crime Commission, 2012).

**CONTEXT**

An important question raised in McKetin et al. (2011) systematic review of the impact of precursor regulations on methamphetamine outcome indicators was ‘when does it work and for whom’. This is of crucial concern to realistic evaluation which assumes that program mechanisms will be activated only under particular circumstances. Pawson & Tilley (1997) refer to this as programme contexts. They explain that context should not be confused with locality and that depending on the intervention, what is contextually important may relate not only to place but to a range of factors including systems of social and interpersonal relationships, individual attributes, and even biology and technology (Pawson & Tilley, 2006). Contexts both enable and constrain the capacities of the individual and the discussion in Chapter 2 about drug dependence and the consequences of harmful practices, particularly injecting drug use, is especially relevant. The contexts of the drug user that were able to be measured using the available data are modes of administration of methamphetamine, that is, injecting, smoking or ingesting. In addition there were two measures of treatment outcome that are indicative of different drug user contexts; they are treatment compliance and non-compliance.

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function in society, i.e. Unemployment, and engaging in criminal behaviour which can lead to contact with the criminal justice system and stigmatisation through a criminal record). These factors together constitute what is referred to as a ‘risk environment’ (refs).
OUTCOME PATTERNS

The unit of analysis of the evaluation is ‘closed treatment episode’[^37], which is the operationalisation of the social process of ‘help seeking behaviour’ or drug treatment demand. The intervention was introduced within the multiple contexts of the drug user (based on their method of drug administration and degree of compliance with treatment). Thus the mechanisms (of ‘specific deterrence’ and ‘deviant adaptation’) triggered by the intervention will vary and will do so according to different conditions (Pawson & Tilley, 2006). The different conditions in this case are the five different interventions that together constitute Project STOP and include the two stages of rescheduling of precursor medicines; the rollout of the electronic medication recording system at the state and then the national level; and regulatory changes in the health legislation controlling the dispensing of pharmacy only medicine, and in the criminal law which made reporting details of the sales of precursors mandatory.

The outcomes of this evaluation are the different forms of impact that will be tested for using interrupted time-series analysis (ITSA). In all, there will be six potential forms of outcomes that can be observed from the impact assessment: an abrupt permanent increase or decrease in treatment demand, a gradual permanent increase or decrease, or an abrupt temporary increase or decrease. Thus there will be many potential outcome patterns because of the relevant variations in context and the mechanisms that are activated. Pawson & Tilley (2006) note that any programme:

> is liable to have mixed outcome-patterns. Outcome-patterns comprise the intended and unintended consequences of programmes, resulting from the activation of different mechanisms in different contexts. This notion of outcome-patterns allows for a more sensitive evaluation of complex programmes. (pp.7–8)

[^37]: Closed treatment episode is defined and discussed in detail in Chapter 5, below.
Research Questions

Figure 4.2 (above) is a graphic representation of the way the macro and micro elements drawn from the crime square are related. At the macro level there is civil society (the social context) and the state (the policy pillar of law enforcement), and at the micro level is the methamphetamine market and the drug user. This research only evaluates one dynamic between these four players, that is, between law enforcement and the drug user (treatment seeking). The preceding discussion addressed the issue of how to evaluate a drug control measure (specifically a third party policy intervention) in a way that goes beyond the narrow question of ‘does it work or not’? I discussed the way in which DLE is typically evaluated through the lens of either the micro-economic ‘prices and risks’ framework, or through the analysis of indicator data by epidemiological researchers.

In this survey of the extant research literature I argued that what is missing is evaluation that is aimed at developing and using a theory-drive framework to assess the impact of supply side DLE. I then discussed how I propose to achieve this evaluation objective through the revision and application of the ‘crime square’ as my theoretical frame, by applying Pawson & Tilley’s CMO approach to identifying ‘mechanisms’ and using Vaessen & Leeuw’s (2010) extension of Coleman’s typology of mechanisms in order to develop my own impact theory. I will use these devices: the causal model of drug use behaviour, the CMO evaluation approach, along with the application of Coleman’s typology of mechanisms, to demonstrate the range of mechanisms that influence changes in methamphetamine treatment seeking behaviour. The research questions are:

1. Did the TPP intervention impact on methamphetamine treatment seeking behaviour?
2. How did the TPP intervention impact on methamphetamine treatment seeking behaviour?
   a. What kind of impact did the TPP intervention have on treatment seeking behaviour?
      That is, was the impact abrupt or gradual, and was its duration temporary or permanent?
   b. Did the TPP intervention impact on treatment seeking behaviour for other drug types? Is there counterfactual evidence that the TPP intervention effect was due to other secular or system-wide factors?
   c. Did the TPP intervention impact diversion of drug users into treatment? That is, did the TPP intervention influence criminal justice system responses to methamphetamine users?
3. What are the mechanisms that link the macro level TPP intervention to observed changes in methamphetamine treatment seeking behaviour?
   a. How can these mechanisms be conceptualised?
   b. How are these mechanisms observed in the data?

The next chapter outlines the methods, data and analytic strategy I use to answer these questions.
Chapter 5 METHODS

INTRODUCTION

The first aim of this thesis is to evaluate the overall effectiveness of a TPP intervention. The second aim is to develop and use a theory-driven evaluation framework – that goes beyond the traditional drug supply/demand evaluation paradigm – to assess, in an innovative way, the range of mechanisms that influence changes in methamphetamine treatment seeking behaviour. A key aspect of this research was the examination of the relationship of one of the pillars of Australian drug policy namely, drug law enforcement activities and policies, to drug user behaviour. The regulation of precursors and the roll out of Project STOP in Queensland, Australia is aimed at preventing the diversion of pseudoephedrine to the illicit market for manufacture into the illicit amphetamines type substances.

My research questions are:

1. Did the TPP intervention impact on methamphetamine treatment seeking behaviour?
2. How did the TPP intervention impact on methamphetamine treatment seeking behaviour?
   a. What kind of impact did the TPP intervention have on treatment seeking behaviour?
      That is, was the impact abrupt or gradual, and was its duration temporary or permanent?
   b. Did the TPP intervention impact on treatment seeking behaviour for other drug types? Is there counterfactual evidence that the TPP intervention effect was due to other secular or system-wide factors?
   c. Did the TPP intervention impact diversion of drug users into treatment? That is, did the TPP intervention influence criminal justice system responses to methamphetamine users?
3. What are the mechanisms that link the macro level TPP intervention to observed changes in methamphetamine treatment seeking behaviour?
   a. How can these mechanisms be conceptualised?
   b. How are these mechanisms observed in the data?
Conducting an impact analysis requires the ability to establish a causal connection between the intervention and the outcome(s). The ‘gold standard’ for this approach is the experiment (Shadish et al., 2002). Evaluating a policy intervention where I had no control over implementation meant that the conditions of a true experiment could not be met. In this case a quasi-experiment was chosen. Among the various quasi-experimental designs is one that rivals the true experiment: the interrupted time-series design, which has become the standard method of causal analysis in applied behavioural research (Glass, 1997). Conducting a quasi-experimental interrupted time-series analysis meant locating appropriate data collected for a long enough period and at as small as possible time periods (e.g. weekly or monthly). These were key criteria I considered when deciding which data would best enable a robust impact evaluation.

The next section provides a brief overview of the different indicator data available for the research in Australia and the rationale for selecting the Alcohol and Other Drug Treatment Services National Minimum Data Set (AODTS-NMDS). This is followed by a detailed description of that data, the unit of analysis and the indicator variables I constructed for use in the impact analysis. The final section outlines the statistical procedures used to analyse the data, and the chapter concludes with a description of the analytic strategy.

**Indicator Data**

A core research objective of this thesis was to measure the impact of a drug control intervention (precursor regulation and Project STOP) on drug use behaviour. Evaluations of the impact of drug law enforcement interventions typically focus on the effects of interventions on the illicit drug market through measures such as seizures, arrests, and drug purity, availability and price (Willis, Anderson, & Homel, 2011). Public health focused research utilises administrative data such as hospital morbidity and mortality statistics, drug treatment episodes, population and household surveys, as well as specialist drug user and other specialist surveys. Table 5.1 presents the main sources of these data and some of the indicators that are used in research to monitor the illicit drug market and drug use trends (for a discussion of these outcomes as measures of DLE performance see

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38 True experiments satisfy three conditions: the experimenter sets up two or more conditions whose effects are to be evaluated subsequently; persons or groups of persons are then assigned strictly at random, to the conditions; the eventual differences between the conditions on the measure of effect are compared with differences of chance or random magnitude (Shadish, Cook, & Campbell, 2002).
Each of these data sources has strengths and limitations and deciding which one to use to examine the research question required me to assess the relative merits of each. Precursor regulation is a supply side measure within the pillar of drug law enforcement and while its impact on the illicit drug market is important, my interest here is: what was the impact of this intervention on drug user behaviour? Thus, I did not consider using data sources that measured changes in drug markets and drug-related crime (see Table 5.1); I instead considered various health related data sources. The health and drug use related data collections presented in Table 5.1 are part of the range of illicit drug monitoring systems in place that are designed to detect emerging drug trends (e.g. the Illicit Drug Reporting System (IDRS)) as well as those that monitor longer term trends within a broader community context (e.g. the National Drug Strategy Household Survey (NDSHS)). There are also a range of routine data collections in Australia that record longer term trends in illicit drug use, including ambulance callouts to overdoses, emergency room presentations, presentations for drug treatment (the Alcohol and other Drug Treatment Services data collected as part of the National Minimum Dataset (NMDS)) and illicit drug related hospital separations (the National Hospital Morbidity Database (NHMD)). These routine data sources provide the context within which emerging drug trends can best be understood (Shand, Topp, Darke, Makkai, & Griffiths, 2003), and accordingly, they are useful for the comprehensive surveillance of illicit drug-related harms in Australia.

The data sources in Table 5.1 were categorised in terms of the types of outcomes they measured. Broadly speaking, the outcomes were divided into treatment, harm minimisation, consumption and drug use patterns, and the illicit drug market. The corresponding indicators that were available to measure these outcomes are summarised. As the aim of the research was to measure the impact of DLE on drug user behaviour, the data sources I considered narrowed to the AODTS-NMDS, DUMA, the NDSHS and IDRS. Both the Illicit Drug Reporting System and the National Drug Strategy Household Survey data were discounted as the frequency of measurement was annual (IDRS) or every three to four years (NDSHS). The DUMA data are collected quarterly, however, it is collected in only two sites in Queensland (the capital city Brisbane and Southport on the Gold Coast) and the sample is purposive and small. The national minimum data set of the Alcohol and Other Drug Treatment Services data is a comprehensive collection that began in 2002/03, and it is administrative data that is collected monthly from the population of those seeking help for their use of all drug types.
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</tr>
<tr>
<td></td>
<td>Drug treatment outcome – ‘compliance with treatment’</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>psycho-stimulants, T436 Mental and behavioural disorders due to use of</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>stimulants, F150-F155</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trends in drug-related emergency department presentations</td>
<td>Number of drug-related emergency department presentations by drug type</td>
<td>State/Territory</td>
<td>Monthly</td>
<td>State</td>
</tr>
<tr>
<td>Mortality</td>
<td>Number of drug-related deaths by drug type</td>
<td>health agencies</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ABS Causes of death</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumption &amp; drug use patterns: Trends in the pattern and frequency of</td>
<td>Number of people who used amphetamines &amp; other drug types in the past</td>
<td>DUMA (persons in</td>
<td>Quarterly</td>
<td>Selected cities</td>
</tr>
<tr>
<td>illicit drugs consumed by drug type</td>
<td>month, (including frequency &amp; route of administration of drugs).</td>
<td>police custody)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>IDRS</td>
<td>Annual</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>NDSHS</td>
<td>Tri-Annual</td>
<td></td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Perceived purity, availability &amp; median street price of illicit drugs</td>
<td>Number of illicit drug traffic/supply arrests by drug type</td>
<td>Law enforcement</td>
<td>Monthly</td>
<td>States &amp; Territories</td>
</tr>
<tr>
<td></td>
<td>Number of illicit drug possession/use arrests by drug type</td>
<td>databases</td>
<td></td>
<td>States, National</td>
</tr>
<tr>
<td></td>
<td>Collation of a number of data sources (including customs and various law</td>
<td>ACC Illicit Drug</td>
<td>Annual</td>
<td></td>
</tr>
<tr>
<td></td>
<td>enforcement) to provide a snapshot of the illicit drug market for all</td>
<td>Drug Data Report</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>drug types across all States and Territories. In add to arrest data,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>number of clan lab detections, average median weight of illicit drug</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>seizures, price and purity by drug type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Survey items asking sentinel drug population their perception on drug</td>
<td>IDRS</td>
<td>Annual</td>
<td>Selected cities</td>
</tr>
<tr>
<td></td>
<td>purity, availability and price</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes on Abbreviations: AODT-NMDS: Alcohol & Other Drugs Treatment Services-National Minimum Data Set
NHMDS: National Hospital Morbidity Database
ABS: Australian Bureau of Statistics
ACC: Australian Crime Commission
DUMA: Drug Use Monitoring in Australia
IDRS: Illicit Drug Reporting System
NDSHS: National Drug Strategy Household Survey
I chose to use the AODTS-NMDS for a number of reasons. First, the NMDS was available as de-identified monthly counts and amenable to interrupted time-series analysis, which is an appropriate and useful method for measuring the impact of a policy intervention (Gilmour, Degenhardt, Hall, & Day, 2006; Rehm & Gmel, 2001). Second, utilising drug treatment data allowed me to focus the research theoretically on the impact of one pillar of drug policy (law enforcement) on another (treatment). Third, the data set contains within it a number of indicators relevant to the assessment of a drug policy intervention on drug user behaviour, for example, trends in treatment demand, changes in drug user behaviour (i.e. drug-substitution and routes of administration) as well as trends in treatment compliance. The key limitations of the data are that it is administrative and thus the quality of the items collected may be flawed.

Drug treatment data is considered a leading indicator of drug abuse in the community and contributes to understanding trends and patterns of drug dependency, which can increase our understanding of the nature and extent of the problem (Donmall, 2006). In sum, in utilising this routinely and systematically collected data as an epidemiological tool, I have the opportunity to evaluate the influence of supply-side drug law enforcement partnerships on the drug use patterns and help-seeking trends of a difficult to access population (Stauffacher, 2002). I turn now to a detailed description of the data and the indicators used in the analysis of the impact of Project STOP.

**The AODTS-NMDS**

The Alcohol and Other Drug Treatment Services-National Minimum Data Set (AODTS-NMDS) is an administrative repository collated from information that is routinely collected by treatment providers in the various states and territories. The Australian Institute of Health and Welfare (AIHW) administers this data and I applied for access to de-identified unit record data from Queensland and Victoria for as far back as 2001/02 (Australian Institute of Health and Welfare, 2008, 2010a).

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39 I was required to submit an ethics application to the AIHW and obtain ethics clearance from my research institution, Griffith University for the conduct of this research.

40 This data was requested as part of a broader project which compared the regulatory framework in Queensland with Victoria, which has a voluntary (and thus not a third party) policing partnership. Initial
Access to this data is only provided under strict conditions and the AIHW ethics committee ensures that each data access request is assessed on a case by case basis to ensure that client confidentiality will not be breached by the provision of the requested data\(^4\). (Australian Institute of Health and Welfare, 2008, p. 130).

The initial application was made in 2008 (for the collection from 2002/03 to 2006/07) and was followed with another in 2011 for the years 2007/08 to 2008/09 (see the ‘Letter of Approval’ in Appendix B). The Australian Institute of Health and Welfare provided ‘Confidentialised Unit Record Data’ from the NMDS for the years 2002/03 to 2008/09 and the documentation they provided for the release of that data is included in Appendix B.

**BACKGROUND TO THE COLLECTION**

In 1995, the Alcohol and other Drugs Council of Australia (ADCA) held a national forum *Treatment and services: where to from here?* The forum was attended by clinicians, researchers and government administrators and there was agreement that a lack of comparable national data for the Alcohol and Other Drugs Treatment Services (AODTS) sector was limiting the overall effectiveness of service provision (Australian Institute of Health and Welfare, 2007). The outcome was the development of a national minimum data set (NMDS) for AODTS.

The AODTS-NMDS became a national project of the Intergovernmental Committee on Drugs (IGCD). The Australian Institute of Health and Welfare (AIHW) was given the role of co-ordinating the project analyses revealed that there was no impact of *Project STOP* Victoria and while this was an important finding, I am focused on Queensland as a case study of a Third Party Policing intervention. The regulatory framework for *Project STOP* in Victoria is voluntary and was therefore an example of a policing partnership and thus outside the scope of this research.

\(^4\) The data are provided under strict conditions according to the following protocol (Australian Institute of Health and Welfare, 2008, p. 57): a potential researcher must make a formal request for access to the Alcohol and Other Drug National Minimum Data Set. If the request is for access to unit records from more than one jurisdiction, the request for access form is then forwarded to all relevant jurisdictions for approval. If approved by all relevant jurisdictions, the researcher will then be required to sign the AIHW confidentiality undertaking signed by all AIHW staff. Every request for access to unit record data in the national database must receive AIHW Ethics committee approval. Unit record data may contain potentially identifying information. The Ethics Committee assesses each data access request on a case-by-case basis to ensure that client confidentiality will not be breached by provision of the requested data. In some cases, specific conditions for access to and use of the data will be applied.
and is the custodian of the national data collection. The NMDS is a sub-set of data routinely collected by state and territory health authorities for administrative purposes. The development of the NMDS involved specifying data items that had standard definitions and collection methods across all health jurisdictions.

The aim of developing a NMDS was to aggregate Australian Government, State and Territory data. The AODTS-NMDS provides national data about clients who access alcohol and other drug treatment services, service utilisation, and treatment programs. At the jurisdictional and agency level, it provides information on drug problems and treatment responses relevant to their local circumstances and community. In conjunction with other sources of information, the AODTS-NMDS are able to be used to inform debate and policy development related to the alcohol and other drug treatment sector (AIHW 2007).

**Scope of the AODTS-NMDS**

The agencies included in the collection are all publicly funded government and non-government agencies that provide one or more specialist drug and/or alcohol treatment services. All clients who complete one or more treatment episodes at a drug (or alcohol) treatment service during the reporting period (1 July to 30 June in the following year) are in scope. There are a wide range of agencies that are not included in the collection; for example, agencies that only provided opioid maintenance and Aboriginal and Torres Strait Islander (ATSI) substance use services are outside the scope of the collection. Other agencies that provide alcohol and drug treatment services that are not in the scope of the AODTS-NMDS include correctional facilities, acute care or psychiatric hospitals and private agencies that do not receive government funding. See the documentation in

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42 AOTD services for ATSI clients are funded by the Office for Aboriginal and Torres Strait Islander Health (OATSIH) as Indigenous Substance Use Services, Aboriginal primary health care services, Aboriginal medical services and community controlled health services. These services are not under either a State or Territory health authority jurisdiction and the basis upon which data are collected are different to those of the AODTS-NMDS. The numbers of ATSI clients included in the NMDS underrepresents the actual number of ATSI who received treatment for drug and alcohol problems and was not included in the indicators requested for this study.

43 Clients born in other countries represent a small proportion of episodes (13% in 2008/08, AIHW 2010) with England (2%) and New Zealand (2%) representing the next most common countries of birth. “Similar to the issues outlined above for Indigenous Australians, treatment episodes for people born outside Australia are not

Footnote continues next page
Appendix B for details. In addition, individuals who may be receiving treatment via their general practitioner, pharmacist or other health care provider and not from a specialist drug and alcohol treatment service are outside the scope of this collection. Thus the numbers of episodes reported though the AODTS-NMDS do not reflect the total number of people receiving treatment for alcohol and other drug use.

**Unit of Analysis**

Since 2001/02, the unit of measurement for the AODTS–NMDS collection has been closed (or completed) treatment episodes. A closed treatment episode refers to a period of contact between a client and a treatment agency and it must have a defined date of commencement and cessation. During the period of contact there must have been no change in the principal drug of concern, the treatment delivery setting or the main treatment type (Australian Institute of Health and Welfare, 2011).

A treatment episode may cease for a number of valid reasons, such as the treatment being completed or the client ceasing to participate without notice. A treatment episode is deemed to have terminated in the event that there has been no (service) contact between the client and the treatment agency for a period of three months or more, unless the period of noncontact was planned between the client and the treatment agency.

It is important to note that the number of closed treatment episodes captured in the AODTS–NMDS does not equate to the total number of persons in Australia receiving treatment for alcohol and other drug use. Using the current collection methodology, it was not possible to reduce duplication in client registrations that can occur where, for example, a client attends a number of different agencies throughout the collection period or re-registers with the same agency and is assigned a new identification number.

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directly comparable to general population proportions” (AIHW, 2010: p.16) and comparisons between these groups and the Australian born components of the population are not advised (AIHW, 2010: p.14).
**INDICATOR VARIABLES**

Table 5.2 presents the data items available in the NMDS. The collection consists of items related to the characteristics of the treatment agency and the treatment episode; I created indicator variables from those items relating to the treatment episode (see the second column of Table 5.2).

**Table 5.2: AODTS-NMDS Data Items**

<table>
<thead>
<tr>
<th>Treatment Agency Items</th>
<th>Episode Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Establishment Identifier</td>
<td>Person Identifier</td>
</tr>
<tr>
<td>State/territory</td>
<td>Sex</td>
</tr>
<tr>
<td>Geographical location (Australian Standard Geographical Classification, ASGC)</td>
<td>Date of birth</td>
</tr>
<tr>
<td>Establishment sector</td>
<td>Country of birth</td>
</tr>
<tr>
<td></td>
<td>Indigenous status</td>
</tr>
<tr>
<td></td>
<td>Preferred language</td>
</tr>
<tr>
<td></td>
<td>Client type</td>
</tr>
<tr>
<td></td>
<td>Source of referral</td>
</tr>
<tr>
<td></td>
<td>Date of commencement</td>
</tr>
<tr>
<td></td>
<td>Date of cessation</td>
</tr>
<tr>
<td></td>
<td>Reason for cessation</td>
</tr>
<tr>
<td></td>
<td>Treatment delivery setting</td>
</tr>
<tr>
<td></td>
<td>Method of use for principal drug of concern</td>
</tr>
<tr>
<td></td>
<td>Injecting drug use</td>
</tr>
<tr>
<td></td>
<td>Principal drug of concern</td>
</tr>
<tr>
<td></td>
<td>Other drug of concern (up to 5)</td>
</tr>
<tr>
<td></td>
<td>Main treatment type</td>
</tr>
<tr>
<td></td>
<td>Other treatment type (up to 4)</td>
</tr>
</tbody>
</table>

The documentation for the release of the unit records from the NMDS is included in Appendix D. On page 4 of that document is a table (2.1) that presents ‘Specifications for each year’s episode file’. I selected all episodes from the state of Queensland who were seeking treatment for their own alcohol or other drug use (n=138,015). The sex (male=70.1%, female=29.6%) and age variables were straightforward and required very little cleaning (mean age=31, SD=12.8). We did not request ‘born in Australia’, and ATSI (Aboriginal or Torres Strait Islander); over 90% of closed treatment episodes report they are born in Australia, and a very small percentage of ATSI clients are captured in the AODTS-NMDS, as they have their own data base (Australian Institute of Health and Welfare, 2011). The cessation date for each episode was used to create a date variable for each month/year and so
each indicator was aggregated according to the month and year that the episode ended. There were 73 time points in total ranging from July 2003 to June 2009. Below is a description of each of the indicator variables that were created from the NMDS and that were analysed using interrupted time-series analysis. Table 5.3 illustrates the structure of the data and a description of each indicator is below.

Table 5.3: Indicator variables created from the AODTS- NMDS unit record files.

<table>
<thead>
<tr>
<th>Unit of Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Closed Treatment Episodes</td>
</tr>
<tr>
<td>Principal Drug of Concern</td>
</tr>
<tr>
<td>Amphetamines</td>
</tr>
<tr>
<td>Quasi-control series</td>
</tr>
<tr>
<td>Alcohol</td>
</tr>
<tr>
<td>Cannabis</td>
</tr>
<tr>
<td>Heroin</td>
</tr>
<tr>
<td>Method of use</td>
</tr>
<tr>
<td>Ingests</td>
</tr>
<tr>
<td>Smokes</td>
</tr>
<tr>
<td>Injects</td>
</tr>
<tr>
<td>Injecting drug use</td>
</tr>
<tr>
<td>Never injected</td>
</tr>
<tr>
<td>Treatment Outcomes</td>
</tr>
<tr>
<td>Compliant</td>
</tr>
<tr>
<td>Not Compliant</td>
</tr>
</tbody>
</table>

Voluntary and coerced treatment admissions

I used the AODTS item ‘source of referral’ (which referred to the source from which the person was transferred or referred to the AODTS) to create two dummy variables ‘voluntary’ or ‘coerced’ treatment admission. Using episodes from Queensland, those that had self-referred (26%) or had been referred to treatment by family or a friend (3.4%), medical practitioner (4.7%), hospital (5.9%), mental health service (3.2%), AODTS (3.7%) or other health care service (2.6%) (domain values 1 through to 7; see Table 2.1 in Appendix B) were coded as voluntary episodes. Those referred by corrections (8.2%), police (26%) or court diversion (12.3%) were coded as ‘coerced’. There was an ‘other’ category which constituted 3.9% of episodes, which were coerced referrals under the Mental
Health Act that are not included in the analysis\textsuperscript{44}; finally, 0.3% were coded as missing. The total number of voluntary episodes from Queensland between 2003/09\textsuperscript{45} to 2008/09 was 68,211 (49.4%) and the number of coerced episodes was 69,387 (50.3%), and 417 episodes (0.3%) were missing.

**Principal drug of concern**

The data item ‘principal drug of concern’ coded the client’s reported main drug according to the Australian Standard Classification of Drugs of Concern (Australian Bureau of Statistics, 2011). This item was used to create four drug types for the ‘voluntary’ admissions: amphetamines, alcohol, cannabis and heroin. The amphetamines series was the main indicator of interest in the time-series analysis, while the other three drug types were used as quasi-controls analysis. A series for amphetamines was also created for the ‘coerced’ treatment admissions.

**Method of use**

The method of use indicator variable was created from the episode item ‘method of use for principal drug of concern’ which was the client’s usual method of administering the principal drug of concern. The item values included ingests, smokes, injects, sniffs (powder), inhales (vapour), other and not stated (see table 2.1 in Appendix D). The indicators used in the analysis were ‘ingests’, ‘smokes’ and ‘injects’. The other three methods: ‘sniffs’, ‘inhales’ and ‘other’ were too small in number across the 73 time points and were not included in the analysis. This indicator variable was created for both categories of admissions: ‘voluntary’ and ‘coerced’, using episodes that reported amphetamines as the reason they sought treatment.

**Injecting drug use**

An indicator variable ‘never injected’ was created from the episode item ‘injecting drug use’ which reported on the client’s use of injecting as a method of administering the principal drug of concern. ‘Never injected’ was the indicator of interest here given that the item ‘method of use’ dealt with the issue of injecting drug use of the main drug of concern. An indicator variable of ‘never injected’ was

\textsuperscript{44}I decided to exclude these episodes as the mechanism at play was the mental health system which is another institution and my concern in this thesis is with the criminal justice system.

\textsuperscript{45}Records from the year 2002/03 were dropped from the analysis due to data quality issues discussed below.
created for both voluntary and coerced episode where amphetamines were the principal drug of concern.

**Treatment outcome**

The AODTS-NMDS does not contain an indicator of treatment outcomes; however, the AIHW does use categories of the item ‘reason for cessation’ (of treatment) to create two categories that can be used as an outcome variable (see AIHW, 2010a p.26). The two categories are ‘expected/compliant completions’ and ‘unexpected/non-compliant completions’. The groupings of reasons for cessation are presented in Table 5.4 below. I used these two categories to create two indicator variables each for ‘voluntary’ and ‘coerced’ admissions for amphetamines. The two outcome indicators were ‘Treatment compliance’ and ‘Treatment non-compliance’.

**Table 5.4: Treatment Compliance Outcome in the AODTS-NMDS**

<table>
<thead>
<tr>
<th>Expected/Compliant Completions</th>
<th>Unexpected/non-compliant completions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment completed</td>
<td>Ceased to participate against advice</td>
</tr>
<tr>
<td>Ceased to participate at expiation(^{(a)})</td>
<td>Ceased to participate without notice</td>
</tr>
<tr>
<td>Ceased to participate by mutual agreement</td>
<td>Ceased to participate involuntary (non-compliance)</td>
</tr>
<tr>
<td></td>
<td>Drug court and/or sanctioned by court diversion service</td>
</tr>
<tr>
<td></td>
<td>Imprisoned, other than drug court sanctioned</td>
</tr>
<tr>
<td></td>
<td>Died</td>
</tr>
</tbody>
</table>

\(^{(a)}\) ‘Ceased to participate at expiation’ is an expected/compliant completion in the sense that legally mandated treatment is completed. It is not possible to exclude episodes reported as ‘ceased to participate at expiation’ where clients finished enough treatment to expiate their offence but did not return for further treatment (Australian Institute of Health and Welfare, 2010a).

**Length of episode**

Another possible indicator I considered for inclusion in the analysis was ‘length of episode’, which was recorded in days (see Table 2.1 in Appendix D). Over 64% of episodes were recorded as lasting for one day, around 34% of episodes were recorded lasting from more than one day to one year (i.e. 2 to 365 days) and the remaining 2% were over one year but with an upper number in the thousands

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\(46\) There was a third category ‘changes to treatment mode’ which is in effect an administrative cessation and so was not included in the analysis (Australian Institute of Health and Welfare, 2010a).
of days. Given the skewed nature of the variable and the highly improbable length of treatment in the thousands of days I decided not to include this variable in the analysis.

In the next section I describe the intervention time-points used in the analyses. I then describe the statistical procedures I used to analyse the impact of the intervention (Project STOP and precursor regulations) on treatment demand and drug use among those seeking treatment for amphetamines in Queensland between 2003/04 and 2008/9.

**THE THIRD PARTY POLICING INTERVENTION**

The third party policing intervention began with the introduction of the electronic medical recording system Project STOP that assisted pharmacists to comply with a number of legislative changes that commenced after the electronic database was introduced. In all there was a further four time-points identified in the review of the response to the ATS problem in Queensland in the study period to 2009 (see Chapter 3, above). The intervention occurred across five specific events that occurred between 2005 and 200847 and together comprised the supply-side drug law enforcement third party policing intervention that was introduced in Queensland as a direct response to the problem of methamphetamine use and harm in that state.

The intervention time-points that were introduced sequentially into the series were: PROJSTOP, REG1, REG2, PROJSTP2 and CRIMLAW. The first was November 2005 when Project STOP (PROJSTOP) was rolled out in Queensland. The second, in January 2006 consisted of two regulatory changes, first S2 pseudoephedrine products were re-scheduled to S3 pharmacy only medicine (see Appendix C, the SUSMP), and the Health Regulation 1996 (Qld) was amended to require the production of photographic identification when purchasing S3 pseudoephedrine products (REG1). Next was April 2006 when liquids and tables containing more than 800 or 780 milligrams (respectively) of pseudoephedrine were rescheduled to S4 prescription only medicine (REG2). The fourth intervention time-point was August 2007, the date when Project STOP (PROJSTP2) was rolled out

47 Since the end of the study period in 2009 further changes have been introduced in Queensland whereby the use of the electronic medication recording system Project STOP by pharmacists to record sales of pseudoephedrine products is now mandated by law (Ransley, 2012)
nation. The final intervention time-point was the introduction of the mandatory reporting of pseudoephedrine sales (CRIMLAW) in Queensland in June 2008.

STATISTICAL PROCEDURES

Interrupted Time-Series Analysis

I used the Box–Jenkins–Tiao approach to modelling interrupted time series analysis (ITSA) to assess the impact of Project STOP on monthly closed treatment episodes for amphetamines and other drugs (Box & Tiao, 1975; Tiao, 2001). Interrupted time series analysis is considered to be a strong quasi-experimental design (Shadish et al., 2002). Originally formulated by (Shadish et al., 2002) the time-series quasi-experiment is a strategy for assessing the impact of a discrete intervention on a social process. There are several reasons why interrupted time series analysis is a useful and appropriate technique to assess the impact of an intervention. First, it is often difficult to identify adequate matched control groups when an innovation is introduced. In time-series analysis, serial data (closed treatment episodes48) collected at consistent intervals (monthly) act as their own control (Shadish et al., 2002). Second, time-series analysis is particularly suitable when an intervention is a naturally occurring event and the data used for evaluation comes from archives gathered routinely for administrative purposes (i.e., treatment episodes) (Glass, 1997). Finally, time-series analysis has become recognised as a standard statistical method of evaluating the impact of a policy intervention on a time series of relevant outcome indicator data (Gilmour et al., 2006).

Interrupted time-series analysis adjusts for the presence of serially correlated errors. It also adjusts for nonstationarity, seasonality and outliers in the time series. In conjunction with the quasi-experimental design, it is a powerful method enabling researchers to conduct an ‘objective’ assessment of the impact of an intervention (Cunningham et al., 2008). Interrupted time-series analysis is comprised of two sets of analyses. First, autoregressive integrated moving average

48 The unit of analyses are closed treatment episodes, defined as a period of contact with definite commencement and cessation dates between an individual and a treatment provider (Australian Institute of Health and Welfare, 2011, p. 4; McCleary & Hay, 1980).
(ARIMA) analysis is used to model the ‘noise’ component of the data, and then the intervention component is modelled (McDowell, 1980).

**Modelling Stochastic ARIMA Processes**

ARIMA models are a class of stochastic process models developed by (Box & Jenkins, 1976; Box & Tiao, 1975; McCleary & Hay, 1980; McDowell, McCleary, Meidinger, & Hay, 1980), and are widely used in the social sciences (Chamlin, Myer, Sanders, & Cochran, 2008; Rehm & Gmel, 2001). The general approach Box and Jenkins developed was one of fitting statistical models that account for the autocorrelation processes that occur in a given time-series. A time-series is a sequence of ‘realisations’ of an underlying social process (McCleary & Hay, 1980). The basic model of a time-series is an input-output system. The input is a sequence of random shocks \( \alpha_t \) that passes through a series of ‘filters’. The filters are ARIMA structures that determine the properties of the output series \( Y_t \) (McCleary & Hay, 1980; McDowell et al., 1980). The ARIMA structures outlined by Box and Jenkins are integration or differencing \((d)\), autoregression \((p)\) and moving average \((q)\).

The simplest of all series is presented in Figure 5.1 and is a white noise process, ARIMA \((0, 0, 0)\). This series of random shocks are normally and independently distributed around a mean of zero with a constant variance and uncorrelated error. This process is said to be stationary. This white noise model is the ‘null hypothesis’ used in the Box–Jenkins approach to determine the adequacy of a given ARIMA model. The presence of one or more of three ARIMA ‘filters’ determines the properties of the output series. Three structural parameters, \( p, d, q \), describe the relationships between the random shocks \( \alpha_t \) and the time-series and they are: integration (or differencing) \( d \), autoregression \( p \) and moving average \( q \), (see Figure 5.2, below).

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49 ‘the relationship between realisation and process in time series analysis is analogous to the relationship between sample and population in cross-sectional analysis’ (McCleary & Hay, 1980, p. 30).
Time-series models are built around these three components ($p$, $d$, $q$) and the procedures that are used to build a model are referred to as time-series analysis because the series is being decomposed into its components. The first component that is considered is integration, which is closely related to the concept of trend (McCleary & Hay, 1980).

A series with no trend is said to be ‘white noise’. Trend is any systematic change in the level of the time-series (McCleary & Hay, 1980). Non-stationary series are those whose mean and covariance are functions of time and are said to contain trend. Trend can be one of two types: deterministic (e.g. a fixed linear regression line that is determined by a constant parameter and a slope parameter), or stochastic (i.e. random). If a trend is stochastic then differencing the values of the series ($Y_t$) by its prior value ($Y_{t-1}$) can produce an ARMA process that is stationary. Stochastic trend is said to be ‘integrated’ and an important concept for understanding integration is the stochastic trend phenomenon known as random walk.

A series with a trend pattern over time arises as a function of each time point $Y_t$ being correlated with the previous time point $Y_{t-1}$; this process is called a random walk. Stochastic series are said to have ‘long memories’, as the effect of a random shock at time $t$ manifests itself across subsequent
time points because of the correlation between adjacent time points (Enders, 1995). The equation for a pure random walk is presented in Table 5.2 as Model 1, where the current observation $Y_t$ equals the previous observation $Y_{t-1}$ plus a random shock $\alpha_t$ (Yaffee, 2000, pp. 77–80). The accumulation of these random variations generates meanderings of series level, hence it is said to be integrated.

An integrated process, or random walk can drift or trend. Random walk with drift (Model 2, Table 5.5) is a series that drifts upwards or downwards around a nonzero mean. The inclusion of a constant term $\alpha_0$ in the second equation represents this type of nonstationarity. The parameter, $\alpha_0$, is interpreted as the level of the series and is its arithmetic mean. Model 3 in Table 5.5 represents the process of random walk with drift and trend and includes a deterministic trend term $B_t$. This parameter is interpreted as the slope of the time-series process. Series which do not randomly move away from a constant mean but change in level systematically contain deterministic trend. These types of series can be rendered stationary by detrending with ordinary least-squares regression (OLS) techniques, for example, by regressing it on a linear function of time (Rehm & Gmel, 2001).

Table 5.5: Types of Integrated Processes

<table>
<thead>
<tr>
<th>Model 1</th>
<th>Random walk</th>
<th>$Y_t = \rho_t Y_{t-1} + \alpha_t$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 2</td>
<td>Random walk with drift</td>
<td>$Y_t = \alpha_0 + \rho_t Y_{t-1} + \alpha_t$</td>
</tr>
<tr>
<td>Model 3</td>
<td>Random walk with drift and trend</td>
<td>$Y_t = \alpha_0 + \rho_t Y_{t-1} + \beta t + \alpha_1$</td>
</tr>
</tbody>
</table>

Notes: where $\alpha_0$ is a deterministic constant, 
$\rho_t$ is a stochastic trend term, 
$\beta t$ is a deterministic trend term, 
$\alpha_1$ is the error term or random shock.

Commentators such as McCleary & Hay (1980) caution against using ordinary least squares type methods to de-trend a series, however, because it can be difficult to tell whether the change in the level of a series with a finite length is due to deterministic trend or stochastic drift. Deterministic trend is a fixed function of time whereby future values of a series are determined by the constant ($\alpha_t$) and slope ($B_t$) parameters. Stochastic modelling on the other hand allows the estimate of trend
to be dynamic, that is, each observation of the time-series has the same influence in determining the trend line thus allowing a series to drift over time. The advantage is that a dynamic model can be built that can account for both drift and trend (McCleary & Hay, 1980). Stochastic behaviour can be conceptualised as the outcome of a process operating through time. In contrast, linear regression is static in nature and a change at time $t$ precedes a predictable fixed change at time $t+1$ and this relationship holds over all periods (McDowall, 2002).

To sum up, Model 1 in Table 5.2 is pure random walk with no constant mean, drift or trend. The second model is random walk with drift; it contains a constant (or nonzero mean). The third model is random walk with drift plus a deterministic trend. Differencing ($\nabla Y_t$) removes the random walk (integrative process) and renders the series a succession of random shocks $a_t$, in other words it is white noise. The effect of differencing is illustrated below:

$$\nabla Y_1 = Y_1 - Y_0$$
$$= (Y_0 + a_1) - Y_0 = a_1$$

$$\nabla Y_2 = Y_2 - Y_1$$
$$= (Y_0 + a_1 + a_2) - (Y_0 + a_1) = a_2$$

$$\nabla Y_3 = Y_3 - Y_2$$
$$= (Y_0 + a_1 + a_2 + a_3) - (Y_0 + a_1 + a_2) = a_3$$

$$\vdots$$

$$\nabla Y_t = Y_t - Y_{t-1}$$
$$= (Y_0 + a_1 + a_2 + a_3 + \cdots + a_{t-1} + a_t) - (Y_0 + a_1 + a_2 + \cdots + a_{t-2} + a_{t-1}) = a_t$$

The series no longer drifts away from its expected value; it instead fluctuates around its mean level. The random walk is represented by ARIMA (0,1,0) and these random shocks are assumed to have a mean of zero (McCleary & Hay, 1980). If the series does not have a mean of zero, that is, if the shocks are not random then the nonzero level of the process is represented with a constant. In other words the random walk follows a linear trend. The difference equation model for linear trend is (McCleary & Hay, 1980, p. 43):
Equation 1

\[ Y_t = Y_{t-1} + \theta_0 + a_t \]

The parameter \( \theta_0 \) is interpreted as the slope of the equation and is estimated as the series mean. What this means in a practical sense is that an ARIMA \((0, 1, 0)\) as represented in Equation 1 can incorporate drift and trend. This difference equation means that ‘the best prediction of the current time series observation \((Y_t)\) comes from the preceding observation \((Y_{t-1})\) and a constant’ (McCleary & Hay, 1980, p. 43).

**Initial identification and estimation of ARIMA \((0, 1, 0)\)**

I check whether a series is stationary by estimating an ARIMA \((0, 0, 0)\) model and examining the key statistic for time-series analysis, the autocorrelation function (ACF) plot. The ACF of a nonstationary process will decay very slowly over a long period. The ACF is the standardised autocovariance function (ACV), that is, the covariance between one observation and another observation in the same series \(k\) lags away (Yaffee, 2000, p. 110):

\[
ACV(k) = \sum_{t=1}^{n-k} (Y_t - \bar{Y})(Y_{t-k} - \bar{Y})
\]

Yaffee (2000) presents the ACF as the standardised ACV by dividing the auto covariance by a quantity equal to the variance, that is, the product of the standard deviation at lag 0 and the standard deviation at lag 0. This is analogous to computing the Pearson product moment correlation\(^{50}\) of the series by dividing the covariance of a series and its lagged form by the product of the standard deviation of the series itself (Yaffee, 2000, p. 111):

\[
ACF(k) = \frac{ACV(Y_tY_{t-k})}{\text{std dev } Y_t \cdot \text{std dev } Y_{t-k}}
\]

---

\(^{50}\) The formula for the Pearson product moment coefficient of two variables \(x\) and \(y\) is: \( \rho_{xy} = \frac{\text{COV}(xy)}{\sqrt{\text{V}(x) \cdot \text{V}(y)}} \)
A series with an ACF that decays very slowly is nonstationary. Once the series has been transformed to stationarity, typically by differencing once, ARIMA (0, 1, 0), we can then proceed with further identification of the series.

In order to test whether a stationary series has deterministic trend I test the null hypothesis that the value of the constant \( \theta_0 \) is equal to zero. I then estimate an ARIMA (0, 0) including a constant parameter and if \( \hat{\theta} \) is not statistically different from zero I conclude the process was drifting, not trending, and drop the constant from the subsequent analysis. The constant in a differenced series is the average difference between adjacent observations, that is, the trend of the series. For single differencing, the trend corresponds to the slope of a straight line fit through the series. Testing the significance of the constant in a singly differenced series is equivalent to testing whether a linear trend (with nonzero slope) is present in the data.

To sum up, recall the input-output model in Figure 5.1 and Figure 5.2, whereby white noise is driving a time-series process, that is, white noise is the input and the series \( Y_t \) is the output. For processes that drift or trend the ARIMA (0, 1, 0) filter integrates random shocks. The shock enters the filter and remains there influencing all future outputs. Mc Cleary & Hay (1980) describe the ‘filter’ of this integrated model as a ‘black box’:

\[
\text{All future outputs of the ARIMA (0, 1, 0) black box will contain the random shock } a_t \text{ as well as all prior random shocks back into the infinitely distant past. To unlock this black box, we simply difference the time-series. (p.45)}
\]

It is at this point that McCleary & Hay (1980) introduce the backward shift operator that indicates differencing:

---

51 This is not to be confused with the evaluation black box discussed above in Chapter 4. These are distinctly different concepts.

52 Another assumption required for stationarity is that of variance or homogenous stationarity as well. Some series may display fluctuating variance. A simple time plot usually reveals expanding, contracting or fluctuating variance. If variance instability is detected the series can be transformed to stability by a number of procedures. The most common ones are log transformations and the square root transformations (for details see Osborne, 2002).
Equation 2

\[(1 - B)Y_t = (1)Y_t - (B)Y_t = Y_t - Y_{t-1}\]

**AUTOREGRESSIVE (AR) AND MOVING AVERAGE (MA) PROCESSES**

Once the series has been rendered stationary the remaining autocorrelation processes can be identified. A **stationary** stochastic process is one that neither drifts nor trends and is fully determined by its mean, variance and autocorrelation function. The two fundamental tools used to identify autocorrelation in a given series are the autocorrelation function (ACF) and the partial autocorrelation function (PACF). These are typically presented in a correlogram. A correlogram is a graphical representation of the amount of correlation which exists between errors (or residuals) across successive lags. The ACF plot shows the magnitude of the unadjusted correlation between successive lags in a series. In other words, the ACF is a set of correlation coefficients between the series and lags of itself over time. The PACF shows the extent of the correlation between successive lags after partially out the effects of the correlation relationships between intervention lags (McDowall et al., 1980).

Different patterns in the ACF and PACF plots provide information about the type of autocorrelation still present in the series after differencing. One manifestation of autocorrelation is the autoregressive process. An autoregressive process of the order \( p \) for a stationary series \( Y \) is conceptualised in Equation 3, below (McDowall et al., 1980):

\[Y_t = \phi_1 Y_{t-1} + \cdots + \phi_{t-p} + \alpha_t\]  

**Equation 3**

The value of \( Y \) at a given time point \( t \) is comprised of a random shock component \( \alpha_t \) and a proportion of the previous values of observation \( Y \) at time \( t - 1 \). The proportion of \( Y \) from the previous value of \( Y_{t-1} \) is represented by the autocorrelation parameter \( \phi \). A typical first order autoregressive (AR) process for a given stationary variable \( Y \) is apparent from the pattern of an ACF plot that decays slowly and has a PACF with significant spikes that sharply cuts off. The lag at which the PACF cuts off is the indicated number (or order) of AR terms (see Table 5.6).

The other major type of autocorrelated process is the moving average process. Moving averages (MA) are conceptualised in terms of pure random shock components \( \alpha_t \) which as seen above comprise one part of the autoregressive process. A moving average process of order \( q \) for a stationary series \( Y \) is written in equation 4 below (McDowall et al., 1980):

\[Y_t = \phi_1 Y_{t-1} + \cdots + \phi_{t-p} + \alpha_t\]
The value of stationary series $Y$ at time $t$ is expressed in terms of the random shock component at time $t$ ($a_t$) and proportions of previous random shocks at lag $q$. The ACF and PACF plots for moving average processes are the inverse of those for auto regressive processes. An MA process has a PACF that declines slowly and an ACF that cuts of abruptly after the first lag (see Table 5.6).

Most major texts discuss the theoretical autocorrelation function correlograms for different kinds of ARMA models (McCleary & Hay, 1980; McDowall et al., 1980; Yaffee, 2000). ACF and PACF plots for more complex autocorrelation processes such as higher order $p$ or $q$ or mixed models that contain MA and AR processes are part of the challenge in conducting time-series analysis and correctly interpreting such equivocal plots. Another complicating type of autocorrelation is seasonal, which will typically present itself as significant spikes at the appropriate lag, such as 12 for monthly data. These multiplicative ARIMA models are thoroughly discussed along with interpreting the ACF and PACF plots for various types of ARMA processes in Yaffee (Yaffee), which I relied on for conducting my analyses, as well as the SAS/ETS® 9.22 User’s Guide (2010).

The parameter estimates for an AR and an MA process must be bounded to between -1 and +1. These are called the bounds of stationarity for the AR parameter and the bounds of invertability for the MA parameter. When $\theta$ (the AR parameter) equals 1 or -1 the process is no longer stationary and would need to be transformed in order that it be amenable to attenuation. As seen above, moving average processes are in essence the inverse of autoregressive ones. The MA parameter, $\theta$, must reside within the bound of invertability for $\theta$ (see Yaffee, 2000, pp. 94–99).

The formal statistical tests presented by Box and Jenkins in their time series text were Q statistics which are chi-square like test statistics. This test for a given lag length (N) tests the null hypothesis that none of the intervening lags up to and including N contain an AR or MA parameter that is significantly different from zero. This testing is part of the diagnostic stage of the Box–Jenkins model building. A later version of the original Q-statistic was developed for small sample properties and was called the Ljung–Box Q statistic and SAS/ETS® 9.22 provides this statistic and $p$-values as a standard component of the output from the ACF and PACF plot routines. It also provides plots that test the null hypothesis that the residuals are white noise.
Outliers

The final source of nonstationarity for time-series is the presence of extreme observations or outliers. These observations may be influential in that they can distort the autocorrelation function and bias the estimates of model parameters (Thome, 1995). Careful consideration has to be given as to how to deal with an outlier or outliers. One possible solution is to replace it with some interpolation method. Another approach is to incorporate a dummy variable coded as a shift or pulse depending upon the outlier’s impact on the series. In fact outliers can be modelled using inputs as occurs in impact analysis (Thome, 1995; Yaffee, 2000). In the analyses presented in subsequent chapters, unless the outlier has theoretical importance it will be assumed to be random error and will be replaced using mean value substitution.

Table 5.6: Identifying ARIMA Processes, selected examples only.

<table>
<thead>
<tr>
<th>ARIMA Model</th>
<th>ACF</th>
<th>PACF</th>
</tr>
</thead>
<tbody>
<tr>
<td>White noise process ARIMA (0,0,0)</td>
<td>All zero or close to zero</td>
<td>All zero or close to zero</td>
</tr>
<tr>
<td>Integrated process ARIMA (0,1,0) $d=1$</td>
<td>No decay to zero</td>
<td>1 spike at order of differencing</td>
</tr>
<tr>
<td>Autoregressive model ARIMA (1,0,0)</td>
<td>Exponential, decaying to zero</td>
<td>Use the partial autocorrelation plot to identify the order of the autoregressive model. For AR (1) there will be 1 positive spike at lag 1.</td>
</tr>
<tr>
<td>Autoregressive model ARIMA (2,0,0)</td>
<td>Exponential, decaying to zero</td>
<td>2 positive spikes at lags 1 and 2</td>
</tr>
<tr>
<td>Moving average model ARIMA (0,0,1)</td>
<td>One negative spike the rest are essentially zero</td>
<td>Exponential decay of negative spikes</td>
</tr>
<tr>
<td>Moving average model ARIMA (0,0,2)</td>
<td>Two negative spikes the rest are essentially zero</td>
<td>Exponential decay of negative spikes</td>
</tr>
<tr>
<td>Mixed autoregressive and moving average ARIMA (1,0,1)</td>
<td>Exponential decay of positive spikes</td>
<td>Exponential decay of positive spikes</td>
</tr>
<tr>
<td>Include seasonal autoregressive term.</td>
<td>High values at fixed intervals</td>
<td></td>
</tr>
</tbody>
</table>

Summary of the Box-Jenkins Approach to ARIMA Model Building

The approach that Box & Jenkins (1976) developed to fit statistical models that can account for the autocorrelation contained in a given time series comprises three steps: identification, estimation and diagnosis. In the Identification stage the ACF and PACF plots are examined. If the ACF plot decays very slowly and does not reach zero then it is nonstationary and must be transformed to stationarity.
before proceeding. The ACF and PACF plot are then re-examined in order to identify autoregressive or moving average processes or some combination from the patterns in the spikes shown in the plots. Here, seasonality is also identified from the spike patterns (Table 5.6). In the estimation stage, statistical modelling is conducted to estimate the parameters of the model believed to be revealed in the autocorrelation function correlograms. The adequacy of a model is assessed during the diagnosis stage. The residuals from the estimated models are assessed using ACF and PACF plots, and Q statistics formally test the null hypothesis that the residuals are not significantly different from white noise.

The Box–Jenkins modelling approach is essentially iterative, whereby correlograms are systematically examined, models are estimated and re-estimated and model residuals are examined for white noise, which indicate statistical adequacy. Once this ‘noise’ component of interrupted time-series analysis has been successfully modelled the next component, the intervention component, is then modelled and the impact of the event is assessed. Referring back to the input–output models (Figures 5.1 and 5.2) where the ARIMA process was conceptualised as a series of filters, McDowell et al. (1980) presents this process as a time-series observation sent backward through the $p$, $d$, $q$ filters to emerge as white noise, that is, random shock $a_t$ (see Figure 5.3):

![Figure 5.3 The ARIMA Process](image)

There is now a stochastic benchmark against which the effect of an ‘event’ (i.e. an intervention induced change) on the level of the series can be assessed (Hibbs, 1977). It is to this I now turn.

**IMPACT ANALYSIS THEORY**

The impact analysis is essentially a regression function; with a dependent variable representing the response series and independent variables consisting of an ARIMA noise model and an intervention component (Yaffee, 2000). Box and Tiao (1975) outlined how an ARIMA based approach could incorporate a range of intervention effects. As seen in the previous section, this approach is based
on an input series being put through a series of filters that transform it into an output series. One set of filters relates to the noise component of the series and incorporates differencing \((d)\), and estimation of any AR \((p)\) or MA \((q)\) components. The other set of filters relates to the interventions or structural component of the series.

The time-series analysis described so far has outlined the procedure developed by Box & Jenkins (1976) and explicated for the social sciences by McCleary & Hay (1980) and McDowall et al. (1980). This procedure known as the ‘Box–Jenkins’ time-series approach, involves identifying, estimating and diagnosing an appropriate ARIMA \((p, d, q)\) model for the noise \(N_t\) component of the model. Once the noise component has been successfully modelled, the intervention component is then added and the full impact assessment model can now be written as (Box & Tiao, 1975; McCleary & Hay, 1980):

\[
Y_t = f(I_t) + N_t
\]

Equation 5 introduces \(f\), which represents a function of the intervention component \((I_t)\). The noise \((N_t)\) component is the null case of the time-series quasi-experiment. The time-series \((Y_t)\) has been adequately explained as noise in the first part of the analysis (described above). Now the intervention component \(f(I_t)\) is introduced and if it increases the explanatory power of the model by a statistically significant amount we can conclude that the exogenous intervention has had a significant impact on the social process as measured by the series itself. Recalling the purpose of employing intervention time-series analysis as a quasi-experimental design, the introduction of an intervention tests the null hypothesis that the ‘event’ caused a change in the social process (as measured by the time-series).

The event in this case, for example, is the introduction of Project STOP into pharmacies in Queensland in November 2005. The social process captured by the monthly counts of voluntary treatment admissions for amphetamines is conceptualised as ‘treatment seeking’ or ‘help seeking’ behaviour. The intervention \((I_t)\) (in this case Project STOP) was captured by a dummy variable defined as:

\[
I_t = 0 \text{ prior to November 2005} \\
I_t = 1 \text{ from the onset of November 2005}
\]

The series are monthly count data beginning July 2003 and ending in July 2009, which are 72 observations in total.
I now turn to discuss exactly how an intervention component \( f(I_t) \) is introduced into the stationary series which has been rendered white noise by the (prior) ARIMA analysis. A note on terminology: the intervention component can also be referred to as a transfer function. It is so-called because the ‘function’ models how the intervention is translated into future values of the series. I use the terms interchangeably following McCleary & Hay (1980). What follows is a description of the range of intervention effects that can be applied in an ARIMA framework in order to assess the form of an intervention impact. This discussion is a summary drawn from these four key texts: Box & Tiao (1975), McCleary & Hay (1980), McDowell et al. (1980), and Yaffee (2000).

**The intervention component**

The intervention is the hypothesised change agent and is represented by a binary (dummy) variable, also called a step function.

\[
f(I_t) = S_t = \begin{cases} 
0, & \text{when } t < T \\
1, & \text{when } t \geq T
\end{cases}
\]

An input event that is properly represented by a dummy variable represents a permanent change in the response series, and is input as a zero order step function illustrated in Figure 5.6 below. The components of this step function include the regression coefficient of the intervention \( \omega_0 \), and the intervention indicator variable \( I_t \) which is coded as a zero or a one to indicate its absence or presence; McDowell et al. (1980) called this term the *change agent*. A stationary series \( Y_t \) modelled using this step function represents an *abrupt permanent change* in the level of the series at the onset of the intervention:

\[
Y_t = \omega I_t \quad \text{Equation 5}
\]

A positive regression coefficient means that the level of the series rose and a negative value means that it fell. The magnitude of the coefficient \( \omega_0 \) indicates the size of the effect.
Many interventions in the social sciences will not have such a dramatic or permanent impact on a social process, particularly a behavioural outcome. McDowell (et al, 1980) summarises some possible types of impact in terms of the **onset** and **duration** of the impact. Both McDowell et al. (1980) and McCleary & Hay (1980) present a simple theory of impact along these two dimensions, see Figure 5.5, below:
Three of these four types of impact, namely abrupt and permanent (described above), gradual and permanent, and abrupt and temporary impacts, correspond to the input of various zero-order and first-order transfer functions. McCleary & Hay (1980) argue that most types of social science interventions will be well-represented by one of these three types. The impact of an ‘event’ on a social process can be either abrupt or gradual in onset and either permanent or temporary in duration; Figure 5.5 illustrates these impacts. The zero-order step function, which models an abrupt and permanent impact is a static input and is basically just a dummy regression variable. The other two impacts require the ability to model the input dynamically and this can be achieved by the

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53 McDowall (et al, 1980) argue that the fourth type of impact, gradual and temporary is not easily modelled and is least useful and do not discuss it.
introduction of a denominator function $(\delta)$ into the input, thus creating a first-order transfer function.

**First-order transfer functions**

The introduction of the denominator parameter delta $(\delta)$ changes the intervention component from a static to a dynamic function (Hibbs, 1977). The intervention component (which is also called a transfer function) models how the intervention is translated into future values of the series $(Y_t)$. Transfer functions are classified by the order of their dynamics, for example an OLS regression function coefficient $\beta$ is a zero order (static) transfer function denoted $\omega_0$. The first-order transfer function has two parameters, $\omega_0$ in the numerator and $\delta_1$ in the denominator, thus creating a dynamic term that enables us to model a gradual onset (growth) or temporary duration (decay) depending on whether we use a step or a pulse intervention $(I_t)$ as the input variable. The growth or decay rate can be either positive or negative, that is, either above or below the mean level of a stationary series $(\hat{Y}_t = 0)$ as indicated by the plus or minus value of omega $(\omega)$.

It is often the case that the effect of a given intervention may not have an immediate impact until some period of time after its onset. A step function is still input, however, in order to allow for a delay the extra denominator parameter is included. This first order step function is a ratio that includes the denominator $\delta_1$ as well as the numerator, $\omega_0$. Delta is a single rate parameter that controls the gradualness of the growth in the impact of the intervention after onset, see Equation 7 (Yaffee, 2000).

$$S_t = f(I_t) = \frac{\omega_0 I_{t-1}}{1-\delta_1} \quad \text{Equation 6}$$

The shape of the first order function depends on the magnitude of the rate parameter. The closer the value that $\delta_1$ is to zero, the more abruptly the series will increase from one time period to the next. In other words, when the rate parameter $\delta_1 = 0$ the denominator reduces to unity and the formula reduces to that of Equation 5.6, a zero order step function (Yaffee, 2000). If the rate
parameter is between 0 and 1\textsuperscript{54} and the input is a step function, there is a gradual increase in the level of the response until a permanent level is attained (see panel 2 in Figure 5.4).

A third type of impact that can be modelled is an intervention which has an immediate impact but its effect decays over time. The most extreme example is a situation whereby the effect is apparent at one time and the series returns to its previous level in the next moment of the series (δ=0, see panel 1, Figure 5.6). This situation can be modelled with a simple pulse response function. As seen in Equation 5.8, when a step function is differenced it becomes a pulse function. At the time of the intervention $t=T$, the introduction of the intervention, $I_t$ (coded as one), has impacted the series. The magnitude of the impact is measured by the regression coefficient $\omega_0$.

$$Y_t = \omega_0 I_t (1 - L) = \omega_0 P_t \quad \text{Equation 7}$$

A more typical situation however, is one in which the intervention effect decays more or less gradually over time; the pulsed impact can be represented by the formula in Equation 9 (Yaffee, 2000):

$$Y_t = \frac{\omega_0}{1 - \delta_1 B} P_t \quad \text{Equation 8}$$

This is a first-order pulse function which has a sudden peak and a more or less gradual return to its previous value. The value of delta determines the rate of attenuation, for example, when the rate parameter $\delta_1 = 1$, there is no decay and the effect is that of a step function (Figure 5.6). The closer the value of delta is to unity the slower or more gradual is the attenuation of the level of the series over time. On the other hand a delta parameter value of 0.1 or 0.2 results in a much steeper, more rapid decay of the level over time. A delta parameter with a negative value indicates decay with oscillation (Yaffee, 2000). This first-order pulse function is illustrated in the first panel of Figure 5.6.

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\textsuperscript{54} For both the first-order intervention components (the gradual permanent and abrupt temporary) the value of δ must lie within the bounds of system stability, that is to say, delta is constrained to $0 < \delta < 1$ (McDowall et al., 1980).
First-order transfer function \( Y_t = \frac{\delta_0}{1-\delta_1 B} I_t \) applied to a Pulse and a Step input - different values of \( \delta \).

**PANEL 1**

\[ f(I_t) = (1 - B) S_t = P_t \]

**PANEL 2**

\[ f(I_t) = S_t \]

---

**Figure 5.6:** First-order transfer functions applied to a Step & a Pulse input
TESTING DIFFERENT IMPACTS

So far I have discussed three possible impact patterns in accordance with Mc Cleary & Hay’s (1980) conceptualisation of impact along two dimensions: onset and duration. The first, simplest impact pattern was abrupt and permanent and determined by a zero-order step function. This intervention component, specifically the parameter omega (ω), estimated the difference in the level of the pre- and post-intervention series. The next two intervention components were first-order transfer functions, that is, we introduced a denominator parameter delta (δ) which allowed for a dynamic application of input (see Equation 5.7). When applied to a step function, this first order intervention component modelled a gradual, permanent pattern of impact. When applied to a pulse function, the first order transfer function modelled an abrupt temporary pattern of impact. The shape of these patterns varied, with different values of δ. Panels 1 and 2 in Figure 5.6 illustrate and compare the two first order intervention components for different values of δ.

Figure 5.6 also illustrates the relationships between the zero- and first-order transfer functions. The first row in the figure compares the impact patterns of a pulse and a step transfer function when delta, δ=0. Both functions are effectively zero-order components with identical equations (Box & Tiao, 1975):

\[
\frac{\omega_0(B)}{\delta_1(B)} S_t \quad \frac{\omega_0(B)}{\delta_1(B)} P_t
\]

At the other extreme, where δ = 1, the pulse function (P_t) also reduces to a zero order step function, that is, after an abrupt onset it never recovers. McCleary & Hay, (1980) present the algebraic working out of this as follows:

\[
f(I_t) = \frac{\omega_0}{1 - \delta_1 B} (1 - B)I_t = \frac{1 - B}{1 - \delta_1 B} \omega_0 I_t
\]

55 The first-order step function when δ = 1 is in effect a ‘ramp’ and is outside the bounds of system stability which is the same as nonstationarity. This is interpreted to mean that the event has affected a trend in the post intervention time-series process (Box & Tiao, 1975, Yaffee, 2000).
when $\delta = 1$, the operator terms cancel out and the first order transfer function reduces to the zero-order transfer function (p.169):

$$f(l_t) = \omega_0 l_t.$$

McCleary & Hay (1980) suggest that these relationships imply a simple method for testing which intervention component of the three is appropriate. First, we begin with the pulse input to model a temporary effect for a stationary series. If it is not temporary we will see evidence in the form of $\delta \geq 1$ which means precisely that the impact does not decay. Next, we test for a gradual permanent impact and if $\delta = 0$ a gradual pattern is ruled out and in fact reduces to the zero-order step function associated with an abrupt permanent impact. Thus, because the zero-order step and first-order step and pulse functions are related at the extremes of system stability (i.e. $0 < \delta < 1$), two of these three can be ruled out using this strategy. These impacts are based on lower order functions that typically account for most types of impact encountered in the social sciences.

**Goodness of Fit**

Akaike's information criterion (AIC) is an indicator of both the fit and parsimony of a model that adjusts for the number of parameters being estimated (Yaffee, 2000). The smaller the criterion number, the better the fit. It is also a measure of the most efficient prediction of model estimates.

**ANALYTIC APPROACH**

The stages of the data analysis are outlined below:

2. Identify the impact of the introduction of the third party policing intervention (across five time points) on methamphetamine treatment demand trends in Queensland.
3. Compare trends in methamphetamine treatment demand with trends for other drug types (quasi-control series) to identify any secular change that may have impacted all drug types.
4. Analyse the impact of the partnership on a number of drug treatment outcomes by examining changing trends in:
   - the characteristics of those who seek treatment for methamphetamine abuse (mode of administering the drug: injecting, smoking, ingesting or never injected); and
• treatment compliance of those in treatment for methamphetamine use.

A detailed description of the procedure I followed is outlined below.

**Step 1**

I constructed a treatment demand time-series for users in Queensland whose primary drug of concern was methamphetamine. Each of the five intervention time points had specific start points. The introduction of the legislated partnership in Queensland occurred in a series of steps between 2005 and 2008. Project STOP was rolled out in November 2005 in Queensland. Shortly after, pseudoephedrine was re-scheduled in two stages: in January and April of 2006. This was followed by the national roll out of Project STOP in August 2007. Although this did not lead to a change in the regulatory framework, the national rollout was accompanied by efforts at encouraging its uptake by pharmacists and a publicity campaign directed at customers. Another legislative change occurred in June 2008 when end-use declarations were required by police. The interventions will be introduced into the time-series as dummy variables (i.e. pre-intervention=0, post-intervention =1). The pre- and post-intervention segments will be examined to identify the form of the intervention effects (e.g. whether the intervention was associated with an abrupt temporary change, a gradual permanent change or an abrupt permanent shift to a new level). Second, the impact analysis will provide an estimate of the magnitude of the intervention impact. Finally, the analysis will determine whether the effects occur by more than random chance.

**Step 2**

I will use three quasi-control series to test the counterfactual that any impact of Project STOP was due to other secular or system factors. I will examine the NMDS for evidence of changes in voluntary admissions for other drug types (i.e. heroin, marijuana and alcohol). Results from the analysis of treatment admissions for other drug types will test the hypothesis that any change in treatment seeking for amphetamines was due to broader secular change that impacted treatment seeking for all drug types. In addition, I will analyse the impact of the interventions on coerced

56 See the legislative time-line presented in Chapter 3.
admissions for amphetamines. Analyses of the coerced admissions will test for the influence of the TPP intervention on criminal justice responses to methamphetamine users.

Step 3

I will analyse the impact of the interventions on a range of mechanisms suggested by Australian and overseas research that has examined the effect impact of drug supply suppression on trends in drug treatment and drug use patterns (Cunningham et al., 2008; Degenhardt, Conroy, et al., 2005; Degenhardt, Day, Conroy, et al., 2005; Roxburgh et al., 2004; Topp et al., 2003). This is the theoretical focus of the thesis in which possible mechanisms of change will be examined using the outcome time-series to test different context-mechanism-outcome (CMO) models (discussed in Chapter 4). First, a ‘compensation’ model of change suggests that in times of drug suppression users will compensate in part by changing their drug use behaviour by using more efficient ways to administer their drug of choice (Westermeyer, 1976). Second, an ‘intransigence’ model suggests that when drug supply is restricted, older, more dependent users will be more likely to continue using than will younger, less dependent users, who may switch drugs or leave the market altogether. Third, a ‘

‘model suggests that when a new drug source emerges extant drug behaviours can decline and new ones emerge (Ferrence, 2001). Finally, a ‘deterrence’ model (Clarke & Weisburd, 1994) suggests that suppressed drug supply (due to the introduction of the interventions) will result in increased compliance with treatment as users have greater (albeit external) incentive to seek help and exit the drug market.

The results of descriptive analyses of the AODTS-NMDS are presented in Chapter 6. This is followed in Chapter 7 by an analysis of the impact of the TPP intervention on treatment seeking. Then in Chapter 8 I report on the analyses that explore the mechanisms of change in drug use behaviour.
Chapter 6 Describing the Data – Characteristics of Drug Treatment Seeking in Queensland, 2003–2009

INTRODUCTION

The aim of this chapter is to present a descriptive analysis of the indicators that were created from the AODTS-NMDS for Queensland (2002/03 to 2008/09), and where possible compare with data from Australia (Australian Institute of Health and Welfare, 2010a). An exploration of the characteristics of this data was important for an understanding of the impact analyses conducted in the next two chapters, 7 and 8. I present these analyses in three sections. First I present descriptive analyses of the AODTS-NMDS closed treatment episodes, initially for Australia and Queensland. The second section presents more detailed analyses for Queensland. The final section is a summary and conclusion.

DESCRIPTIVE STATISTICS & BIVARIATE ANALYSES – AUSTRALIA AND QUEENSLAND

This section presents descriptive summary statistics of the AODTS-NMDS for Australia and Queensland from 2002–03 to 2008–09. The collection period for each census year is between 1 July and 30 June. The unit of analyses are closed treatment episodes, defined as a period of contact with definite commencement and cessation dates between an individual and a treatment provider (Australian Institute of Health and Welfare, 2011 p.4). The numbers of treatment episodes for Queensland have increased over time; however this is due largely to improvements in data

57 All the tables and figures reported in this section are based on the data provided by the AIHW either from the confidentialised unit record file (CURF) monthly count data extracted from the NMDS for Queensland, or from tables provided in the report on the National Minimum Data Set for Australia (AIHW 2011).

58 The analysis presented here includes only those seeking treatment for their own drugs use 98%, and excludes those seeking treatment for someone else’s drug use 2%.
reporting. Indeed, Queensland only started producing a state bulletin for the collection year 2008–09 in which it was noted that until 2007 Queensland did not provide comprehensive data delivered by publically funded non-government organisations (NGOs) who provide drug treatment services (Australian Institute of Health and Welfare, 2010b). Notwithstanding these concerns with data comprehensiveness, I will focus on patterns in the data and will compare Queensland with Australia where possible in order to validate as much as possible the findings presented here.

There was a total of 958,751 closed treatment episodes reported in Australia from 2002/03 to 2008/09; 115,571 (12%) of those were from Queensland. Table 6.1 presents the growth in closed treatment episodes for Queensland from 2002/02 to 2008/09 (see Table E.1 in Appendix E for Australia). In addition to percentage values for each year, I have included an additional calculation, per cent change\(^{59}\) in treatment episodes year to year. This statistic is useful for identifying which specific collection year experienced notable shifts in treatment episodes (AIHW 2010a, p.56).

Table 6.1, below, shows the increase in the number of closed treatment episodes in Queensland from collection year 2002/03 to 2003/04, which represents a proportionate increase of 32%. The growth in episodes in Australia for the same period was only 5% (Table E.1, Appendix E). In the following two years (2003/04 to 2004/05 and 2004/05 to 2005/06), Queensland showed growth of 10% and 22% respectively. This compares with 5% and 7% growth for the same years in Australia (Table E.1). The first three years of growth in reported closed treatment episodes in Queensland saw large increases that were likely due to improvements in the comprehensiveness of reporting from treatment establishments; specifically those from NGOs. Overall, closed treatment episodes in Queensland are likely to have been underreported in the first three years, and in particular in the first collection year reported here (2002/03).

---

\(^{59}\) Per cent change is the change in closed treatment episodes from one period to another expressed as a percentage of its value in the first period, and can be interpreted as an annual growth rate.
<table>
<thead>
<tr>
<th>Collection Year</th>
<th>f</th>
<th>%</th>
<th>% point change</th>
<th>% change</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002/03</td>
<td>13,556</td>
<td>8.9</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2003/04</td>
<td>17,912</td>
<td>11.8</td>
<td>+2.9</td>
<td>+32.1</td>
</tr>
<tr>
<td>2004/05</td>
<td>19,743</td>
<td>13.0</td>
<td>+1.2</td>
<td>+10.2</td>
</tr>
<tr>
<td>2005/06</td>
<td>24,159</td>
<td>15.9</td>
<td>+2.9</td>
<td>+22.4</td>
</tr>
<tr>
<td>2006/07</td>
<td>24,885</td>
<td>16.4</td>
<td>+0.5</td>
<td>+3.0</td>
</tr>
<tr>
<td>2007/08</td>
<td>26,332</td>
<td>17.4</td>
<td>+1.0</td>
<td>+5.8</td>
</tr>
<tr>
<td>2008/09</td>
<td>24,984</td>
<td>16.5</td>
<td>-0.9</td>
<td>-5.1</td>
</tr>
<tr>
<td>Total</td>
<td>151,571</td>
<td>100.0</td>
<td>7.6</td>
<td>14.0(^a)</td>
</tr>
</tbody>
</table>

\(^a\) This figure is the average annual percentage growth rate. Excluding the collection year 2002/03 from the time series yields a total percentage point difference from 2003/04 to 2008/09 of 4.7% and an average annual percentage growth rate of 6.6%.

The most prevalent principal drugs of concern for which Australians sought treatment between 2002/3 and 2008/09 were alcohol, amphetamines, cannabis and heroin (see Table E.2, Appendix E). Alcohol was the most widespread principal drug of concern in Australia, representing an average of 41% of closed treatment episodes over the study period; the next most prevalent drug of concern was cannabis (23%), followed by heroin (14%) and amphetamines (11%). In Queensland (Table E.4) on the other hand, the most prevalent principal drug of concern in treatment episodes was cannabis (40%)\(^60\), followed by alcohol (30%), amphetamines (9.2%) and heroin (4.6%).

In terms of growth rates in treatment episodes for these four drugs, there were marked differences in the magnitude of growth between Australian and Queensland trends (see Table E.3 and Table E.5). It is likely however, that these differences were due to the poor reporting in Queensland in the earlier years of the collection and in 2002/03 in particular (discussed above, see AIHW 2010b). In terms of the pattern of growth in treatment episodes for each drug there was remarkable

\(^60\) One reason why cannabis may be more prevalent than alcohol in treatment episodes in Queensland (when compared with Australia) could be the very high proportion of mandated treatment episodes for cannabis that are diverted from the criminal justice system (I will examine this issue further in the next section).
consistency between Australia and Queensland, especially when the collection year 2002/03 was omitted from the Queensland series^61 (see Table 6.2, below).

Overall, there was an increase in the average annual growth rate for alcohol in Australia (5.6%) and Queensland (16%) (see Table E.3 and Table E.5). There was positive growth over the collection period until 2008/09 when that year recorded negative growth for both Australia and Queensland. The pattern was similar too for cannabis and heroin, with trends in Australia and Queensland fluctuating between positive and negative growth over the collection period. The average annual growth rate for cannabis was 2.5% in Australia (for the period 2002/03 to 2008/09), and 5.4% in Queensland (2003/04 to 2008/09). Likewise, the average annual growth rate for heroin was very similar over the respective time periods; both experienced overall negative growth, -6.2% for Australia and -6.7% in Queensland.

Amphetamines, which are the primary focus of the analysis in this thesis, experienced a close to zero average annual growth rate for both Australia (-0.6%) and Queensland (0.3%). Closer examination of the trend in growth rate, however, reveals that for Australia there was between 4 and 8% growth in closed treatment episodes for amphetamines for the four years 2002/03 to 2006/07 (Table E.3). This growth was followed in the two subsequent years with negative growth: -4% in 2007/08 and -23% in 2008/09. The relatively large figure of -23% could be due in part to the underreporting of episodes in NSW due to system issues for 2008/09 (see AIHW, 2010a).

In Queensland (Table E.5) the outstanding year is 2005/06 which experienced a very large, 40% growth in closed treatment episodes (CTEs) for amphetamines from the previous collection year (2004/05). The comparable rate for Australia for that year was 7.8%. In all the other years Queensland recorded negative growth for amphetamines episodes. Alcohol and cannabis also experienced large percentage increases in episodes in that year (27% and 17% respectively). It was

^61 Closer visual examination of scatter plots of the monthly counts of closed treatment episodes for each of the selected principal drugs of concern from 2002/02 to 2008/09 revealed a marked break in the data between June 2003 and July 2003. These months represent the end and start dates of the new census year 2003/04. This break was consistent across all four drugs of concern, and was most likely an artefact of an improvement in reporting CTEs in Queensland, especially from 2003/04. The decision was made to drop the 12 time points from July 2002 to June 2003 from the Queensland data for the time-series analysis.
impossible at this stage of the analysis to discern to what extent this large percentage increase in episodes for amphetamines was due to improvements in reporting or to other external factors (for example, Project STOP which was introduced in November 2005). Other possible factors that may have impacted these trends can be examined by using other variables available in the NMDS. Further description and analyses of the drug series presented in the next section.

**Characteristics of Queensland Closed Treatment Episodes**

Table 6.2 below, presents selected characteristics of closed treatment episodes in Queensland for the collection years 2002/03 to 2008/09. The two demographic variables available in the NMDS that I accessed were age and sex. The table shows that the mean age of CTE’s across all the collection years was around 31 years; likewise the proportion of CTE’s that were male was consistently around 70%. Treatment outcome, a variable created by the AIHW and which I reproduced for this analysis, showed consistency across the collection years (see Chapter 5 for a full description). The other variable examined here was source of referral which indicated whether the CTE was ‘voluntary’ or ‘coerced’, that is, diverted to the health sector from the criminal justice system (CJS). This variable fluctuates from two-thirds of CTE’s being ‘voluntary’ in the 2003/04 (and one third ‘coerced’) to a roughly equal proportion of both in subsequent years.

**Table 6.2: Characteristics of Total Closed Treatment Episodes, Queensland, 2002/03-2008/09**

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Demographics</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Age (mean)</td>
<td>30.9</td>
<td>30.9</td>
<td>29.9</td>
<td>30.2</td>
<td>30.9</td>
<td>31.0</td>
<td>31.3</td>
<td>149,919&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Male (%)</td>
<td>69.9</td>
<td>69.7</td>
<td>69.1</td>
<td>70.6</td>
<td>70.3</td>
<td>70.6</td>
<td>71.3</td>
<td>106,220&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Source of Referral (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voluntary admission</td>
<td>49.0</td>
<td>63.4</td>
<td>52.0</td>
<td>48.4</td>
<td>49.8</td>
<td>50.2</td>
<td>48.8</td>
<td>74,639&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Coerced - diverted thru Court/Police</td>
<td>50.5</td>
<td>36.6</td>
<td>48.0</td>
<td>51.6</td>
<td>50.2</td>
<td>49.8</td>
<td>51.2</td>
<td>70,554</td>
</tr>
<tr>
<td>Treatment Outcome (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compliant</td>
<td>62.4</td>
<td>64.9</td>
<td>66.7</td>
<td>67.3</td>
<td>63.8</td>
<td>64.3</td>
<td>65.4</td>
<td>92,658</td>
</tr>
<tr>
<td>Non-Compliant</td>
<td>24.6</td>
<td>24.5</td>
<td>25.6</td>
<td>25.3</td>
<td>27.8</td>
<td>24.0</td>
<td>27.2</td>
<td>36,548</td>
</tr>
<tr>
<td>Changed treatment mode</td>
<td>13.0</td>
<td>10.6</td>
<td>7.8</td>
<td>7.4</td>
<td>8.3</td>
<td>11.7</td>
<td>7.4</td>
<td>13,143</td>
</tr>
</tbody>
</table>

<sup>a</sup> 1,652 episodes (1.1%) were excluded from the analysis because of missing values on this variable.
b 44,892 episodes (29.7%) were female, & 459 (0.3%) were missing.
c 5,937 (3.9%) were excluded from this analysis as they were episodes referred under the mental health act.

**Characteristics of Closed Treatment Episodes for Methamphetamine**

In this final section of descriptive analysis I present the growth trends for methamphetamine admissions in Queensland. This is followed by more detailed description of the characteristics of CTEs for amphetamines for ‘voluntary’ and ‘coerced’ admissions. This analysis compares the characteristics of the two groups of treatment episodes for amphetamines that differed by whether they voluntarily sought or were coerced into drug treatment. This comparison was important for subsequent analyses (Chapter 7 and 8) that examines the impact of the intervention on treatment seeking (voluntary admissions) and then unpacks further the causal mechanisms generating the impact of Project STOP and regulations on treatment episodes for amphetamines. Voluntary and coerced admissions are conceptually distinct social processes and the analyses below demonstrate some of the important differences between these two types of treatment admissions.

**Trends for Voluntary and Coerced Treatment Admissions for Methamphetamine**

Overall, there was a decline in voluntary treatment admissions for methamphetamine over the period 2002/03 to 2008/09 from 14% admissions to 9%. Prior to 2005/06 the proportion had been declining, however, in that census year there was a 30% growth in admissions, which was followed by a sharp decline in growth rate in subsequent years of nearly -4, -11 and -20% (2006/07, 2007/08 and 2008/09 respectively). In contrast, there was an overall growth in coerced treatment admissions, although only around 2%, from 3.7% in 2002/03 to 5.9% in 2008/09. In terms of growth rate however, 2005/06 was the year that saw the greatest increase in coerced admissions of 68% from the previous year. The next two years saw that growth decline dramatically to around 4% and the last year saw negative growth of -10%.
Table 6.3: Trends in Treatment Admissions for Methamphetamine, Queensland, 2002/03-2008/09

<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Voluntary Admissions</td>
<td>14.1</td>
<td>13.0</td>
<td>12.2</td>
<td>14.1</td>
<td>13.0</td>
<td>10.8</td>
<td>9.3</td>
</tr>
<tr>
<td>Percentage change</td>
<td></td>
<td>-15.0</td>
<td>30.0</td>
<td>-3.77</td>
<td>-11.3</td>
<td>-20.6</td>
<td></td>
</tr>
<tr>
<td>Coerced Admissions</td>
<td>3.7</td>
<td>5.1</td>
<td>4.8</td>
<td>6.1</td>
<td>6.4</td>
<td>6.4</td>
<td>5.9</td>
</tr>
<tr>
<td>Percentage change</td>
<td></td>
<td>34.6</td>
<td>34.3</td>
<td>67.9</td>
<td>3.8</td>
<td>3.8</td>
<td>-10.6</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>145,193</td>
</tr>
</tbody>
</table>

*The percentage base was 145,193 which was the total number of closed treatment episodes in Queensland for all major drugs over the study period.

**Demographic factors**

The mean age of voluntary episodes for amphetamines was slightly higher (31 years old) than that for coerced admissions (29 years old) (Table 6.3 and Table E.6). Further, the mean age for voluntary episodes remained stable across the study period whereas the average age for coerced episodes increased by small increments each year (see Table E.6). There was a much greater difference in the proportion of male episodes between the voluntary and coerced sub-groups. The proportion of voluntary admissions that were male ranged between 63% and 67% (mean=64%). The proportion of male coerced episodes on the other hand ranged between 73% and 78% (mean=75%).

**Injecting drug use**

In terms of method of use for amphetamines, both voluntary and coerced episodes saw a decline in episodes that reported injecting and a concomitant increase in smoking the drug. The magnitude of difference was greatest for coerced episodes, which saw a growth in smoking amphetamines from nearly 1% in 2002/03 to 12% in 2008/09 (Table E.6). The proportion of voluntary episodes that smoked was not only smaller but grew to a lesser extent over the study period.

Voluntary episodes remained the most likely to report injecting as their preferred method of use over the entire study period (Table 6.4). There was a decline in injecting drug use over the entire
period from 87% in 2002/03 to 80% in 2008/09 among voluntary admissions; however, this decline was much less than that of coerced admissions.

Although the majority of coerced episodes injected amphetamines, there was an overall decline in the proportion whose preferred means of administration was injecting (from 87% in 2002/03 to around 70% in the last two years of the data).

In terms of injecting drug use status the notable difference between the voluntary and coerced episodes for amphetamines was the growth in episodes of those who never injected drugs amongst the coerced episodes. Those coerced episodes who had never injected grew from less than 10% in 2002/03 to just over a quarter by 2008/09. The proportion of voluntary admissions that reported never injecting grew from 5.7% to 10.6% over the study period.

**Treatment compliance**

Compliance with treatment likewise differed between the two sub-groups. Treatment compliance amongst the voluntary episodes on the whole remained much the same, with around one-third of episodes complying and around one half not complying. The collection year 2006/07 saw non-compliance spike to 60% but returned to around 50% in subsequent years. Treatment compliance for coerced episodes grew from a little over one-third to nearly 80% in 2005/06 and thereafter declining to 70%. Non-compliance decreased from a high of 48% in 2002/03 to 17% in 2005/06, and thereafter rising somewhat.

---

62 Note that ‘current injector’ is not used in this or subsequent analyses as an indicator of injection drug use status due to the unacceptable high proportion of ‘missing’ reported for this variable.
Table 6.4: Characteristics of Voluntary Admissions for Methamphetamine, Queensland, 2002/03-2008/09.

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Demographics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (mean)(n=9,114)</td>
<td>39.9</td>
<td>28.3</td>
<td>30.8</td>
<td>30.0</td>
<td>30.0</td>
<td>30.3</td>
<td>30.0</td>
</tr>
<tr>
<td>Male (%) (n=9,070)</td>
<td>61.0</td>
<td>63.2</td>
<td>61.3</td>
<td>67.6</td>
<td>66.6</td>
<td>63.8</td>
<td>63.8</td>
</tr>
<tr>
<td>Method of Use (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ingests</td>
<td>10.4</td>
<td>12.2</td>
<td>12.9</td>
<td>9.3</td>
<td>10.6</td>
<td>11.1</td>
<td>10.9</td>
</tr>
<tr>
<td>Smokes</td>
<td>1.0</td>
<td>2.1</td>
<td>3.1</td>
<td>7.2</td>
<td>7.8</td>
<td>8.2</td>
<td>6.7</td>
</tr>
<tr>
<td>Injects</td>
<td>87.2</td>
<td>84.7</td>
<td>80.8</td>
<td>82.0</td>
<td>79.6</td>
<td>78.3</td>
<td>80.5</td>
</tr>
<tr>
<td>Sniffs/Inhales/Other</td>
<td>1.3</td>
<td>1.1</td>
<td>3.3</td>
<td>1.5</td>
<td>1.9</td>
<td>2.3</td>
<td>1.7</td>
</tr>
<tr>
<td>Injecting Drug Use (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current injector</td>
<td>81.0</td>
<td>74.8</td>
<td>76.4</td>
<td>71.3</td>
<td>75.8</td>
<td>74.0</td>
<td>72.1</td>
</tr>
<tr>
<td>3-12 months ago</td>
<td>9.9</td>
<td>12.1</td>
<td>9.8</td>
<td>11.6</td>
<td>7.5</td>
<td>8.5</td>
<td>11.0</td>
</tr>
<tr>
<td>More than 12 months ago</td>
<td>3.3</td>
<td>5.0</td>
<td>4.5</td>
<td>8.0</td>
<td>5.5</td>
<td>7.2</td>
<td>6.4</td>
</tr>
<tr>
<td>Never injected</td>
<td>5.7</td>
<td>8.0</td>
<td>9.3</td>
<td>9.1</td>
<td>11.2</td>
<td>10.3</td>
<td>10.6</td>
</tr>
<tr>
<td>Treatment (n=8,391)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compliant</td>
<td>29.3</td>
<td>42.0</td>
<td>34.0</td>
<td>38.2</td>
<td>27.0</td>
<td>29.9</td>
<td>36.4</td>
</tr>
<tr>
<td>Non-Compliant</td>
<td>49.0</td>
<td>44.7</td>
<td>52.5</td>
<td>49.1</td>
<td>60.1</td>
<td>45.5</td>
<td>52.7</td>
</tr>
<tr>
<td>Changed Mode of Tx</td>
<td>21.7</td>
<td>13.3</td>
<td>13.5</td>
<td>12.8</td>
<td>12.9</td>
<td>24.6</td>
<td>10.9</td>
</tr>
</tbody>
</table>

**Summary and Conclusion**

These initial findings reinforce the distinctiveness of the two types of admissions for methamphetamine treatment. The ‘voluntary’ group were slightly older, less likely to be male but most likely to be injecting drug users. Those users of amphetamines that were ‘coerced’ into treatment by the mechanism of the criminal justice system were younger, mostly males, who were more likely to smoke methamphetamine. There were marked differences in treatment compliance; not surprisingly coerced admissions were much more likely to be compliant and had the lowest proportion of non-compliance. Overall the greatest difference between the two groups was in the respective admissions growth rates, with voluntary treatment episodes declining most markedly over the study period. The annual increments presented here, however, are not sensitive enough to give a clear indication of whether the introduction of Project STOP in November 2005 was associated with this change.
The analysis also revealed a marked break in the data between June 2003 and July 2003 for the monthly counts of closed treatment episodes for each of the selected principal drugs of concern. These months represent the end and start dates of the new census year 2003/04. This break was consistent across all four drugs of concern, and was most likely an artefact of an improvement in reporting CTEs in Queensland, especially from 2003/04. I made the decision to drop the 12 time-points from July 2002 to June 2003 from the Queensland data for the time-series analysis. The ITSA presented in the following two chapters are based on seventy two time-points from July 2003 to June 2009.

In the next chapter I present the interrupted time-series analyses (ITSA), which assesses the impact of the third party policing intervention that rolled out across five time-points, on both voluntary and coerced closed treatment episodes for amphetamines. In addition, I use three quasi-control series to account for possible threats to validity: voluntary admissions for alcohol, cannabis and heroin. Interrupted time-series analysis is a powerful quasi-control experimental method that will enable me to assess whether precursor regulation had a significant impact on drug user treatment seeking in Queensland over the study period.
Chapter 7  THE IMPACT OF THE THIRD PARTY POLICING INTERVENTION ON TREATMENT SEEKING

INTRODUCTION

This chapter addresses the following research questions:

1. Did the TPP intervention impact on methamphetamine treatment seeking behaviour?
2. How did the TPP intervention impact on methamphetamine treatment seeking behaviour?
   a. What kind of impact did the TPP intervention have on treatment seeking behaviour? That is, was the impact abrupt or gradual, and was its duration temporary or permanent?
   b. Did the TPP intervention impact on treatment seeking behaviour for other drug types? Is there counterfactual evidence that the TPP intervention effect was due to other secular or system-wide factors?
   c. Did the TPP intervention impact diversion of drug users into treatment? That is, did the TPP intervention influence criminal justice system responses to methamphetamine users?

The aim of the analysis presented in this chapter is to use interrupted time-series analysis (ITSA) to evaluate the overall effectiveness of the TPP intervention. As discussed in Chapter 6 above, there were two types of methamphetamine user who underwent treatment for their drug use. The first group were admitted voluntarily, that is, they either self-referred, were referred by a health or other community service, or by family and friends. This voluntary group measured the underlying social process of treatment demand. The second group were compelled into treatment via the criminal justice system and thus did not measure treatment demand; they were instead used as an indicator of law enforcement intensity. The three quasi-controls that were analysed were voluntary treatment demand for alcohol, cannabis and heroin. The results from these analyses addressed the question of whether the third party policing intervention had significant impact on the demand for treatment for amphetamines, and what type of impact it had in Queensland.
Interrupted time-series analysis (ITSA) consists of two steps: first, I modelled the ‘noise’ component of the series using ARIMA: autoregressive \((p)\) integrated \((d)\) moving average \((q)\) analysis, or \((p, d, q)\). These three elements model the different types of serial autocorrelation that may be present in time-series data (see, Appendix B). Second, the model is diagnosed. The residuals from the ARIMA model are examined to determine whether all the autocorrelation in the data have been modelled. Formally, the null hypothesis that the residuals do not significantly differ from white noise is tested. The objective of ARIMA modelling is to render the series white noise. Once the noise component has been successfully modelled the impact analysis can commence. The impact analysis introduces an additional intervention component(s) into the model.

There was no á priori theory to determine the appropriate transfer function needed to model the impact of each intervention so I employed the hypothesis testing strategy suggested by McCleary & Hay (1980), and discussed in Chapter 5. To briefly summarise: I first test an abrupt temporary impact with a first-order pulse function. I then test a gradual permanent impact with a first-order step function. Finally I test for an abrupt permanent impact using a zero-order step function. Through this process I determine the correct impact pattern and the appropriate transfer function to input into the series.

Introducing an intervention component into a series that has been rendered white noise is a test of the null hypothesis that the series is white noise. If the interruption has a statistically significant impact on the series I can conclude that the exogenous ‘event’ did cause a change in the social process under observation; moreover I can determine the magnitude and duration of the impact. This is the procedure I followed when introducing each of the five intervention time-points into the series in succession. I determined the type of impact of one before introducing the next intervention time-point in turn and only retained those interruptions that had a significant impact. The results of these analyses of the AODTS-NMDS data for Queensland from July 2003 to June 2009 are presented below.

Voluntary treatment admissions for amphetamines

Figure 7.1 below presents the monthly counts of closed treatment episodes for voluntary admissions for methamphetamine from July 2003 to July 2009. The plot shows what appears to be a change in the level of the series upward from November 2005. The increase in treatment episodes appears to last for around a year or so and thereafter declines. However, before inferring that these apparent
changes in the series were due to the intervention(s), the data were checked for the potentially confounding effects of other stochastic processes using ARIMA analysis. This was followed by the impact assessment of the intervention. These two analyses together comprise interrupted time-series modelling (ITSA).

**Figure 7.1: Plot of Voluntary Methamphetamine Admissions**

*The ARIMA model*

Typically, an intervention segments a time-series into two, pre- and post-intervention. ARIMA analysis is conducted on the series prior to the intervention and then the effect of the intervention is tested. The recommended length for time-series analysis is a minimum of 50 observations (McCleary & Hay 1980). The entire series for amphetamines episodes was 72 observations; however there were only 28 observations prior to the introduction of the first intervention point in November 2005 (the roll out of Project STOP in Queensland). I did conduct an analysis on the pre-intervention series of 28 observations (though not presented here), and the ‘noise’ structure was the same as the one for the entire series. The ARIMA analysis of the entire series is reported next.

Identification is the first step in building an ARIMA model and so I specified an ARIMA (0, 0, 0) model for the series (VMETH) and inspected the ACF and other output. The results indicated that the series was not stationary, the ACF plot decayed very slowly and the estimate for the constant was significant, which was evidence that there was trend in the data. After differencing the series once, I
re-estimated an ARMA (0, 0) model. Inspection of the ACF and PACF plots indicated that the series still contained autocorrelation (see Figure 7.2, above).

Autoregressive and moving average processes leave unique patterns in ACF and PACF plots and a visual examination of them indicated a simple non-seasonal moving average model (Figure 7.2 below). The model I estimated was an ARIMA (0, 1, 1) and the output is presented in Appendix F. The moving average parameter maximum likelihood estimate was 0.70 (t=8.20, Pr > |t| < .0001). The autocorrelation check of the residuals indicated that they were not significantly different from white noise (Q-statistic to lag 6=2.58, Pr > ChiSq 0.82). The residual diagnostics are presented in Figure 7.3, below. The ACF and PACF plots indicate that the series are white noise, meaning that differencing the series and introducing a moving average component at lag one had rendered the series white noise. In other words, the data have been transformed into a series of random shocks. The intervention (dummy) variables were now introduced into the series in a regression type analysis which reveals whether that ‘interruption’ changes the level of the series. Sometimes referred to as ‘transfer functions’, the introduction of different forms of the intervention allows me to test which function best describes the impact.

![Trend and Correlation Analysis for VMETH(1)](image)

**Figure 7.2: Identifying the Series - Voluntary Amphetamine Episodes, ARIMA (0, 1, 0)**
The second stage of an interrupted time-series analysis is the impact assessment. The assessment consists of introducing the independent variable(s) (the intervention or interruption) and assessing their impact on the dependent time-series (see McCleary & Hay, 1980; McDowall et al. 1980; and Yaffee, 2000). An impact can vary by onset and duration, that is, the onset may be abrupt or gradual and its duration either permanent or temporary. Different forms of the intervention (transfer functions) are introduced to assess the effect of the intervention component.

Five intervention time-points were introduced sequentially into the series.

I. The first was in November 2005 when Project STOP (PROJSTOP) was rolled out in Queensland.

II. The second, in January 2006, consisted of two regulatory changes, first S2 pseudoephedrine products were re-scheduled to S3 pharmacy only medicine (see Appendix C, the SUSMP).
and the *Health Regulation 1996 (Qld)* was amended to require the production of photographic identification when purchasing S3 pseudoephedrine products (REG1).

III. Next was April 2006 when liquids and tables containing more than 800 or 780 milligrams (respectively) of pseudoephedrine were rescheduled to S4 *prescription only medicine* (REG2).

IV. The fourth intervention time-point was August 2007 the date when *Project STOP* (PROJSTP2) was rolled out nationally.

V. The final intervention time-point was the introduction of the mandatory reporting of pseudoephedrine sales (CRIMLAW) in Queensland in June, 2008.

Three of the five interventions had a significant impact on the treatment seeking for voluntary admissions for methamphetamine use. I present the sequence of these interruptions in Tables F.1, F.2 and F.3, (in Appendix F), which builds a picture of just how this third party policing intervention (which rolled out across a number of time-points) impacted drug user behaviour over time.

**Intervention 1 – PROJSTOP**

Following the hypothesis testing strategy discussed in McCleary and Hay (1980), three transfer function models were estimated and are presented in Table F.1 (Appendix F). The Model I is a first order pulse response which tested for an abrupt, temporary pattern of impact (discussed in detail in Chapter 5). The parameter \( \omega_0 \) was 29.93 with a t-value of 1.80, \( Pr>|t|=0.072 \). This parameter is a regression coefficient that can be interpreted as an increase of nearly 30 voluntary amphetamines admissions in the month of November with the introduction of *Project STOP*. The rate of change parameter \( \delta_1 \) for this model is in fact a rate of decay. After the first month of the intervention, the increase in voluntary amphetamines admissions declined (the closer the parameter is to 1 the slower the decline). The \( \delta_1 \) parameter was \(-.71 \) (\( t=-2.39, Pr>|t|=0.017 \)), the negative lambda value means that after the series level rose it decayed with oscillation (Yaffee, 2000 p.276-9). This model shows that the impact of *Project STOP* was an abrupt increase in treatment admissions that thereafter declined.

The other two impacts that were tested are shown as Model II and Model III in Table F.1 (Appendix F). Model II shows the results of the test for a gradual permanent impact of *Intervention I*. This model did not converge, indicating instability and thus a rejection of this hypothesis. The third impact tested for was an abrupt permanent effect. This model was not significant. On the basis of these results I retained a first-order transfer function for PROJSTOP and then introduced the next intervention which I present next.
**Intervention 1 & 2 – PROJSTOP + REG1**

The second intervention time-point January 2006 (REG1) was introduced into the series along with the abrupt temporary transfer function that represented the impact of PROJSTOP. I undertook the same procedure as above and tested the three types of possible impacts of the first stage of pseudoephedrine rescheduling (and the requirement for photographic identification). The results of these analyses are presented in Table F.2 (Appendix F).

Models I and II, which tested whether REG1 had an abrupt temporary impact or a gradual permanent impact on voluntary methamphetamine treatment seeking, were not significant. In other words, when REG1 was input as either a first-order step or first-order pulse function it had no impact. When the intervention was input as a zero-order step function, that is, as an abrupt permanent impact it was significant; the parameter estimate for this input was: $\omega_{02} = -1.25$ ($t=-2.06$, Pr>|t|<0.04). The first-order pulse function for PROJSTOP remained significant; the parameter estimates changed slightly with the introduction of *Intervention II*: $\omega_{01} = 35$ ($t=-2.29$, Pr>|t|<0.02) and $\delta_{01} = 0.68$ ($t=-2.37$, Pr>|t|<0.01). The zero-order parameter estimates (the $\omega_0$’s) are independent regression coefficients. These results show that after an initial abrupt increase in admissions of 35 there was an immediate decline in treatment seeking for methamphetamine. Two months later this was followed by an *abrupt permanent* drop in treatment seeking with the introduction of REG1. This drop was small, a little over one episode per month, but was nonetheless significant.

The two intervention components introduced so far had significant impacts on treatment seeking for methamphetamine use. The first intervention was *Project STOP* and it was associated with abrupt but temporary increase in treatment seeking beginning in November 2005. This was followed by a second abrupt permanent drop in treatment admissions from January 2006. I tested the impact of *Interventions III and IV*, which were Stage 2 of the rescheduling of pseudoephedrine in April 2006 and the national rollout of *Project STOP* in August 2007. Neither of these interventions had a significant impact on treatment seeking for voluntary admissions. I dropped these from the modelling and then tested the impact of the first two interventions, along with the final intervention, the introduction of mandatory reporting in June 2008 reported next.

**Intervention 1, 2 & 5 – PROJSTOP, REG1 & CRIMLAW**

Table F.3 (in Appendix F), presents the three impact models which tested for the type of impact that *Intervention V*, CRIMLAW had on treatment seeking. Model II, which tested for a gradual permanent
effect, was not significant. The parameter of Model III ($\omega_{03}$), which tested for the abrupt permanent impact of mandatory reporting, was -2.24 and was bordering on significant ($t=-1.76, Pr>|t|=0.08$); however, the model was unstable. Note, the moving average estimate was close to the bounds of invertibility ($\theta_1=0.99$), which meant that the series was no longer stationary. Model I, which input the intervention as an abrupt but temporary impact, was significant. The regression estimate $\omega_{03}$ was equal to an increase of around 32 episodes in that month (June 2008), which declined thereafter by a rate $\delta_3$ of 0.89, which is relatively slow. This intervention occurred close to the end of the series with only 12 time-points remaining following the introduction of mandatory reporting in June 2008.

In June 2009, the last time-point of the series, there were close to an additional nine episodes seeking treatment for methamphetamine. Given the pattern that occurred with the first two interventions, an abrupt temporary increase followed by a permanent drop in the series, it seems not unreasonable to conjecture that this may have occurred after the end of the current series, but this remains to be explored in future research.

I present the final interrupted time-series model that analysed the impact of precursor regulations on treatment seeking for methamphetamine drug treatment in Table 7.1, below. Three out of the five interventions that were input into the series had a significant impact on voluntary admissions. The residuals were not significantly different from white noise, indicating that the model was statistically acceptable. The equation that represents the impacts is:

$$(1 - B)Y_t = \left(\frac{\omega_{01}}{1 - \delta_1}\right) (1 - B)I_{29} + \omega_{02}I_{31} + \left(\frac{\omega_{03}}{1 - \delta_3}\right)(1 - B)I_{60} + (1 - \theta_1 B)a_t$$

where $Y_t$ represents the series that has been differenced by an order of one as indicated by the backshift operator, $(1 - B)$. There are three intervention functions, $I_{29}$, $I_{31}$ and $I_{60}$ where the subscripts represent the observation number of the interruptions that were input into the series (there were 72 time-points in total, with one lost due to differencing leaving 71 observations for the

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63 A further change happened after the end of the data I had for analysis and occurred in July 2010. In that month there was an end to a moratorium on section 285 (a) of the Health Regulation which mandated the use of an electronic online database such as Project STOP to record pseudoephedrine sales (using record books was no longer permitted); it remains to be seen whether this intervention saw a further permanent drop in treatment seeking (Queensland Health, Pharmacy Guild of Australia, & Queensland Police Service, 2010).
The final part of the equation indicates that an ARMA \((0, 1)\) model accounts for the noise component \((\sigma_t)\) of the equation.

*Project STOP* was rolled out in Queensland pharmacies in November 2005. In that month treatment seeking for methamphetamine increased by nearly 33 admissions. Two months later in January 2006, regulations commenced that rescheduled pseudoephedrine products so that they were only available in pharmacies and that when purchasing them the buyer had to produce photographic ID. This resulted in an immediate and sustained decrease in treatment seeking by nearly two admissions per month for the next 29 months. The introduction of an amendment to the Drugs Misuse Regulation that required pharmacists to report details of sales of pseudoephedrine to the QPS saw an increase of nearly 32 admissions in June 2008 when the amendment commenced. This increase was not permanent; however, its effect declined slowly over the months that followed and its effect was still felt at the end of the series. The supply-side drug law enforcement intervention aimed at preventing the diversion of precursor chemicals had significant impacts on treatment seeking. It would appear that different interventions had different impacts and understanding these patterns required further analyses, which is reported in the next chapter.

| Parameter                                                                 | Estimate | t Value | \(Pr > |t|\) |
|---------------------------------------------------------------------------|----------|---------|----------------|
| Project STOP rolled out, November 2005 (Qld)                             |          |         |                |
| \(\omega_{01}\)                                                          | 32.66    | 2.02    | 0.04           |
| \(\delta_1\)                                                             | -0.69    | -2.46   | 0.01           |
| Pseudoephedrine rescheduled to S3 & photographic ID required for purchase, January 2006 |          |         |                |
| \(\omega_{02}\)                                                          | -1.71    | -2.0    | 0.04           |
| Mandatory reporting, June 2008                                           |          |         |                |
| \(\omega_{03}\)                                                          | 31.99    | 1.97    | 0.05           |
| \(\delta_3\)                                                             | -0.89    | -8.15   | <.0001         |
| ARIMA                                                                     |          |         |                |
| \(\theta_1\)                                                             | 0.72     | 7.62    | <.0001         |
| Autocorrelation check of Residuals                                        | Chi-square | Degrees of freedom | \(Pr > \text{ChiSq}\) |
| \(Q_{24}\)                                                               | 16.29    | 23      | 0.843          |
Goodness of Fit

I compared the AICs of each of the significant models in Tables F.1, F.2 and F.3. Akaike’s information criterion (AIC) is an indicator of both the fit and parsimony of a model that adjusts for the number of parameters being estimated (Yaffee, 2000). The smaller the criterion number, the better the fit. It is also a measure of the most efficient prediction of model estimates. I compared the AIC for each of the significant models reported above. The AIC for Model I in Table 6.6 which consisted of the abrupt temporary impact of PROJSTOP was 611.85. For Model III in Table 6.7 which included the abrupt temporary impact of PROJSTOP followed by an abrupt permanent drop in treatment seeking with the introduction of REG1, the AIC equalled 610.84. The final model (Table 6.8) which consisted of the impact of PROJSTOP, REG1 and CRIMLAW had the smallest AIC number of 608.71. These information criterions indicate that not only was this last model the best fit but that together the three significant interventions predicted the changes in treatment seeking the most efficiently.

The Quasi-Control Series

In order to test the validity of the conclusions drawn so far I created three quasi-control series from the AODTS_NMDS for Queensland. It is possible that unmeasured system-wide factors (for example undocumented changes in treatment provision or recording) could have impacted admissions for methamphetamine. If there were secular changes such as these then it could be expected that these would impact on other drug series as well. The other drug series I analysed were the three other major drug types for which individuals seek treatment, namely, alcohol, cannabis and heroin. Voluntary admissions for alcohol appeared to shift upwards from April 2006 when admissions peaked at 519 in that month. Prior to April 2006 the average number of admissions was 349 per month and from April 2006 to June 2009 the average number was 496 (Figure 7.4). Cannabis admissions appeared to fluctuate steadily between 150 and 200 admissions per month. The plot for heroin admissions appears to have three shifts in the series mean. The first occurs early in the series after a peak of around 120 admissions in February 2004, followed by a decline to a low of 46 some 11 months later in January 2005. Admissions then rebounded to around a second (lower) peak of 69 in February 2005, which was followed in the next 10 months by a steep decline. The last 24 months of the series from July 2007 shows admissions fluctuating around a mean of 62 admissions per month.
Figure 7.4: Plots of Voluntary Admissions for Alcohol, Cannabis and Heroin Treatment
I further examined the alcohol, cannabis and heroin series and constructed ARIMA models for each. The ARIMA model that rendered the voluntary alcohol admissions white noise was a mixed model: $p=2$, $d=1$, and $q=1$, or ARIMA $(2, 1, 1)$. The cannabis series was modelled using ARIMA $(0, 1, 2)$. The heroin series was unable to be rendered white noise and was not used as a quasi-control. Using the impact hypotheses procedure described and illustrated above, I input each of the five interventions to test for any impact on the alcohol and cannabis series. The models indicated no statistically significant changes in the levels of any of these two series at the times of each of the five intervention points. The models are not presented here. These findings represent some validation that there were no system-wide confounding factor(s) that could have accounted for the impacts found in the voluntary admissions for methamphetamine. I turn now to an examination of the series for coerced treatment admissions for amphetamines.

**Coerced Treatment Admissions for Amphetamines**

The treatment admissions in this series are those individuals who were compelled into drug treatment from amphetamines by the criminal justice system. Figure 7.5 presents a time plot of the series from July 2003 to July 2009. The series appears to trend upwards from the beginning of the series until the end of 2005. Thereafter this upward trend appears to level out and then decline somewhat. I began the analysis by identifying and building an appropriate ARIMA model.

![Figure 7.5: Plot of Coerced Methamphetamine Admissions](image_url)
The results of the impact analysis are presented in Table 7.2, below. I undertook the same procedure as reported above, testing the impact of each intervention in succession and retaining only those interruptions that had a significant impact on the series level. Table 7.2 presents the impact, the ARIMA parameters and the residual diagnostics. The equation representing the impact \( I_{29} \) (PROJSTOP) introduced at the 29th observation in the series is:

\[
(1 - B)Y_t = \left( \frac{\omega_0}{1 - \delta_1} \right) (1 - B)I_{29} + (1 - \theta_1 B)a_t
\]

The residuals are not significantly different from white noise \( Q_{24} = 21.16, p < 0.511 \) so the model is statistically acceptable. The stochastic part of the model is an ARMA \((1, 1)\). Results from the impact analysis show that only one of the five intervention time-points is significant. The only significant impact occurred in November 2005 when Project STOP was introduced in Queensland. There was an abrupt increase of around 19 treatment admissions in that month, which was followed by a slow decline in admissions at a rate of \(-0.94\) per month. A decay rate of \(0.94\) is very slow and so I input the parameter estimates into the equation below to calculate how many months the impact was felt (see Yaffee 2000, p. 278):

\[
Y_t = \delta_1 Y_{t-1} + \omega_0 I_{29}(1 - \beta)
\]

The calculation of the duration of the impact of Project STOP on coerced findings showed that its impact was felt until the end of the series, when there was an additional increase in diverted episodes of nearly one and a half in the month of June 2009. These findings indicate that the third party policing partnership aimed at suppressing the supply of methamphetamine that was rolled out in Queensland had an effect on the criminal justice response to methamphetamine users. Demand side policing was effected by this supply side intervention, which manifests in this data as an increase in numbers of offenders who reported that methamphetamine was their principle drug of concern and who were diverted to drug treatment.
Table 7.2: Impact Analysis of Coerced Treatment Admissions for Methamphetamine

| Parameter | Estimate | t Value | Pr>|t| |
|-----------|----------|---------|------|
| **Project STOP rolled out, November 2005 (Qld)** | | | |
| $\omega_{01}$ | 18.85 | 2.48 | 0.01 |
| $\delta_1$ | -0.94 | -24.33 | <.0001 |
| **ARIMA** | | | |
| $\theta_1$ | 0.73 | 7.53 | <.0001 |
| Autocorrelation check of Residuals | Chi-square | Degree of freedom | Pr>| ChiSq |
| $Q_{24}$ | 21.16 | 22 | 0.511 |

**SUMMARY & CONCLUSIONS**

The problem of the diversion of precursors available from community pharmacies into the illicit market for manufacture into methamphetamine in Queensland was met with a comprehensive and coercive regulatory response by that State government. The Queensland government amended the regulatory framework already in place and mandated how pharmacists were to oversee the dispensing, recording and reporting of pseudoephedrine sales. The regulations put into place indirectly criminalised pharmacists who did not comply with the regulations. In order to assist their members to comply with the anticipated changes the local branch of the Pharmacy Guild developed, in partnership with the Queensland Police Service, the electronic medications recording system known as Project STOP. The introduction of this online data base was followed up with three regulatory changes that in effect created the most coercive regulations regarding the retail sale of precursor chemicals in Australia.

The interrupted time-series analysis presented in this chapter initially analysed voluntary treatment admissions for methamphetamine and demonstrated the significant impact of two of the regulations that were introduced after the initial significant impact of Project STOP. The impact of Project STOP was significant and it had an abrupt effect of increasing treatment seeking that then began to decline. Within two months of the rollout of Project STOP there were regulatory changes that commenced in January 2006. These changes were stage one of the re-scheduling of pseudoephedrine products to S3, *pharmacy only medicine*, and in addition, customers purchasing these products were required to produce photographic identification. These changes resulted in an
abrupt permanent drop in treatment seeking of two admissions each month for nearly two and a half years until June 2008. In that month the mandatory reporting of pseudoephedrine sales by pharmacists to the QPS commenced. The introduction of mandatory reporting saw an abrupt increase in treatment admissions in that month, which was followed by a slow decline in the following months.

I also explored the possibility that system-wide factors may have accounted for these impacts by analysing two quasi-control drug series. The quasi-control series were voluntary treatment admissions for alcohol and cannabis. None of the regulatory changes or the introduction of Project STOP impacted these series. This provides some validation of the findings reported in this chapter.

Finally, I examined the impact of the five intervention time-points on coerced admissions for methamphetamine. These admissions are diverted from the criminal justice system to drug treatment and are an indicator that the intervention effected criminal justice responses to methamphetamine users. The impact analyses I conducted indicated that the introduction of Project STOP resulted in the abrupt increase in coerced treatment admissions followed by a slow decay over the rest of the series. Demand side law enforcement was impacted by the roll out of a supply side drug law enforcement intervention.

In order to test the possible underlying mechanisms that gave rise to the changes observed here, I created additional time-series for analysis. I unpacked both the voluntary and coerced admissions series and created indicator series relating to treatment compliance and the mode of administration of methamphetamine. The descriptive analyses in Chapter 6 showed that methamphetamine admissions differed according to referral status (voluntary versus coerced) and also according to the main methods of administering methamphetamine. I hypothesise that analysing different subgroups of methamphetamine users who were in drug treatment may provide insights into the mechanisms that underlie behavioural changes in response to the introduction of the TPP intervention. I explore these issues in the next chapter.
Chapter 8 EXPLORING MECHANISMS OF CHANGE

INTRODUCTION

This chapter addresses the final step in the analysis and is the theoretical focus of the thesis. The aim of this chapter is to use the theory-driven evaluation framework developed in Chapter 4 to assess, in an innovative way, the range of mechanisms that influence changes in methamphetamine treatment seeking behaviour. This is a classic evaluation problem, that is, how do interventions introduced at the macro level lead to collective outcomes? All policies aim at change at the aggregate level, for example, reducing crime rates. The results reported in Chapter 7 demonstrated the impact of the intervention on the aggregate outcome, treatment seeking. In effect, those results report on a macro-macro relationship. The problem now is how to construct an explanatory model of these findings. The intervention itself and treatment seeking are processes embedded in a complex social reality; the causal processes between the intervention and outcome are potentially complex. The analysis reported here uses a quasi-experimental method placed within the logic of Pawson & Tilley’s principle of linking mechanisms to contexts and outcomes through examining context-mechanism-outcome-configurations (CMOC). The research questions addressed in this chapter are:

What are the mechanisms that link the macro-level TPP intervention to observed changes in methamphetamine treatment seeking behaviour?

   a.  How can these mechanisms be conceptualised?
   b.  How are these mechanisms observed in the data?

The findings in Chapter 7, which reported on the interrupted time-series analysis of the impact of the five intervention points, revealed three distinct impacts on voluntary treatment admissions: there was an abrupt temporary increase in treatment seeking (in November 2005), followed by an abrupt permanent drop with the introduction of regulatory changes in January 2006. Then in June 2008 when mandatory reporting was introduced there was another abrupt increase in admissions
followed by a decline in subsequent months. One intervention point impacted the coerced admissions: the introduction of Project STOP electronic medical recording system in November 2005. In this chapter I will explore, in detail, the impact of the TPP intervention on a number of measures (or contexts) of drug user behaviour.

I analysed the impact of the TPP intervention on a number of mechanisms suggested by Australian and overseas research that has examined the impact of drug supply suppression on trends in drug treatment demand and drug use patterns (Cunningham et al., 2008; Degenhardt, Conroy, et al., 2005; Degenhardt, Day, Conroy, et al., 2005; Roxburgh et al., 2004; Topp et al., 2003). Each mechanism was postulated via different context-mechanism-outcome (CMO) models. Pawson & Tilley’s (1997) seminal text Realistic Evaluation addresses the ‘black box’ issue through the development of the CMO approach. This approach stresses that the components of a ‘causal’ theory of impact include a context (C) and a mechanism (M), which account for an outcome (O). The logic of this approach is that causal outcomes follow from mechanisms acting in contexts (Figure 8.1). It is the mechanism that does the explanatory work, that is, an action (intervention) is causal only if its outcome is triggered by a mechanism acting in a context (Pawson & Tilley 1997, p.58, and see the discussion in Chapter 4).

Figure 8.1: Pawson & Tilley’s CMO Configuration
In this section I specify the details of the third party policing intervention introduced in Queensland from 2005 to 2008, and relate it to the different components of my model of drug use behaviour. Recalling the explanatory model introduced in Chapter 2 and discussed in Chapter 4 (see Figure 4.2 in Chapter 4), drug use behaviour is posited as emerging from four social and structural elements: a user, the illicit drug market, the state, and state agents such as the police and society, including third parties such as a community pharmacists. Left realist criminology points to a square (social system) of drug use behaviour that emerges from interactions between drug law enforcement and other agencies of social control in the community, the dynamics of the illicit drug market, and the motivations and actions of the individual drug user. Drug use behaviour is generated not just as the interplay of these four factors, but as social relationships between each point on the square. The social context of drug use consists of the immediate social interaction of these four elements and the setting of each of them within the wider social structure.

In Queensland, in the context of my study, the state government introduced regulations governing the supply of precursor chemicals at the retail level. Law enforcement in partnership with community pharmacies developed the electronic medical recording system known as Project STOP and worked together to address the issue of the diversion of pseudoephedrine products to the illicit market for manufacture into methamphetamine. The nature of the legislation that was introduced by the State government effectively co-opted community pharmacists, as agents of the state, to be responsible for the supply of pseudoephedrine to the general public for the legitimate purpose of providing relief from cold and flu symptoms.

As (third party policing) agents in the community, pharmacists are responsible for the way the medicine is managed, including how it is stored in the pharmacy and the conditions under which it is dispensed. They are responsible for recording details of its sale, and latterly, reporting these details to police, who can also access this information via the online database introduced to pharmacists in November of 2005 (Project STOP). In addition, the purchase of the Schedule 3 (S3) product (pharmacist only medicine) is personally overseen by the pharmacist and can only be made once the buyer produces acceptable photographic identification. Re-scheduling pseudoephedrine products to S3 (pharmacist only medicine) has meant that these products are now stored behind the counter, making them less accessible to the public. All these procedures and requirements are legislated in Queensland in health regulations and the Drugs Misuse Act and were introduced at different points in time between 2005 and 2008. Collectively, I refer to this intervention as the third party policing...
(TPP) intervention and its aim is to deter and/or apprehend ‘pseudo runners’ who, prior to the introduction of these regulations, could obtain these precursor chemicals freely over the counter and on-sell them to ‘cooks’, who then extracted the chemical and manufactured methamphetamine for distribution in the illicit drug market. As such, each of the intervention time-points of the TPP intervention are the situational mechanisms64 theorised as acting as a general deterrent for the diversion of the precursor chemical to the illicit market.

**THE SITUATIONAL MECHANISMS – STATE CONTROL THROUGH THIRD PARTY POLICING**

Situational mechanisms capture the macro-micro transition of how a change in the environment affects the opportunity structure, values and beliefs of an individual (Vaessen & Leeuw, 2010). Vaessen and Leeuw define ‘environment’ as ‘all the social, political, institutional, economic and physical conditions that surround the individual actor’ (p. 153). I operationalise ‘environment’ in this evaluation as the introduction of the TPP intervention, which consists of points in times when five different regulatory or policy changes were introduced:

1. *Project STOP*, the online electronic medical recording database was introduced into Queensland pharmacies – November 2005;

2. *Stage 1* Pseudoephedrine rescheduling: placed all current pseudoephedrine products (slow-release, combination and undivided preparations) in all pack sizes into Schedule 3 (*pharmacy only medicine*). In addition, the *Queensland Health Regulation (1996)* was amended to require photographic ID for the purchase of pseudoephedrine and that the sale is conducted under the supervision of the pharmacist – commenced January 2006;

3. *Stage 2* Pseudoephedrine rescheduling: Moved all liquid formulations containing more than 800mg of pseudoephedrine, and all combination or single ingredient products, such as capsules and tablets, containing more than 720mg of pseudoephedrine to Schedule 4 (*prescription only medicine*) – commenced April 2006;

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64 In the context of the discussion here *situational mechanism* refers to how a change in the environment (macro level) affects the opportunity structure of the individual and is one of Coleman’s social mechanisms discussed in Chapter 4. It does not refer to situational crime prevention which is another theoretical frame that I don’t deal with here.
4. *Project STOP* – rolled out on a national basis and the Australian Pharmacy Guild undertakes activities to promote the uptake of the database amongst community pharmacies – August 2007;

5. *Mandatory reporting* of pseudoephedrine sales: the *Drugs Misuse Regulation (1989) (Qld)* was amended and mandated that end-user declarations recorded by pharmacists were to be forwarded to the Commissioner of police. In addition, the possession of a combination of controlled ‘substances’ and ‘things’ that can be used to manufacture methamphetamine was prohibited – commenced, June 2008.

To sum up, the social and policy context for drug use behaviour was Queensland, Australia where various precursor regulations had been introduced since 1996 (see details in Chapter 3), culminating in the introduction of a specific technology (the electronic medical recording system which is an online database called *Project STOP*) in November 2005. The database was developed by the Queensland branch of the Australian pharmacy guild in partnership with the chemical diversion desk of the Queensland Police Service (Webster, 2012). The roll out of the software, which is a live online database and has GPS tracking capabilities, was followed up with a series of regulatory changes that re-scheduled the precursor chemical pseudoephedrine and its retail supply. The purpose of the *Project STOP* database was to assist pharmacists to meet the new regulatory requirement for the dispensing of pseudoephedrine, identify legitimate sales and alert police to suspect purchases. The consumption of amphetamines in Queensland from the 1990s through to around 2005 was characterised by growth, and thereafter it stabilised. The findings reported in Chapter 6 indicated that treatment demand for methamphetamine began to decline after 2005 and the analysis in Chapter 7 indicated that different situational mechanisms (i.e. the introduction of different intervention points) impacted treatment seeking for methamphetamine. The interrupted time-series analysis, however, did not answer the crucial research question of what were the causal processes that generated these impacts.

**The Action-Formation Mechanism – The Illicit Drug Market**

The action-formation mechanisms assumed to be at work here are illicit drug market dynamics for methamphetamine. It is at this micro level where insights and evidence provided by economic analyses of the role of the ‘price’ mechanism in influencing drug user behaviour are important. The available data measuring prices and/or purity and the availability of methamphetamine in Queensland is not adequate for assessing the impact of interventions such as the one I am concerned with here. It is collected from small samples of sentinel drug users on an annual basis
and is unable to capture, with fine detail, trends over time (S. Kinner, Fischer, & Lloyd, 2005; S. Kinner & Lloyd, 2006; Mclwraith et al., 2010). In addition, law enforcement drug seizure data reported by the Australian Federal and Queensland Police do not distinguish between types of amphetamines; that is, between crystalline methamphetamine, which is typically imported, and base methamphetamine which is much more likely to be manufactured locally, that is, in Queensland clandestine laboratories.

The importance of drug prices (and its corollary, purity) comes from economic research evidence, which hypothesises that, ceteris paribus (other things being equal), drug law enforcement aimed at preventing the diversion of precursor chemicals to the illicit drug market will increase prices and decrease the purity of methamphetamine (J.P. Caulkins & Reuter, 1998; Reuter & Kleiman, 1986). The logic of the ‘prices & risks’ theory of illicit drug markets is as follows: the unit cost of illicit drugs is extraordinarily high due to its illegality, and given the high prices and potential for dependence, spending, especially for heavily dependent users, will account for a significant proportion of their disposable income. Therefore, ‘one would expect drug prices, and changes in those prices, to affect users’ behaviour’ (Caulkins & Reuter, 1998, p. 595).

The costs of producing illicit drugs such as methamphetamine include procuring precursor chemicals and the equipment to manufacture the drug, the costs associated with labour, loss through seizures, and compensation for the risks of incarceration and physical harm (Reuter & Kleiman, 1986). Law enforcement efforts to contain drug markets keep the costs of drug production high. The third party policing initiative outlined above could be expected to produce a spike in drug prices; however, subsequent increases are typically transient as drug suppliers adapt by modifying their operations, such as seeking alternative sources of precursors, changing manufacturing methods, and so on (J.P. Caulkins & Reuter, 2006; Ritter, Bright, & Gong, 2012)

Analysis of price and purity data where available has established ‘beyond doubt that drug use responds to variation in price, even for dependent users’ (J.P. Caulkins, 2007, pp. 62, emphasis added). Indeed, a behavioural economic study conducted in Australia using a sample of
methamphetamine users provides evidence supporting this claim\textsuperscript{65} (Chalmers, Bradford, & Jones, 2009). The findings from the study showed that as the price of methamphetamine increased purchases decreased significantly, that is, a 10% increase in price led to and 16–27% fall in the quantity purchased. Among methamphetamine users increases in price did produce some substitution into heroin and pharmaceuticals, although where substitution did occur, the fall in consumption of methamphetamine was considerably greater than was the increase in consumption of other drugs.

The research evidence from overseas studies (Cunningham et al., 2009; Dobkin & Nicosia, 2009) examining the impact of diversion controls aimed at the retail sale of pseudoephedrine supports the conjecture that precursor controls introduced in Queensland will impact the price and purity of methamphetamine in the local illicit market. Regulatory changes relating to the prevention of precursor diversion from retail sales significantly impacted price and purity in the United States, with prices tripling and purity decreasing from 90 to 20%. The effect was temporary however, lasting only four months (Cunningham et al., 2009). Law enforcement activities against a rogue chemical company had a similar impact. Of note, concurrent with the increase in prices and decrease in purity there was a significant increase in treatment seeking and a drop in arrests for methamphetamine (Dobkin & Nicosia, 2009).

The theoretical and empirical work presented here provides support for the assumption that the introduction of precursor controls in the present study could be expected to impact the price and purity of methamphetamine in the local market. The evidence reviewed supports the argument from the ‘prices & risks’ economic frame that supply suppression can be expected to produce a spike in prices that will last until the drug market adjusts to a new equilibrium. The final type of mechanism that is of core concern in the impact analysis is the transformation mechanism. It is this mechanism that will be incorporated in the CMO configurations discussed below.

\textsuperscript{65} The investigators recruited a sample of 100 self-reported methamphetamine users from healthcare facilities in New South Wales. This group were older (mean age of 57) polydrug users: 91% were injection drug users and around one-third reported that methamphetamine was their primary drug of choice, 41% reported primarily using heroin. Participants were given a fixed budget and a range of drug pricelists and asked how many units of each drug they would buy with their drug budget. Prices of methamphetamine and heroin were varied across a succession of trials and the quantity of each drug purchased was recorded.
Context-Mechanism-Outcome Configurations

Context-mechanism-outcome pattern configurations are models ‘indicating how programmes activate mechanisms amongst whom and in what conditions, to bring about alterations in behaviour or event or state regularities’ (Pawson & Tilley, 2006, p. 8). These configurations bring together mechanism-variation and context-variation to explain outcome pattern variation and a table presenting the hypothesised outcome patterns is presented in Table 8.1, below. In the discussion above (and in detail in Chapter 3) I have described the macro-level drug policy environment in Queensland, where a comprehensive range of regulations were introduced over a four year period. Next I will outline the hypothesised mechanisms and the proposed outcome patterns that would arise from them if they are triggered, the different contexts, and the impact outcomes that were explored in the interrupted time-series analysis, which is reported last.

Mechanisms & Outcome Patterns

There has been much research that has examined the impact of drug supply reduction on drug use patterns. Criminological research also suggests that crime prevention efforts may deter ‘offenders’ from engaging in criminal actions; the counterfactual to this theory is that crime may displace to other places or times (Weisburd & Green, 1995). This research provides evidence that drug users adapt to changes in illicit drug markets and suggests a number of possible ‘causal’ mechanisms. Three of the mechanisms postulated here were drawn from prior research on the impact of precursor regulation on amphetamine users in the United States (Cunningham et al., 2008) and from the impact of the heroin shortage on treatment outcomes in Australia (Degenhardt, Conroy, et al., 2005). The fourth mechanism is drawn from deterrence theory. Together these mechanisms comprise the ‘theories of change’ tested in this chapter. They were analysed by conducting interrupted time series on the various indicator variables developed and described in Chapter 5 (Methods). Each of these indicator variables was initially examined in the descriptive analysis section of Chapter 6. The mechanisms and the hypothesised outcome patterns to be tested are explained next and summarised in Table 8.1.

Compensation

The first hypothesised transformational mechanism is ‘compensation’. This theory of change suggests that when drug supply is suppressed users will compensate by using more efficient ways to administer their drug of choice (Westermeyer, 1976). The expected pattern of outcome from the
impact of the diversion interventions on treatment seeking for methamphetamines if this mechanism is triggered is:

- the prevalence of injecting amphetamines reported in treatment episodes will increase in association with the intervention;
- ingesting will decrease.

**Intransigence**

An ‘intransigence’ mechanism triggered when drug supply is restricted will result in older, more dependent users finding ways to continue using (including substituting to other drugs\(^{66}\)), while younger, less dependent users may leave the market (Kleiman, 1988). Drug use behaviour change (as reflected in treatment episode trends) hypothesised under this model is:

- the number of episodes who had never injected amphetamines will decrease in association with the intervention;
- injecting will stay the same.

**Diffusion**

A ‘diffusion’ model suggests that when a new drug source emerges extant drug behaviours can decline and new ones emerge (Ferrence, 2001). Precursor regulation in Australia was designed to suppress locally manufactured amphetamines; however, the illicit drug market may adjust by importing the drug from overseas. Domestically produced methamphetamine is typically ‘base’ or ‘powder’, and not the most potent crystallised form called ‘ice’, which requires a special manufacturing process. Typically, ice is imported into Australia and it is often smoked. This mechanism hypothesises that if the market adapts and replaces the suppressed supply of locally produced methamphetamine with ‘ice’ from overseas then the hypothesised outcome pattern would be that:

\(^{66}\) The impact analysis reported in Chapter 7 showed no evidence of users substituting to either alcohol or cannabis. This is consistent with Chalmers (et al, 2009) study which found that while price increases in methamphetamine was associated with some substitution to other drugs it was not enough to translate into a population level change.
• an increase in smoking could be expected to be reported in treatment episodes, if the source of supply changes from domestic production of base and methamphetamine to the importation of ice;
• on the other hand, injecting and ingesting the drug could be expected to follow trends in domestic production following the introduction of the intervention. Using the detections of clandestine laboratories during the study period as a market indicator (Berbatis, Sunderland, & Dhaliwal, 2009), injecting and ingesting could be expected to drop after the introduction of the intervention.

**Compliance**

The fourth model of change was conceptualised within the rational choice framework. The way that deterrence could be triggered by supply suppression was by users facing restricted drug supply having greater incentive to seek help and the outcome pattern hypothesised is:

• users motivated to exit the methamphetamine market and who enter treatment will increase their compliance with that treatment;
• conversely, the number of episodes that ended due to non-compliance will decrease.

**Desistance**

Another way that deterrence could operate is that supply suppression triggers drug users to desist from using and motivates them to exit the methamphetamine market altogether. The outcome pattern in this case would be:

• an overall permanent decline in injecting and smoking methamphetamine.

**Contexts**

The analyses in Chapter 6 revealed an important dimension of treatment seeking behaviour and that was between users voluntarily referring themselves for treatment and those who were mandated for treatment by the criminal justice system (CJS). These two groups of drug users were analysed separately. The reasoning for this is that those who are diverted ('coerced') into treatment by an institutional mechanism, namely, the criminal justice system are likely to be representative of a different type of treatment admission compared with the ‘voluntary’ episodes who are motivated by
changes in the drug market dynamics for methamphetamine. This distinction is important when interpreting the meaning of the ensuing analyses (which is done in the following chapter 9).

The realistic evaluation approach assumes that mechanisms are triggered under particular circumstances, and in the case of drug use behaviour, the context of the individual user was conceptualised in two ways. The first important attribute of illicit drug users is the mode of administration used to deliver the drug. Mode of administration has important implications for drug harms including risk of dependence and infection with blood-borne viruses (Darke, Cohen, Ross, Hando, & Hall, 1994; Domier, Simon, Rawson, Huber, & Ling, 2000; Hall, Darke, Ross, & Wodak, 1993; McKetin et al., 2008). The main modes of administration measured by the data are injecting, smoking, ingesting and never injected.

An additional context considered relevant here was that the only treatment outcome variable in the AODTS-NMDS which measures treatment is compliance. Details of how this indicator variable was constructed are in Chapter 5. Treatment compliance is a measure of the successful completion of a treatment episode and indicates co-operation with the treatment provider. Non-compliance is an indicator that a client ceased treatment against advice, or a coerced client was sanctioned by drug court or imprisoned for non-co-operation with the treatment provider. All these contexts are listed in Table 8.1.

**Outcomes**

There are three types of impact pattern that are tested in the interrupted time-series analyses. These are first, an abrupt permanent impact, second, a gradual permanent impact, and third, an abrupt temporary impact. These impacts can be either an increase or a decrease in the series level; thus in all there are six possible impact outcomes (see Table 8.1). I conducted interrupted time-series analysis testing each of the possible context-mechanism-outcome patterns hypothesised in Table 8.1 and present the results in the next section.
Table 8.1: Context-Mechanism-Outcome Hypothesis Grid of the Impact of the Third Party Policing Intervention

<table>
<thead>
<tr>
<th>Policy Interventions (I) (Independent Variables)</th>
<th>Contexts – Voluntary &amp; Coerced Admissions (C) (Dependent Variables)</th>
<th>Mechanisms (M) (Unobserved)</th>
<th>Outcomes (O) (Observed possible pattern for each dependent variable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I₁ Project STOP Qld rollout (Nov 2005)</td>
<td>C₁ Injecting</td>
<td>M₁ Intransigence</td>
<td>O₁ Episodes increase abruptly &amp; permanently</td>
</tr>
<tr>
<td>I₂ Pseudo reschedule, Stage I (Jan 2006)</td>
<td>C₂ Smoking</td>
<td>M₂ Compensation</td>
<td>O₂ Episodes decrease abruptly &amp; permanently</td>
</tr>
<tr>
<td>I₃ Pseudo reschedule, Stage II (April 2006)</td>
<td>C₃ Ingesting</td>
<td>M₃ Diffusion</td>
<td>O₃ Episodes increase gradually &amp; permanently</td>
</tr>
<tr>
<td>I₄ Project STOP National rollout (Aug 2007)</td>
<td>C₄ Never Injected</td>
<td>M₄ Compliance with treatment</td>
<td>O₄ Episodes decrease gradually &amp; permanently</td>
</tr>
<tr>
<td>I₅ Mandatory reporting (Jun 2008)</td>
<td>C₅ Treatment compliance</td>
<td>M₅ Desistance</td>
<td>O₅ Episodes increase abruptly &amp; temporarily</td>
</tr>
<tr>
<td></td>
<td>C₆ Treatment non-compliance</td>
<td></td>
<td>O₆ Episodes decrease abruptly &amp; temporarily</td>
</tr>
</tbody>
</table>

**Analyses**

The interrupted time-series analysis (ITSA) of the impact of the five intervention points are presented here. The analysis is in two parts: first I present the results for the voluntary admissions, and then the analysis of the coerced admissions. The indicator series that were developed for the analysis correspond with the various drug user contexts presented above (and see Table 8.1).

Accordingly, there are six contexts for both the voluntary and the coerced admissions that are analysed: C₁ injecting, C₂ smoking, C₃ ingesting, C₄ never injected, C₅ treatment compliance and C₆ treatment non-compliance. First I will present time-plots for each of the six series. After describing the plots I conducted an ITSA that successively introduced each of the five interventions (I₁,₅) into the series (C₁₋₆) and tested which of the six possible outcome patterns (O₁₋₆) was significant. I follow the same procedure as was presented in Chapter 7 and only report significant impacts here.
VOLUNTARY ADMISSIONS

The procedure used to conduct the impact analysis is the same as that reported in Chapter 7. After identifying each series, \((C_1 \text{ to } C_6)\) and fitting appropriate ARIMA models I was able to render each of the six context series white noise. I then entered each of the five interventions \((I_1 \text{ to } I_5)\) in succession and tested the type of impact by introducing each of the three different transfer functions: abrupt temporary, gradual permanent or abrupt permanent. I only retained significant intervention transfer functions before introducing the next intervention for impact assessment. In all there were six series that were analysed where three transfer functions were introduced for each of the five interventions. I present the time plots for the significant series first before reporting the results of the interrupted time-series analysis.

Significant impacts of one or more of the interventions were found for three of the drug use contexts hypothesized above. The significant contexts are injecting and smoking methamphetamine and non-compliance with treatment. The interventions that were significant are different to those found to impact the total treatment seeking series. This supports the notion that the drug user context series are measuring different social processes compared with the overall series, which measures treatment seeking. The time-plots of the three series also reflect this and I discuss them next.

Time-plots

The time-plot for injecting methamphetamine (top panel in Figure 8.2) has a very similar trend line to the overall treatment admissions series for voluntary episodes for methamphetamine (see Figure 7.1). This will be because over 80% of treatment admissions for methamphetamine report injecting the drug as their preferred method of administration. The time-plot indicates that the trend for injecting was declining from July 2003 when the series begins, until towards the end of 2005. The admissions of those who inject methamphetamine then spiked around November 2005 when Project STOP was introduced. Thereafter, injecting methamphetamine appears to decay slowly over the rest of the series. There does, however, appear to be a break in the level of the series after June 2008. Indeed the mean number of injecting methamphetamine admissions after June 2008 is around 73 and the average prior to that is 82 episodes.
Figure 8.2: Time Plots of Significant Context Variables: Injecting, Smoking & Non-compliance – Voluntary Admissions
Smoking methamphetamine (found in the middle panel of Figure 8.2) fluctuates around an average of three and a half episodes per month until January 2006, after which there appears to be a spike upwards. Indeed, for the next three months the treatment episode counts of smoking methamphetamine are more than trebled. From April 2006 onwards the level of the series drops and fluctuates around a mean of eight and a half episodes, so smoking methamphetamine remains at a higher level to that in the first part of the series.

The third context series that experienced significant impact(s) from the TPP intervention were those non-compliant treatment admissions for methamphetamine. This series fluctuates around an average of 57 non-complying episodes until July 2007. There is a steep drop in non-complying from August 2007 until June 2008 when it appears to start to increase again. The number of non-compliant episodes from August 2007 to May 2008 dropped to an average of 48 episodes per month. There is a large spike in non-compliance after June 2008, although this starts to decline again fairly quickly. The average number of non-compliant episodes from June 2008 to the end of the series is 45, so even though non-complying spikes upward, the average number of non-compliant episodes from that time is still fewer than that of the first part of the series.

C. Injecting methamphetamine

Table 8.2 present the results of the impact analysis of the five intervention time-points on episodes that reported injecting methamphetamine as their preferred mode of administering the drug. Only one intervention had a significant impact and that was the last one in June 2008, the introduction of mandatory reporting. I tested for an abrupt temporary impact, a gradual permanent, and an abrupt permanent effect. The results show that the introduction of mandatory reporting of sales of pseudoephedrine by pharmacists to the Queensland Police Service was associated with an abrupt and permanent drop in treatment seeking of around two and a half episodes per month ($\omega_{01}=-2.5$, $t=-1.73$ $p=0.08$).

Recall the impacts of the interventions on total treatment admissions analysed in Chapter 7. Treatment seeking was impacted by three of the five interventions. There was an initial upward spike in help seeking with the introduction of Project STOP in November 2005, followed by an abrupt drop in the series level in January 2006. When mandatory reporting was introduced in June 2008 there was another upward spike. These impacts resulted from the introduction of a number of changes to the way pseudoephedrine is governed at the retail level and suggest that taken together, users of methamphetamine who sought help for their drug use were responsive to the presumed effects on drug supply of precursor diversion interventions. The result below suggests that injecting
drug users, who are older and more dependent, were able to withstand the effects of the four prior interventions on drug supply until the most ‘coercive’ one was introduced in 2008.

Table 8.2: Impact Analysis of TPP Intervention on Injecting Methamphetamine – Voluntary Admissions

| Parameter                                      | Estimate | t Value | Pr>|t| |
|------------------------------------------------|----------|---------|-----|
| Mandatory reporting, June 2008                 |          |         |     |
| $\omega_{01}$                                   | -2.5     | -1.73   | 0.08|
| ARIMA                                           |          |         |     |
| $\phi_{1}$                                      | 0.72     | 5.66    | <0.0001|
| $\phi_{11}$                                     | 0.25     | 2.11    | 0.03|
| Autocorrelation check of Residuals              | Chi-square | Degrees of freedom | Pr>|ChiSq|
| $Q_{24}$                                        | 15.61    | 22      | 0.83|

C₂ Smoking methamphetamine

Table 8.3 shows the results of the impact analysis of the five intervention time-points on admissions who reported that smoking methamphetamine was the mode of administration they used. Two different interventions had a significant impact on this series. Both the regulations, stage one and two of the rescheduling of pseudoephedrine, had significant impacts, but in opposite directions. The introduction of the first stage of the rescheduling in January 2006 was associated with an abrupt permanent increase in treatment seeking among those who smoked amphetamines of nearly three episodes per month. However, only two months later in April 2006 stage two of the rescheduling of precursor chemicals saw a significant and permanent drop in treatment seeking among those who smoked methamphetamine of nearly three episodes. So despite the overall trend of increased smoking of methamphetamine revealed in the analysis in Chapter 6 and seen in the time plot above, the second precursor diversion intervention was associated with a permanent drop in smokers who sought help. This may indicate that an alternative source of supply of smokable methamphetamine, which is imported, did not emerge in the illicit methamphetamine market in Queensland.
Table 8.3: Impact Analysis of TPP Intervention on Smoking Methamphetamine – Voluntary Admissions

| Parameter | Estimate | t Value | Pr>|t|
|-----------|----------|---------|-----|
| Pseudoephedrine rescheduled to S3 & photographic ID required for purchase, January 2006 | | | |
| $\omega_{01}$ | 2.59 | 4.29 | <.0001 |
| Pseudoephedrine rescheduled to S3 to S4 | | | |
| $\omega_{02}$ | -2.76 | -4.24 | <.0001 |
| ARIMA | | | |
| $\varnothing_1$ | 0.79 | 5.53 | <.0001 |
| $\varnothing_{10}$ | 0.19 | 1.81 | 0.07 |
| Autocorrelation check of Residuals | Chi-square | Degrees of freedom | Pr>|ChiSq |
| $Q_{24}$ | 12.73 | 22 | 0.94 |

C6 Treatment non-compliance

The third series that was impacted by the TPP intervention was treatment non-compliance. The descriptive analysis in Chapter 6 showed that voluntary methamphetamine admissions were the least compliant with treatment (after heroin admissions). The results in Table 8.4 show the results from the impact analysis of the five intervention time-points on admissions that were non-compliant with treatment. Two of the interventions significantly impacted this series. The national rollout of Project STOP in August 2007 was associated with a significant drop in non-compliant episodes numbering close to four and a half per month ($\omega_{01}=-4.32$, t=-2.45, p=0.01). Following the abrupt drop in episodes the impact decayed at a rate of .96 thereafter. A decay rate of .96 is very slow and so I input the parameter estimates into the equation below to calculate how many months the impact was felt (see Yaffee, 2000, p. 278):

$$Y_t = \delta_1 Y_{t-1} + \omega_0 I_{50}(1 - \beta)$$

A drop in episodes is evident right up until the introduction of mandatory reporting in June 2008. One month prior to the introduction of mandatory reporting, treatment non-compliance had decreased by -2.82 episodes. The introduction of mandatory reporting in June 2008 saw an abrupt shift upwards of 10.69 episodes of non-compliance. The decay rate of this temporary increase was
0.7 so it was a relatively faster decline than was the first impact. The increase in the number of non-complying episodes that resulted from this intervention was felt for around six months.

The introduction of the third party policing partnership that governed the supply of precursor chemicals to the public and presumably suppressed the supply of the illicit drug methamphetamine had a contradictory impact on episodes that did not comply with treatment. Treatment non-compliance among seekers of treatment for methamphetamine was not affected for nearly two years after the initial rollout of Project STOP in 2005. The national rollout of Project STOP in the middle of 2007 did impact non-compliance, which dropped. This is a positive result, indicating that a different sort of methamphetamine user began to seek treatment, one who was less likely to not comply. There was no impact of any of the interventions on compliance, which means that non-compliers were not entering treatment and becoming compliant.

The second impact associated with the introduction of the most coercive component of the TPP intervention seems somewhat paradoxical. Presumably the introduction of mandatory reporting increased pressure on the illicit market and impacted supply; however, instead of encouraging or motivating users to leave the market via treatment there was a spike in non-compliant users seeking treatment. This unintended consequence could be a form of displacement of users who were ‘unwilling’ to leave the market but who were nonetheless compelled by market dynamics into treatment.
Table 8.4: Impact Analysis of TPP Intervention on Treatment Non-Compliance – Voluntary Admissions

| Parameter | Estimate | t Value | Pr>|t| |
|-----------|----------|---------|---------|
| Project STOP national roll out, August 2007 | | |
| $\omega_{01}$ | -4.32 | -2.45 | 0.01 |
| $\delta_{1}$ | 0.96 | 14.77 | <.0001 |
| Mandatory reporting, June 2008 | | |
| $\omega_{02}$ | 10.69 | 2.14 | 0.03 |
| $\delta_{1}$ | 0.70 | 2.71 | 0.007 |
| ARIMA | | |
| $\theta_{1}$ | 0.75 | 9.09 | <.0001 |
| Autocorrelation check of Residuals | Chi-square | Degrees of freedom | Pr> ChiSq |
| $Q_{24}$ | 12.58 | 23 | 0.96 |

COERCED ADMISSIONS

Previous research on the impact of precursor regulations on treatment admissions (Cunningham & Lui, 2008) divided voluntary from coerced admissions but did not explore in any detail outcome patterns for coerced admissions. The analyses in Chapter 6 revealed that not only were treatment episodes for voluntary admissions impacted by the TPP intervention, so were treatment episodes for coerced admissions. Coerced admissions can be conceptualised as an indicator of criminal justice system responses to methamphetamine users that divert drug-related offenders into treatment. In addition, coerced episodes represent another ‘transformational’ mechanism; in this case it is an institution, the criminal justice system. The third party policing intervention is a supply-side drug law enforcement initiative. Examining possible context-mechanism-outcome patterns for this drug user context provides an opportunity to examine the impact of a supply-side drug law enforcement intervention on demand-side policing.

To date, the exploration of the impact of a supply-side repression intervention such as the Project STOP intervention has not been conducted in much detail on coerced admissions. Theoretical proposals about the meaning of any impact were therefore not available to test. The analyses of the impact of the five intervention points on the same set of contextual factors – injecting, smoking,
ingesting and never injecting methamphetamine, as well as treatment compliance and non-compliance – were conducted on coerced admissions and the results reported below.

The significant contexts for coerced methamphetamine treatment admissions were injecting and treatment compliance. The time plots for these two series are similar and show an upward spike around the time of the introduction of the first intervention, the rollout of Project STOP in November 2005 (Figure 8.3). The impact analyses revealed that Project STOP had a significant impact on both of these types of coerced user and none of the other interventions had an impact.

**C₁ Injecting methamphetamine**

Table 8.5 presents the impact of Project STOP on injecting users who were coerced into treatment. The intervention had an abrupt temporary impact on this type of coerced user. The impact was associated with an upward spike of around 23 injecting users diverted into treatment. This impact decayed quickly thereafter, as indicated by the $\delta_1$ parameter that equaled -0.57.

**C₅ Treatment Compliance**

The rollout of Project STOP had a similar impact on compliant treatment episodes as on injecting (Table 8.6). In November 2005 admissions that were compliant with treatment increased by around 26 in that month and thereafter decayed relatively rapidly ($\delta_1$=-0.58). Project STOP thus had a positive impact on the compliance of those users who were diverted to treatment through the police or the courts.

The rollout of Project STOP impacted the numbers of episodes that were coerced into treatment via demand-side drug law enforcement. Notably the intervention had a significant impact on injectors of methamphetamine. This could reflect an increase of drug law enforcement activity that coincided with the introduction of a new policing strategy, a so-called publicity effect (L. Mazerolle, 2003), or it could reflect an increase in users coming to the attention of police due to methamphetamine-related criminal activity in response to a spike in prices and a drop in purity. The increase in compliant users coerced into treatment suggests that the impact Project STOP had on the drug market and on drug law enforcement responses to methamphetamine users motivated coerced admissions to successfully complete their mandated treatment. Either way the increase in injecting users and compliant users diverted into treatment is a crime control benefit of the precursor diversion intervention.
Figure 8.3: Time Plots of Significant Context Variables: Injecting & Compliance – Coerced Admissions
Table 8.5: Impact Analysis of TPP Intervention on Injecting Methamphetamine – Coerced Admissions

| Parameter | Estimate | t Value | Pr>|t| |
|-----------|----------|---------|--------|
| Project STOP rolled out, November 2005 (Qld) | | | |
| $\omega_{01}$ | 23.21 | 3.63 | 0.0003 |
| $\delta_1$ | -0.57 | -2.60 | 0.009 |
| ARIMA | | | |
| $\theta_1$ | 0.70 | 6.98 | <.0001 |
| Autocorrelation check of Residuals | Chi-square | Degrees of freedom | Pr>|ChiSq| |
| $Q_{24}$ | 20.28 | 23 | 0.63 |

Table 8.6: Impact Analysis of TPP Intervention on Treatment Compliance – Coerced Admissions

| Parameter | Estimate | t Value | Pr>|t| |
|-----------|----------|---------|--------|
| Project STOP rolled out, November 2005 (Qld) | | | |
| $\omega_{01}$ | 26.27 | 3.50 | <.0001 |
| $\delta_1$ | -0.58 | -2.91 | 0.004 |
| ARIMA | | | |
| $\varnothing_1$ | 0.55 | 5.03 | <.0001 |
| Autocorrelation check of Residuals | Chi-square | Degrees of freedom | Pr>|ChiSq| |
| $Q_{24}$ | 22.71 | 23 | 0.48 |
In this chapter I conducted impact analyses on both voluntary and coerced treatment admissions for methamphetamine. These data were decomposed according to important drug user attributes hypothesized as ‘contexts’ and the five intervention points were tested to see if they impacted on these six types of methamphetamine treatment seekers. I have reported on the outcome patterns for the significant interventions. For voluntary admissions different intervention points impacted on different types of drug users. In CMO parlance, there was context-variation and outcome-variation.

The third party policing intervention introduced in Queensland from 2005 to 2008 was distinguished from the other Australian states because of the ‘top down’ nature of the type of regulations introduced (Ransley, 2012). The Queensland Pharmacy Guild was instrumental in developing the electronic medication recording system in anticipation of the regulatory changes they were expecting to be introduced. In addition, pseudo runners were a problem for pharmacists, who sought assistance in determining legitimate sales by forging a partnership with police. This initially ‘voluntary’ partnership became a third party policing one when legislations were introduced governing the way pharmacists were to dispense pseudoephedrine, and they were criminalized if they did not comply. The formation of the partnership and the development of the regulatory framework took place over a number of years. The evidence produced so far in the evaluation demonstrates that overall, the intervention in Queensland had a complex and at times contradictory impact on treatment seeking.

What remains to be done is to examine the outcome configurations of these findings, link the contexts with the outcomes, and develop insights into which of the hypothesized mechanisms triggered the observed patterns of impact. I will present this discussion in the next chapter, which will also summarise the work so far and offer some up some policy relevant reflections and recommendations.
Chapter 9 Drug Use & Drug Control – Discussion & Conclusions

Introduction

Controlling and containing problematic drug use that is harmful to both the user and society is addressed through policies and the implementation of various kinds of interventions. It is a problem that is dealt with by drug law enforcement agencies, drug treatment centres, doctors, emergency response staff and families. The outcomes of interventions aimed at dealing with illicit drug users often have unintended consequences. Specific drug problems emerge, grow and decline in an ‘epidemic’ way, only to be replaced by another new drug problem which follows a similar cyclic pattern. The multi-faceted nature of illicit drug use and attempts to deal with this complex issue give it all the hallmarks of a ‘wicked’ problem. Furthermore, the inter-sectoral nature of ‘the drug problem’ and responses to it create challenges for assessing what types of policy interventions work in what types of contexts.

This thesis has been about unpacking the complexity and outcomes of one family of policy responses to one very specific drug problem – (predominantly injecting) methamphetamine users seeking treatment for their drug use. By developing and using a theory driven evaluation framework I have made an important contribution to evaluating a new kind of drug law enforcement intervention – a third party policing approach to preventing precursor chemical diversion. I have built upon Cunningham and his colleagues’ ground-breaking epidemiological research into the impacts of precursor regulations on various methamphetamine indicators (Callaghan, Cunningham, Victor, & Lon-Mu, 2009; Cunningham et al., 2010; Cunningham & Liu, 2003b, 2005, 2008; Cunningham et al., 2009; Cunningham et al., 2008); and have started a more ‘sophisticated analysis’ of how a supply reduction intervention might impact on drug use behaviour and, by implication, the harms associated with injecting methamphetamine use.

In this concluding chapter, I review the context and policy backdrop of the wicked problem of drug use and drug control. I then present and discuss the results of my evaluation of a specific response to a contemporary drug problem in Australia, that of methamphetamine manufacture in the state of...
Queensland. Then I relate these findings to what is known from economic analyses of supply-side drug law enforcement and offer some critique and insights from my evaluation. I conclude with a call for a more integrated and theoretically based approach to assessing the complex problem of drug use and drug control.

**HISTORICAL CONTEXT OF A WICKED PROBLEM**

Drug addiction, or dependent drug use, first emerged as a social problem in the context of the social and economic upheavals of the industrialising world in the 18th and 19th centuries. The first recognised drug problem occurring in Britain in the early to middle part of the 18th century was the ‘gin epidemic’. The British government responded with multiple legislative interventions in an attempt to curb consumption and a time-series analysis of those measures (which included wholesale and retail excises and licensing fees on the sale of spirits) showed that the control interventions did indeed curb consumption, but only in the short term (Warner et al., 2001). The wicked problem prevailed because long-wave drug cycles appeared to outweigh drug control measures (J.P. Caulkins, 2000b; Musto, 1999; Nicholas, 2006; White & Webber, 2003).

Around the turn of the century opiates (opium and morphine) emerged as the second wave of the modern day, wicked family of drug problems. Morphine use was initially an iatrogenic epidemic among white middle-class women, and the use of opium was romanticised among the upper class. In Britain and the United States the government responded by outlawing opium and morphine in the 1890s. Yet by 1898, the Bayer Pharmaceutical Company had introduced heroin as a substitute for morphine. The hypodermic needle had been invented earlier that century and gradually injecting heroin diffused down the social strata and by the turn of the century injecting heroin use became

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67 It was within literary circles that opium use became romanticised in the 19th century; many writers of the time who were also users, wrote of opium’s mysterious allure; from the exotically furnished opium dens in London’s east end to the ethereal visions and revelations associated with the drug; see for example, Thomas De Quincey’s autobiographical account of opium addiction, ‘Confessions of an English Opium-eater.’ The social reality was quite different, however, with most opium dens set in squalid conditions in back alleys of Chinese immigrant areas (D. Manderson, 1993).
associated with criminality and the ‘dangerous classes’. By the early 20th century the “Junky”\textsuperscript{68} had been born (Acker, 2002).

The first international drug convention, the International Opium Convention of The Hague, was signed in 1912 and commenced in 1915 (UNODC, 2009). The United States government introduced the Harrison Act in 1914, which regulated and taxed the production, importation, and distribution of opiates. With these actions the prohibition of ‘narcotic’ drugs began and set the scene for how ‘addicts’ and other drug users were defined and dealt with as a social problem.

Since this time, scientific and psychological theories, and the cultural ‘ownership’ of dependent drug use, have swung between the medical and psychiatric professions, and law enforcement (Courtwright, 2005; Gusfield, 1989). The drug treatment industry emerged from early beginnings in inebriate asylums and in prisons depending on the degree to which the problem drug user was viewed as ‘sick’ or ‘criminal’ (Gerstein & Harwood, 1990; Lart, 1998; Malleck, 1999; White, 2004). Following the establishment of the prohibition regime in the early 20th century, the Single Convention on Narcotic Drugs was signed in 1961 and consolidated and expanded the prohibition of the production and supply of narcotic (and other) drugs, except for specific purposes, such as medical treatment and research (United Nations). The next big moment in the development of drug control was the declaration of the ‘War on Drugs’ by President Richard Nixon in 1971, setting the stage for nearly 40 years of a law enforcement dominated approach to dealing with the wicked problem of drug addiction.

\textbf{TREATING THE WICKED PROBLEM}

Whilst ‘treating’ drug addiction has, for 40 years, been the poor cousin to drug law enforcement, history does show that drug treatment services were expanded in response to the problem of soldiers returning from the Vietnam war addicted to heroin (White, 2004) and to the rise of illicit drug use among a youthful counter culture (Musto, 1999). The United States developed punitive law

\textsuperscript{68} The term junky, or junkie, came from street slang where heroin (and then cocaine) was referred to as ‘junk’. The term became synonymous with drug addiction and entered popular culture with the publication of “Junkie: the confessions of an unredeemed drug addict” by William S. Burroughs, writer of the Beat Generation.
enforcement responses to drug users leading to an exponential growth in the incarceration of marginalised, often African American youth. Illicit drugs became established in the domestic, black market in the United States and in most Western nations, including Australia in the 1960s and 1970s. The use of amphetamines reached epidemic proportions during this time in Australia as well as in the United States and Britain (Hall & Hando, 1993; Hando & Hall, 1997; Rasmussen, 2008a, 2008b). The control of drugs and drug users had, by the late 20th century, become an intractable ‘wicked’ policy problem.

A Contemporary Drug Policy Problem

The widespread and problematic use of methamphetamine in the wake of the heroin shortage from late 2000 has posed, arguably, the most significant drug policy challenge in Australia so far this century (Allen, 2003; Bush et al., 2004; Nicholas, 2006). The manufacture of methamphetamine is particularly concentrated in the Australian state of Queensland and the ‘double supply’ system of that market has required innovative responses by law enforcement in an attempt to suppress supply.

In Queensland, the police, in partnership with the Pharmacy Guild Australia (PGA), developed an innovative approach to dealing with the rapid rise of methamphetamine use in the early 2000s. In my thesis, I refer to the family of innovations (legislative, policy and technological interventions) underpinning the police–pharmacy partnership as Third Party Policing (TPP) (see Mazerolle & Ransley, 2005). Under this umbrella of TPP, drug law enforcement involved a shift to harness the crime control capacity of community pharmacies in the prevention of pseudoephedrine diversion through the development of an electronic medical recording system. In addition, there were regulatory changes that compelled pharmacists to comply with new requirements for the recording and reporting of sales of the main precursor chemical needed to manufacture methamphetamine, pseudoephedrine. This new regulatory mechanism shifted part of the policing function to a third party, in this case, pharmacists. This use of legislation and regulation to leverage the co-operation of a non-police partner is very much in the domain of third party policing (L. G. Mazerolle & Ransley,

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69 The double supply system refers to the diversion of licit precursor chemicals to the illicit market for manufacture into methamphetamine which is then supplied to drug users (Cherney et al., 2005).
I note that the involvement of pharmacists and the imposition of recording and reporting responsibilities have imposed significant compliance costs on not only the pharmacist but also their associations and the health agencies that regulate them (Ransley, 2012). This regulatory framework as introduced in Queensland without any evaluation of its likely impact on the problem of the illicit supply of methamphetamine or any unintended consequences.

Taken together, I define the family of regulatory responses as an example of a TPP intervention: It is a police–pharmacy partnership that has a range of legal levers (that are the responsibility of the third party – in this case the pharmacists) underpinning the efforts of police to control the supply of methamphetamine precursors. In Queensland, the TPP intervention consisted of five intervention points. The first one – introduced in November 2005 – was the roll out of a live, online electronic medication recording system called Project STOP. This was followed in 2006 by a two-stage rescheduling of pseudoephedrine products in January and April. Then in August 2007, Project STOP was rolled out nationally. The national rollout of Project STOP was accompanied by a publicity campaign. Law enforcement, health and PGA representatives partnered to promote Project STOP at the national level through the Precursor Working Group. They provided industry specific presentations and promotional material on the diversion of precursors and Project STOP results. In June 2008 the Drugs Misuse Regulation was amended and required pharmacists to report details of pseudoephedrine sales to the Commissioner of police.

This intervention aims at preventing the diversion of pseudoephedrine, and it uses pharmacists as agents of control, who are required to determine legitimate sales of the precursor chemical, and refuse to supply it to anyone they suspect is an illegitimate purchaser. The uptake of the software in Queensland was very high, initially around 85% (Siggins Miller, 2009). The Queensland branch of the PGA supplied what was called the “Project STOP” software programme to all community pharmacies free of charge.

A Theoretically Driven Evaluation Approach

The emergence of drug epidemics, and policy responses, including law enforcement and drug treatment, all occur in a complex social system. In Australia, the regulatory regime and policy responses surrounding illicit drugs straddle two key institutions: the health sector and law enforcement. Moreover, Australia’s drug policy framework – although still based on prohibition and the criminalisation of illicit drug supply and use – is underpinned by a harm minimisation philosophy. One outcome is a publically funded drug treatment system which incorporates a range of prevention
and harm reduction measures, notably needle and syringe programmes, education, peer-to-peer support and advocacy. This ‘hybrid’ drug policy framework (Bammer, Hall, Hamilton, & Ali, 2002) is embedded in a complex social system and the evaluation of drug policy responses to the cyclic pattern of drug epidemics is a challenging theoretical and social scientific issue.

In my thesis, I adapt and apply the heuristic of ‘The Crime Square’ from Left Realist Criminology to explicate and better understand the complex policy problem and the impact of interventions to suppress the supply of methamphetamine on drug use behaviour (see Chapter 2). The causal model of drug use behaviour that I developed in Chapter 2 assisted me to theorise the macro-micro links between drug policy interventions and drug user responses through highlighting the action of social mechanisms. This explanatory model theorises that drug use behaviour emerges through a set of relationships between the attributes of the individual user, the dynamics of the illicit drug market, and the social structural determining forces from state and society which set the drug policy agenda and implement a combination of law enforcement, treatment, and prevention and harm minimisation interventions.

In this thesis, I have examined the relationship between a third party policing intervention and the treatment seeking behaviour of dependent users of methamphetamine in Queensland, Australia. My objective was to open the ‘black box’ of evaluation and explore the mechanisms that link a law enforcement intervention to changes in drug treatment episodes. The central aim of my thesis was to develop and use a theory driven evaluation framework to assess a range of mechanisms that could account for intended and unintended consequences of the TPP intervention introduced in Queensland. I developed my evaluation frame by integrating Coleman’s model of social science explanation with its typology of mechanisms and Pawson and Tilley’s context-mechanism-outcome approach to evaluation.

I tested competing plausible mechanisms of change by creating different indicators of drug use behaviour. Drug use behaviour was measured using principle mode of administration for methamphetamine: injecting, smoking, ingesting and never injected. Two additional indicator variables were treatment compliance and non-compliance. Each of the indicators was conceptualised as important drug user attributes or ‘contexts’ of methamphetamine admissions. The postulated mechanisms are unmeasured intervening processes that could only be observed by examining the outcome patterns from the impact analysis of the intervention on the context indicator variables.
I used interrupted time-series analysis to test the impact of each of the five intervention points on first, the total treatment seeking series for both voluntary and coerced admissions. Each time-series consisted of 72 consecutive time-points that were monthly counts of closed treatment episodes in Queensland spanning the period from July 2003 to June 2009. A time-series is assumed to measure an underlying social process; in the case of voluntary admissions the process was treatment or ‘help’ seeking behaviour. In the case of ‘coerced’ admissions, which consisted of episodes that were diverted from the criminal justice system into mandatory treatment, the process was the law enforcement response to methamphetamine users.

The rest of this chapter is presented in two parts. First I outline and discuss the ‘impact theory’ (Figure 9.1) based on the results of the analyses in Chapters 6, 7 and 8 and using the evaluation frame I developed in the first half of the thesis (Chapters 2 through 4). Specifically, I present a table summary of the context-mechanism-outcome configurations (Table 9.1) and draw some conclusions about which mechanisms appear to have been triggered as a result of the intervention based on the observed outcome patterns. In the second part of this chapter I discuss the implications of the impact reflecting on both the theories of supply-side drug law enforcement and the policy implications.

**THE IMPACT THEORY**

The theory of the impact of the TPP intervention that was introduced into Queensland between 2005 and 2008 is presented in Figure 9.1, below. The black arrow linking the box marked ‘Third Party Policing Intervention’ to the box titled ‘Help seeking & drug use behaviours’ indicates what I was able to measure with the available data. The dashed lines below indicates the evaluation ‘black box’ and the mechanisms I proposed and tested using Pawson & Tilley’s approach (Pawson & Tilley, 1997, 2006).
As Figure 9.1 shows, the initial interrupted time-series analyses of the total voluntary and coerced admissions for methamphetamine demonstrated a macro-macro link between the interventions and treatment admissions – this is the solid black line that goes from the box titled “Third Party Policing Intervention” to the box titled “Help Seeking and Drug Use Behaviours.” The overall pattern of impact for the total voluntary admissions for methamphetamine was mixed: three of the five intervention points had a significant impact. The impact pattern was firstly, an abrupt temporary
spike upwards, secondly, a permanent drop then, thirdly, another abrupt temporary upward spike in admissions. The first upward spike occurred with the introduction of the first intervention (the roll out of Project STOP in Queensland) in November 2005. In November 2005, treatment episodes increased by 33 admissions; then in January 2006 (with the introduction of stage one of pseudoephedrine re-scheduling) there was a permanent drop of around 2 episodes each month which lasted until June 2008 when mandatory reporting was introduced and treatment episodes spiked upwards by around 32 admissions. This increase in treatment seeking decayed slowly, but its effect was felt for the rest of the series.

In my thesis, I define the social process underlying voluntary treatment admissions as ‘help seeking.’ Methamphetamine users seeking help for their drug use are motivated to reduce or cease their drug use and seek treatment to do so (Cogger, McKetin, Ross, & Najman, 2008). The international research on precursor controls has showed that regulations led to a spike in the price of methamphetamine and a decrease in admissions (Dobkin & Nicosia, 2009). The initial upsurge in admissions reported here would appear to be contrary to what is expected to occur. The second impact two months later was an abrupt permanent decline. This occurred with the introduction of stage one of pseudoephedrine re-scheduling in January 2006. Along with the re-scheduling, however, new regulations were introduced requiring that pharmacists supervise the sale of pseudoephedrine and that customers must produce photographic identification in order to purchase the product. It is not possible to separate the impacts of these two changes, which were introduced at the same time.

The third impact occurred with the introduction of mandatory reporting in June 2008. After declining by close to two and a half episodes per month since January 2006, treatment seeking again rose abruptly by 32 episodes in that month and thereafter began declining, but very slowly. Again, this pattern contradicts the classical (economic) notion that ‘interventions that restrict or suppress supply typically drive prices up’ (Caulkins, 2003, p. 436), with this notion we expect to see a drop in treatment seeking as users leave the market. A possible explanation for these paradoxical findings is that they could be a form of ‘ecological fallacy’, whereby making assumptions about sub-groups of drug users based on aggregate data leads to misleading. That is, the process of aggregating data may conceal variations that are not visible at the larger aggregate level (Schneider, 1978). As the results of the detailed analyses of various context-mechanism-outcome configurations revealed (in Chapter 8), decomposing total treatment admissions into various drug user ‘contexts’ yielded very different impact patterns and are discussed further in the following section.
To further understand the context-mechanism-outcome configurations of the impact of the TPP intervention, I provide a summary table (see Table 9.1 below) of each of the mechanisms, contexts and the specific outcome patterns of the five distinct interventions – Project STOP rolled out in Queensland in November 2005, Stage one of pseudoephedrine re-scheduling in January 2006, Stage two of pseudoephedrine re-scheduling in April 2006, the national rollout of Project STOP in August 2007, and the introduction of mandatory reporting of pseudoephedrine sales in June 2008 – on both the voluntary and coerced treatment admissions.

**THE CONTEXT-MECHANISM-OUTCOME CONFIGURATIONS OF THE IMPACT**

Table 9.1 summarises the array of outcomes from the family of interventions I have collectively described as TPP in my thesis. In this section, I present a summary of each of the mechanisms, their hypothesised contexts and expected outcome patterns. I discuss the voluntary treatment admissions first.

**Compensation**

Compensation as a transformational mechanism triggered by the suppression of supply of methamphetamine hypothesised that drug users would compensate for the reduced availability of the drug by adopting a method of use that was more efficient in terms of requiring less of the drug. The expected pattern in the indicator variables was of increased injecting drug use alongside a decrease in admissions that ingested the drug. There was no impact on ingesting, but there was an abrupt permanent drop in the numbers of admissions who injected methamphetamine. Using the indicators ‘injecting’ and ‘ingestion’ as proxies for measuring whether users compensated for the suppression of methamphetamine by changing their method of administering the drug was not supported.

Another form of drug users’ compensating for the lack of availability of their drug of choice is through drug switching. I conducted analyses on other principal drugs alcohol, cannabis and heroin and found no evidence of an increase in their consumption concurrent with the decline in episodes of amphetamines admissions. A recent study that examined the response of methamphetamine users to price changes found that with an increase in price there was a decrease in consumption of the drug (see Chalmers et al., 2012). Consistent with my findings, Chalmers and her colleagues found some substitution into heroin, benzodiazepines, and cocaine but it was not enough to offset the reduction in consumption (Chalmers et al., 2012).
### Table 9.1: The Context-Mechanism-Outcome Configurations of the Intervention Impact

<table>
<thead>
<tr>
<th>MECHANISMS</th>
<th>CONTEXTS</th>
<th>OUTCOME PATTERNS</th>
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<td>PROJSTOP</td>
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<td>Compensation</td>
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<td></td>
<td>INGESTING</td>
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<td>Intransigence</td>
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<td>NEVER INJECTED</td>
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<td>Diffusion</td>
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<td>INJECTING</td>
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<td></td>
<td>INGESTING</td>
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<td>Specific deterrence</td>
<td>TREATMENT COMPLIANCE</td>
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<td>TREATMENT NON-COMPLIANCE</td>
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<td>Desistance</td>
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<td></td>
<td>SMOKING</td>
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**Voluntary Admissions**

- **Voluntary Admissions**

**Coerced Admissions**

- **Coerced Admissions**

↑ = Increased treatment admissions
↓ = Decreased treatment admissions
↑↓ = Abrupt temporary increase
↓↑ = Abrupt temporary decrease
× = No impact

### Intransigence

Another possible adaptation of drug users to the reduced availability of a drug is for the user to continue to use the drug. This mechanism comes from (Kleiman, 1988) observation that during times of suppression, seasoned (more dependent) users are more likely to continue drug use than are newer (less dependent) users (see also Cunningham & Lui, 2008). And since more entrenched
methamphetamine users are more likely to inject while newer users are more likely to have never injected, it would be expected that never injecting would decline in association with precursor regulation, but that injecting would be less affected if intransigence was triggered by the suppression of supply. The pattern of findings expected in this case was for the numbers of injectors to stay the same and for the numbers of those who never injected to decrease.

I found, however, that none of the five interventions impacted on admissions that never injected, whereas the numbers of injecting drug user admissions decreased in June 2008. I suggest that rather than users of amphetamines becoming more intransigent in the face of restricted supply, the patterns I found in my analysis support the notion that older more dependent users were leaving the market. I propose, therefore, that the outcome patterns observed in my thesis do not support the operation of intransigence as a transformational mechanism.

**Diffusion**

Studies of the impact of precursor regulations in North America find that the methamphetamine market bounced back due to the import of crystalline amphetamine from Mexico during the mid-2000s (Cunningham et al., 2010; McKetin et al., 2011). This was evidenced in treatment admissions data via an increase in the numbers of users who reported smoking the drug. Similarly, there was an increase in Australia in the numbers of people smoking crystal meth (or ‘ice’), which is primarily imported from overseas. This method of use emerged in Australia as the ‘ice’ epidemic that began in the early 2000s. The American researchers Cunningham et al. (2008) hypothesised that the diffusion of ‘smoking’ reflected an increase of importation of ‘ice’, which is easy to smoke, whereas methamphetamine base and powder are not.

Adapting to a decrease in injectable methamphetamine by increasing consumption of ‘ice’ was therefore hypothesised in my thesis as an indicator of a switch in source of drug supply from domestic production to imported (see Table 9.1). I observe two impacts on smoking methamphetamine admissions: The first impact was an abrupt permanent increase in smoking associated with stage one of pseudoephedrine re-scheduling in January 2006. The second impact occurred with the introduction of stage two re-scheduling – which moved all liquid formulations containing more than 800mg of pseudoephedrine, and all combination or single ingredient products, such as capsules and tablets, containing more than 720mg of pseudoephedrine to Schedule 4 (prescription only medicine) – there was a permanent drop in treatment admissions for users who smoked methamphetamine.
**Deterrence**

Deterrence was measured using two proxy indicators: treatment compliance and non-compliance (see Table 9.1). Compliance with treatment was measured using ‘reasons for cessation of treatment’ responses. Treatment compliant admissions were those that completed the treatment episode or ceased by mutual agreement with the service provider: both reasons indicate cooperation with the service provider. Non-compliance included those admissions that ceased treatment against advice or without notice. For coerced admissions two additional categories included being sanctioned by a drug court or being imprisoned.

There was no impact of any of the interventions on treatment compliance for voluntary admissions. Conversely, I observed two intervention impacts on non-compliance: the first in August 2007 when Project STOP was rolled out nationally. At this time there was an abrupt decrease in non-compliant treatment seeking of around four and a half episodes per month and by May 2008 this decrease had decayed to around 3 episodes that month. The second impact occurred in June 2008, non-compliance increased by nearly eleven episodes – this impact decayed over the next six months.

This contradictory finding gives only partial support to the operation of a deterrence mechanism. Economic research has found there can be what is termed paradoxical effects of tougher DLE, that is, when DLE is harsher, the number of consumers can grow (Poret, 2002). The introduction of mandatory reporting of the sale of pseudoephedrine to police perhaps led to an unintended consequence of ‘pushing’ less motivated methamphetamine users into treatment.

**Desistance**

Overall the pattern of results (see Table 9.1) supports desistence as the transformational mechanism triggered by the effects of the TPP intervention (or what I call the ‘situational mechanism’). There was a permanent drop in treatment seeking for methamphetamine users who injected or smoked the drug. This may be due in part to the timing of the epidemic cycle of methamphetamine. Heavy, dependent drug users may have been maturing out of their dependence and the introduction of measures that suppressed the supply of their drug of choice acted as a catalyst to seek help (Cogger et al., 2008).

Injecting drug use is associated with greater dependence and entrenchment in a drug centered lifestyle. The epidemic phase of methamphetamine use was arguably from 2001 to 2004 and the prevalence at the population level was in decline by 2006, although harms were increasing (Nicholas, 2010). The mandatory reporting of pseudoephedrine sales introduced in June 2008 presumably put
pressure on the price and purity of locally produced methamphetamine, which encouraged injecting users to leave the market. Smoking methamphetamine admissions had dropped permanently at the earlier intervention point in April 2006. By early 2006 there had been widespread publicity about the harmful effects of ‘ice’ and police commentators suggested the end of a peak wave of use (Bartlett, 2006; Carney, 2006; Nicholas, 2006). When there are relatively many negative memories, the rate of initiation into drug use is dampened (Behrens, Caulkins, Tragler, & Feichtinger, 2002), and the increase in drug harms (and treatment seeking) followed by a drop suggests that users who smoked were also exiting the market. There was no support for the other three change mechanisms: compensation, intransigence and diffusion. Each of these three deviant adaptations was, in fact, counterfactuals for the desistence mechanism.

Remembering that an individual could be captured in more than one treatment episode and given what we know about drug using careers – that it can take multiple attempts at treatment to achieve lasting recovery (Hser, Longshore, & Anglin, 2007) – the spike in treatment seeking in the total series suggests that the early peak of admissions (in November 2005) was an indicator of intensity of help seeking so that by two and a half years later those left in the market were more dependent injecting drug users at the end of their using careers, possibly also coinciding with the declining epidemic. To this end this could be indicative of users also motivated by the increasing harms associated with their and their peers’ drug use. The outcome of a comprehensive and sustained series of regulations that transformed the introduction of an electronic medication recording system into a TPP intervention was a rare and important opportunity to evaluate some important health outcomes of supply-side drug law enforcement.

**Coerced Admissions**

Returning to Table 9.1, I tested the deviant adaptations to changes in the methamphetamine market in Queensland from 2003/04 to 2008/09 by examining the impact of the TPP intervention on coerced admissions. These admissions were individuals who were diverted to treatment through the Criminal Justice System (CJS), thus I define the CJS as the mechanism of change. I tested for the patterns of adaptation hypothesised above as a means of validating those findings. In other words, if the CJS was the mechanism by which individuals entered drug treatment for methamphetamine; I was not expecting to find evidence of change in drug use patterns. The findings support this hypothesis: there was no evidence to support any of the deviant adaptations for coerced admissions.
I find, however, two significant impacts in the interrupted time-series analysis. The first was an abrupt temporary increase in the numbers of injecting drug users diverted into treatment. As reported in Chapter 7, this was a short lived impact that possibly reflected a ‘demonstration’ effect of Project STOP on drug law enforcement responses to methamphetamine users in November 2005.

Coerced admissions were the most likely to comply with drug treatment (as reported in Chapter 6). Compliance with mandated treatment was highest overall for cannabis, then alcohol, than methamphetamine and finally heroin. Presumably the threat of further sanctions, most notably imprisonment, was the motivating factor for this relationship. The rollout of Project STOP in November 2005 had an abrupt but short-lived impact on treatment compliance for coerced amphetamine admissions.

A number of factors could have influenced the extent to which law enforcement diverted drug users to treatment, such as a policy and/or funding change supporting the diversion of methamphetamine users to treatment that coincided with the supply-side intervention. In addition, an increase in methamphetamine related crime and the apprehension of offenders could have had an effect. This result could also be a ‘publicity’ effect of the roll out of Project STOP on law enforcement officers, who were encouraged to be more vigilant regarding methamphetamine users, thus increasing contact. Either way the results here demonstrate the dynamic effect of supply-side law enforcement on demand-side policing: these aspects of enforcement are typically treated as quite separate dimensions of drug control.

**Revisiting Supply-Side Drug Law Enforcement**

The logic of supply-side drug law enforcement is that drug control will raise the price of methamphetamine through increasing the cost of manufacture. There is evidence that price increase reduces current consumption of methamphetamine (Chalmers et al., 2009; Chandra, 2007). Price increases will discourage initiation into the market and encourage desistance from use (that is, users leave the market). In this section I consider some implications of my evaluation findings especially in relation to the prices and risks paradigm typically used to frame research into supply side drug interventions.

The RAND researcher, Peter Rydell, and his colleagues, compare the cost effectiveness of supply-side activities with a demand-side one, namely, treatment (C. P. Rydell & Everingham, 1994; P. Rydell, Caulkins, & Everingham, 1996). They treat demand- and supply-side measures as ‘silos’, that is, they do not consider the possible interactions between these two policy pillars. They conceptualise
treatment seeking as ‘demand control’ in two senses (P. Rydell et al., 1996). First, in the short term, consumption is reduced while users are in treatment, and there is a crime control benefit in that users are not engaging in crime while in treatment. The second longer term effect is that not all users will resume use and/or they may decrease their use after treatment. In fact, a recent study examining the treatment outcomes for methamphetamine users in Queensland found significant improvements across key socio-demographic variables. Up to one year after treatment, participants’ income was raised significantly, unemployment decreased, as did criminality and drug use (Cogger et al., 2008). Rydell (1996) argues that even if the outflow of heavy users from the market is zero, treatment is still cost effective. In their study of cocaine about one-fifth of the effect of treatment on consumption occurs during treatment.

In terms of the cost-effectiveness of supply-side measures, the studies by (C. P. Rydell & Everingham, 1994; P. Rydell et al., 1996) found that domestic control is the most cost-effective compared with source country and interdiction because it is the level that is closest to the drug market. They also found that compared with the three levels of supply control measures (international, interdiction and domestic); treatment (demand-side) was the most cost-effective of all policy options. However, what was not considered here is the cost-effectiveness of domestic supply control in tandem with demand control (treatment). That is, a macro-level supply control measure feeding into demand control via treatment admissions.

In other words, in my thesis, I am suggesting a rethink in how we view drug policy ‘pillars.’ My findings suggest we need a more nuanced and integrated view. DLE consists of supply- and demand-side measures and it is ‘demand-side’ DLE that is most harmful in terms of unintended consequences (Maher & Dixon, 1999; Wood & Kerr, 2005). My findings suggest that a supply-side control such as the TPP one evaluated here is less directly harmful. I suggest that an intervention like TPP that uses an array of legal levers to induce third parties to adopt ‘crime control’ functions – in our case pharmacists – has less harmful consequences than reactive, aggressive DLE such as raids and street arrests. Moreover, TPP interventions for drug control also result in positive and effective treatment outcomes. So, my take home point is that not all drug control and DLE measures are harmful. Indeed, the TPP intervention that I assess in my thesis had a significant impact both on treatment seeking and on criminal justice responses to methamphetamine users. Overall, I conclude that policy makers need to consider the possible flow on effects from a supply-side intervention on treatment seeking and from supply-side DLE on demand-side DLE.
My analysis also demonstrates that while the overall demand for treatment spiked at two time points, there was a longer term reduction in the most harmful form of drug use, that is, injecting drug use. This indicates that precursor diversion worked for different types of drug user at different times. The impact of the intervention was felt immediately for the aggregate measure of treatment admissions; however, when admissions were decomposed into different drug user contexts, the patterns of impact were different.

The causal model of drug use behaviour I presented in Chapter Two showed that drug policy is implemented in a dynamic system where the state, society, the illicit drug market and the individual drug user all interact and influence the other through social mechanisms. It also contains a macro-micro dimension which postulates that macro-level supply-side interventions have a micro-level impact on drug user behaviour. The evaluation of the impact of the TPP intervention reported in this thesis was an examination of the impact of a domestic level supply-side measure implemented at the macro (State) level. The measure was the development of a regulatory framework controlling the availability of essential precursor chemicals to the illicit market. The analysis examined its impact on the treatment seeking behaviour of users of methamphetamine.

The aim of my thesis is to evaluate the overall effectiveness of the TPP intervention and to develop and use a theory-driven evaluation framework that went beyond the traditional drug supply and demand paradigm. I achieved this goal and was able to assess a range of mechanisms hypothesised to influence changes in methamphetamine treatment seeking behaviours. I found that the state-level supply-side intervention did impact treatment seeking, and that it was effective in leading to the desistance of the most harmful types of drug use for methamphetamines, namely, injecting and smoking. These findings together imply an outflow of heavy users from the market. There was no sign of drug switching to compensate. There was also no indication of a switch in source of methamphetamine, that is, via importation of ‘ice’.

**Unintended Consequences**

The unintended consequences of TPP are also important to assess. I note that there were a number of pseudoephedrine related pharmacy break-ins reported nationally during the second half of 2007, since supply tightened up after the roll out of Project STOP in August (Pharmacy Guild of Australia & Guild Insurance Limited, 2007). In Queensland a task force was formed to respond to the problem and consisted of senior representatives from the Pharmacy Guild and the Queensland Police Service, who met on a regular basis to develop strategies to address the issue. (Pharmacy Guild of Australia &
Guild Insurance Limited, 2007). A number of pharmacies also ceased stocking pseudoephedrine, replacing it with the less effective phenylephrine (Pharmacy Guild of Australia, 2009). There were also reports that diversion prevention in pharmacies encouraged doctor shopping by ‘pseudo runners’ and sourcing precursors in states where regulations were not tightened up (Queensland Health, 2007). It went beyond the capacity of my thesis to explore further these potential unintended consequences, yet these unanswered questions remain an important area for further research.

CONCLUSIONS

In this concluding section I will discuss to what extent the research questions were answered by the analysis conducted in the thesis; outline some limitations of the analysis and indicate some possible directions for future research to address some of these shortcomings. In terms of the first research question, ‘did the TPP intervention impact on methamphetamine treatment seeking behaviour’, the findings suggest that treatment seeking behaviour was not uniform across the different types of drug user. In particular, those who injected or smoked methamphetamine were the groups that were impacted by the interventions. Injecting drug users however did not evidence any change until the last and most ‘coercive’ of the interventions, namely mandatory reporting of pseudoephedrine sales. Those who smoked methamphetamine were impacted earlier with the second stage of rescheduling in April 2006. So to answer this first research question, two of the more coercive regulations, rescheduling all liquid pseudoephedrine products containing specified amounts of the drug and mandatory reporting impacted those who smoked or injected methamphetamine (respectively). Overall this suggests that a comprehensive or coercive regulatory framework for precursor chemicals, implemented at the macro level can impact the most ‘risky’ forms of drug use (injection and smoking); this has important health implications (Strang et al., 1998).

The two interventions that impacted the behaviour of those that smoked or injected methamphetamine had abrupt and permanent impacts which saw the level of the series drop (albeit by a small increment of around three episodes per month). There was no evidence of drug switching, that is there was no corresponding increase in treatment seeking among the users of alcohol, heroin or cannabis. Further, there was a temporary impact of the roll out of Project STOP on the behaviour of law enforcement as evidenced by the temporary spike in those who were diverted to treatment. This finding suggests a dynamic interplay between supply and demand components of drug law enforcement.
In terms of the mechanisms that were hypothesised and tested by observing the context-mechanism-outcome configurations, there are a number of conclusions that can be drawn. Firstly, the interventions appeared to have a general deterrent impact on injection drug use and smoking methamphetamine. However, the data was only available for this study up to the middle of 2009 and so cannot take a longer view. Based on prior research one could expect treatment demand to change as the methamphetamine market adjusts (Cunningham et al., 2010; Cunningham & Liu, 2008; Cunningham et al., 2008). Further research is needed in order to examine how long the decline in treatment seeking for injection drug use and smoking methamphetamine occurred.

The findings with regard to ‘treatment compliance’ as an indicator of desistance should be treated with caution. The majority of treatment episodes (64%, Chapter 5 p.118) lasted only a day and so this variable is highly skewed. The variable was included as the only ‘treatment outcome’ available and was created by duplicating the method described in the 2008/09 Report on the National Minimum Dataset (see AIHW, 2010a p.26). Further research could examine the 36% of methamphetamine episodes that lasted longer than a day in order to examine whether there is a ‘dose effect’ of treatment length on treatment compliance.

Three models of change drawn from Cunningham et al. (2008) (compensation, intransigence and diffusion) were replicated and tested using treatment episodes for Queensland. The findings here differed from the North American findings in important ways with regards to the diffusion mechanism. Cunningham et al. (2008) explored whether precursor regulations impacted the routes of administration of methamphetamine by examining injection, smoking, snorting and swallowing (ingesting). They found that all these methods except smoking decreased with one of the precursor regulations. Smoking on the other hand increased and they argued this was due to the emergence of a new source of methamphetamine, specifically ‘ice’ from Mexico that was imported to replace the domestic production of methamphetamine. They therefore found that ‘diffusion’ was the mechanism triggered by one of the precursor regulations. This did not occur in the present study. This finding highlights the importance of local conditions and the need to replicate research analyses conducted in different countries.

The analysis conducted in this thesis makes a number of important contributions to the literature. First it represents the first evaluation of a third party policing intervention using non-police related outcome data in Australia. Second, the exploration of the interplay between drug policy pillars is important and this evaluation provides evidence that such research needs to be integrated across the disciplines of public health and criminal justice. Third, the analysis conducted demonstrated the
impact of one policy pillar in this case DLE on treatment demand which has planning and funding implications beyond the scope of one policy domain. During a period when an intervention such as this occurs contact across the sectors in anticipating impact and ensuring the availability of drug treatment (at least in the initial period) is, important as demonstrated by these analyses. The research reported here supports findings from other studies that suggest that drug law enforcement and drug treatment are not either/or policy choices, they need to be integrated (C. P. Rydell & Everingham, 1994; P. Rydell et al., 1996; D. Weatherburn & Lind, 1997; D.; Weatherburn & Lind, 1999; D. Weatherburn et al., 1999).

LIMITATIONS

The use of methamphetamine treatment demand as an indicator of ‘help-seeking’ is acknowledged as a relatively crude measure and is a proxy only. However, there are limited data at a population level available for the measurement of treatment demand and the use of an administrative secondary data set such as the AODTS-NMDS is widespread in drug policy research (Campbell et al., 2011; Dobkin & Nicosia, 2009; Gerra & Chawla, 2012; Nonnemaker, Engelen, & Shive, 2010). Dependent drug users are a difficult to access group and while those who enter treatment for substance abuse may not be representative of the population of all dependent users, the data analysed in this thesis is the population of all those who sought help for methamphetamine use between the years 2003 and 2009. This data was considered more adequate than the other sources reviewed in chapter 5 (Methods); and as a public institution, drug treatment services represent one of the four policy pillars in Australia.

Drug policy indicator data that are available for use in policy evaluation particularly at the macro level are typically surveillance data collected for administrative purposes and not for the purpose of evaluating drug policies (J.P. Caulkins, 2000a). These data are typically prone to error and vary in quality over time and between jurisdictions. Most importantly they are not designed to address causal questions or allow the analysis of causal processes. Another limitation of the AODTS-NMDS was the groups that are excluded, including those in correctional centres and those from ATSI backgrounds. These groups are worthy of further study but were deemed outside the scope of the present study. Policy analysts are forced to make the best with what is available by using innovative approaches as was done in this thesis.
**Future Research**

Some future lines of research that would build upon the evaluation here include:

- Theoretically examine and demonstrate the dynamic interplay between substance abuse, health risk and criminality within a systems approach, for example, use treatment data, police crime incident data, pharmacy purchases and sales transactions to better understand this interplay.

- Examine some of the spatial effects of these macro interventions on micro level outcomes

- Examine other drug and alcohol policies and explore the way the CJS and health systems work together (or fail to work together) to reduce substance abuse and related crime problems.

- Apply a life course model to the issue of desistance from drug abuse and examine the relationship between desistance and institutional structures/barriers that enhance and/or block change.

**Final Word**

An important theme in considering the dynamic interplay between macro-level policy interventions on micro-level behaviour is the ‘ownership’ of the social problem of interest (Gusfield, 1975, 1989). In the context of problematic drug use, institutional ‘ownership’ has swung between the medical profession and law enforcement throughout the 20th century. The dominance of public health or enforcement policy approaches has followed along these lines as well. Since 1985 in Australia a harm minimisation philosophy has gained ascendancy and yet drug law enforcement receives the bulk of the monies spent on drug policies.

In my thesis, I sought to examine the interplay between drug law enforcement and the impact on the drug treatment sector, albeit in a limited manner, pertaining to drug treatment seeking behaviour. This effort to integrate across the different sectors is significant because drug control policy in Australia – as it is elsewhere – typically operates in research and institutional silos reflected in the categorising of different types of policies as falling within four different ‘pillars’: law enforcement, treatment, prevention and harm minimisation. Often debate is polarised between law enforcement and treatment as competing policy options (P. Rydell et al., 1996).

In my thesis, I provide empirical evidence and a rationale for drug policy to take a more ‘systems focus’. I used the crime square from Left Realist criminology to help guide my analysis and pay
attention to what experts lament: that policy makers in one policy domain are not necessarily familiar with or aware of interventions in other domains (Ritter & McDonald, 2008), much less how each domain or pillar may impact the other. Moreover, given that one of the claims for drug policy in this country (Fitzgerald & Sowards, 2002) and indeed internationally is that ‘a balanced approach incorporating prevention, treatment, and market disruption initiatives (such as interdiction, arrests, prosecutions, and regulatory interventions) is the best way to reduce the supply of, and demand for, illicit drugs’ (Office of National Drug Control Policy, 2006) (emphasis added), the exploration of the interplay between the pillars would appear to be important, and to date represents a gap in the available research literature that this thesis sought to address.

Members of the public health and criminal justice disciplines often work with marginalised populations, that is, with people at high risk of drug use, health problems, incarceration, and other social disadvantage (Akers & Lanier, 2009). Akers & Lanier (2009) argue that as the fields of public health and criminal justice increasingly overlap, the distinctions between them become blurred. The emergence of ‘therapeutic jurisprudence’ in the form of specialised drug courts is a clear example of this (Payne, 2006; Roach Anleu & Mack, 2007). Explicit theoretical and methodological linkages between the two disciplines, however, remain rare. A new paradigm that links both the methods and models of public health with those from criminal justice is needed, as are increased linkages between epidemiological analogies, theories, and models and the corresponding ones from criminology (Akers & Lanier, 2009). My thesis represents a contribution to this call for an ‘epidemiological criminology’.
APPENDICES
Amphetamine Type Stimulants (ATS) are a group of synthetic drugs that are powerful central nervous system stimulants, and are chemically related. The amphetamines belong to the phenethylamine family which include stimulants, enactogens (a substance that produces a socialising effect and desire for contact, most often applied to ecstasy-type substances) or hallucinogens. These drugs are often also referred to as psychostimulants, and are distinguished from other illicit drugs which are plant derived or botanical psychoactives, such as heroin, cocaine and cannabis (NDRI & AIC, 2007).

There is considerable confusion and inconsistency in the use of the terminology throughout much of the academic and official literatures. This has significant consequences – for example, even within Australia official data from some jurisdictions report seizures of amphetamine, methamphetamine and ecstasy separately, while others combine them as ATS seizures (Schloenhardt, 2007). This makes accurate comparisons between the jurisdictions difficult, as disaggregation of these substances is often not possible using publicly available data.

The two major sub-groups of ATS are amphetamines and ecstasy-type substances (also commonly referred to as MDMA). Manufacturing ecstasy is more complicated than other ATS and requires different precursors that are more difficult to access in Australia. Consequently, ecstasy is for the most part sourced overseas (Schloenhardt, 2007). Given that ecstasy production in Australia at the present time is very limited, this report deals only with amphetamines.

The term amphetamines are commonly used to refer to both amphetamine and methamphetamine. Methamphetamine is structurally similar to amphetamine but is more potent with stronger effects. Methamphetamine is sometimes referred to as methyl amphetamine but the two terms can be used interchangeably in most circumstances. In this thesis, the terms ATS and amphetamines are used interchangeably to include both amphetamine and methamphetamine, while the specific substance of either amphetamine or methamphetamine is referred to in the singular.

In addition, ATS are available in several different formats, often with different routes of administration (snorting powder, swallowing tablets, injecting, and smoking). These include a powdered form often known as speed (usually amphetamine), an oily form of methamphetamine known as base, and a crystal form of methamphetamine known as ice. However, even usage of these terms can be inconsistent, with usage often depending on geographic location. Figure I below
summarises the common types of amphetamines used in Australia, and their routes of administration.

Common Forms of Amphetamine Type Substances

<table>
<thead>
<tr>
<th>Common names</th>
<th>Medical or chemical name</th>
<th>Form</th>
<th>Route of administration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed, whiz, uppers, goey, louee, daxies, pep pills</td>
<td>Amphetamine (Sulphate) Dexamphetamine</td>
<td>Powder, tablet or capsule, paste, liquid</td>
<td>Snorted, swallowed, injected</td>
</tr>
<tr>
<td>Meth, speed, whiz, base (paste form)</td>
<td>Methamphetamine or Methylamphetamine</td>
<td>Powder, oil or paste</td>
<td>Snorted, swallowed, injected</td>
</tr>
<tr>
<td>Crystal meth, ice, d-meth, glass, crystal, batu, shabu</td>
<td>Methamphetamine hydrochloride</td>
<td>Crystalline powder or crystals</td>
<td>Smoked, swallowed, injected, snorted</td>
</tr>
</tbody>
</table>


This thesis is concerned with all of the substances included in Figure I, but not ecstasy. The terms amphetamines and ATS refer collectively to all of these substances, while methamphetamine refers to meth, and crystal or ice refers to crystal meth.
### Appendix B

#### Time-Series Terminology

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARIMA ((p,d,q))</td>
<td>The acronym for an auto-regressive integrated moving average model. The three terms to be estimated in the model are auto-regressive ((p)), integrated (trend—(d)), and moving average ((q)).</td>
</tr>
<tr>
<td>Autocorrelation</td>
<td>Correlations among sequential scores at different lags. The lag 1 autocorrelation coefficient is similar to correlation between the pairs of scores at adjacent points in time, (r_{Yt,Yt&gt;1}) (e.g., the pair at time 1 and time 2, the pair at time 2 and time 3, and so on). The lag 2 autocorrelation coefficient is similar to correlation between the pairs of scores two time periods apart, (r_{Yt,Yt&gt;2}) (e.g., the pair at time 1 and time 3, the pair at time 2 and time 4, and so on).</td>
</tr>
<tr>
<td>Autocorrelation function (ACF)</td>
<td>The pattern of autocorrelations in a time series at numerous lags; the correlation at lag 1, then the correlation at lag 2, and so on.</td>
</tr>
<tr>
<td>Auto-regressive terms ((p))</td>
<td>The number of terms in the model that describe the dependency among successive observations. Each term has an associated correlation coefficient that describes the magnitude of the dependency. For example, a model with one auto-regressive term ((p=1)) is one in which an observation depends on (is predicted by) the previous observation, and is written: (Y_t = \theta_{t-1} + a_t).</td>
</tr>
<tr>
<td>Differencing</td>
<td>Calculating differences among pairs of observations at some lag to make a nonstationary series stationary.</td>
</tr>
<tr>
<td>Lag</td>
<td>The time periods between two observations. For example, lag 1 is between (Y_t) and (Y_t&gt;1). Lag 2 is between (Y_t) and (Y_t&gt;2).</td>
</tr>
<tr>
<td>Moving average terms ((q))</td>
<td>The number of terms that describe the persistence of a random shock from one observation to the next. A model with one moving average term ((q=1)) is one in which an observation depends on the preceding random shock; and is written: (Y_t = a_t - \theta_a Y_{t-1}).</td>
</tr>
<tr>
<td>Observation</td>
<td>The series score at one time period. The score can be from a single case or an aggregate score from numerous cases.</td>
</tr>
<tr>
<td>Partial autocorrelation function (PACF)</td>
<td>The pattern of partial autocorrelations in a time series at numerous lags after partialing out the effects of autocorrelations at intervening lags.</td>
</tr>
<tr>
<td>Random shock</td>
<td>The random component of a time series. The shocks are reflected by the residuals (or errors) after an adequate model is identified.</td>
</tr>
<tr>
<td>Random Walk</td>
<td>Is a stochastic process wherein successive random shocks accumulate or integrate over time, thus a random walk is called an integrated process.</td>
</tr>
<tr>
<td>Stationarity</td>
<td>A stationary series vary around a constant mean level, neither decreasing nor increasing systematically over time, with constant variance. Obtaining a constant mean level is achieved by removing any stochastic trend contained in the series.</td>
</tr>
<tr>
<td>Trend terms ((d))</td>
<td>The terms needed to make a nonstationary time series stationary. A model with two trend terms ((d=2)) has to be differenced twice to make it stationary. The first difference removes linear trend, the second difference removes quadratic trend, and so on.</td>
</tr>
</tbody>
</table>

*Source: Tabachnick & Fidell, 2007; Yaffee, 2000*
<table>
<thead>
<tr>
<th>Schedule No.</th>
<th>Schedule Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schedule 1 (S1) (defunct)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schedule 2 (S2)</td>
<td>Pharmacy Medicine</td>
<td>Substances and preparations for therapeutic use that are substantially safe but where advice is available if necessary, e.g. simple analgesics such as aspirin, paracetamol and ibuprofen containing more than 24 tablets; non-sedating antihistamines; nasal sprays containing decongestants.</td>
</tr>
<tr>
<td>Schedule 3 (S3)</td>
<td>Pharmacist Only Medicine</td>
<td>Are substantially safe but require professional advice or counselling by a pharmacist. Require pharmacist monitoring, for example pseudoephedrine (added by amendment in 2005), and ventolin.</td>
</tr>
<tr>
<td>Schedule 4 (S4)</td>
<td>Prescription Only Medicine</td>
<td>Require professional medical management or monitoring and are for ailments that require professional diagnosis, e.g. ephedrine and pseudoephedrine (in large doses).</td>
</tr>
<tr>
<td>Schedule 5 (S5)</td>
<td>Caution</td>
<td>Have low toxicity and require caution in handling, storage or use.</td>
</tr>
<tr>
<td>Schedule 6 (S6)</td>
<td>Poison</td>
<td>Have moderate to high toxicity and may result in death or injury if ingested, inhaled or in contact with skin or eyes.</td>
</tr>
<tr>
<td>Schedule 7 (S7)</td>
<td>Dangerous Poison</td>
<td>Have high to extremely high toxicity and can cause death or severe injury at low exposure.</td>
</tr>
<tr>
<td>Schedule 8 (S8)</td>
<td>Controlled Drug (Possession without authority illegal)</td>
<td>Are substances or preparations for therapeutic use which have high potential for abuse and addiction. All S8 drugs require a doctor with an S8 permit before prescribing is permitted. Examples: amphetamines, barbiturates, buprenorphine, cocaine, dextroamphetamine, ketamine, methadone, methamphetamine, morphine, oxycodone &amp; pethidine.</td>
</tr>
<tr>
<td>Schedule 9 (S9)</td>
<td>Prohibited Substance</td>
<td>Substances and preparations that by law may only be used for research purposes. The sale, distribution, use, and manufacture of such substances without a permit are strictly prohibited by law. Examples: cannabis, GHB, heroin, LSD, mescaline, MDMA</td>
</tr>
<tr>
<td>Schedule 10 (S10)</td>
<td>Unscheduled Substances</td>
<td>Many of these preparations are available for sale in supermarkets in addition to pharmacies and include: antacids, ibuprofen (200 mg) less than 24 in a pack, paracetamol (500 mg) less than 24 in a pack, some laxatives, lubricant eye drops and some nicotine replacement therapy.</td>
</tr>
</tbody>
</table>

(Department of Health and Ageing)
Ingrid McGuffog  
Doctoral Scholar  
Key Centre for Ethics, Law, Justice and Governance  
Mt Gravatt campus, Griffith University  
176 Messina Ridge Road  
Mt Gravatt QLD 4122

Dear Ms McGuffog,

Quote for preparing confidentialised 2007-08 to 2008-09 AODTS-NMDS unit record data

In November 2010, the AIHW Ethics Committee reviewed your request for access to unit record file data for the Alcohol and Other Drug Treatment Services National Minimum Data Set (AODTS-NMDS).

The AIHW Ethics Committee decided that the application to access 2007-08 to 2008-09 data is acceptable on ethical grounds subject to the following conditions:

* Cell sizes of less than 5 will be suppressed;
* The AIHW Ethics Committee being informed of any changes in the conduct of this activity and any adverse effects or unexpected ethical issues;
* AIHW assistance is recognised in all publications and reports resulting from the submission; and
* A copy of the report (or relevant sections) will be provided to the AIHW and relevant AODTS-NMDS Working Group members two weeks prior to publication for approval.

As the Institute does not yet hold the 2009-10 data and the content of these data is not known, the Committee did not approve your request to access future years' data.

Previous conditions placed upon access to these data by the AODTS-NMDS Working Group continue to apply. Additional information regarding these conditions will be provided to Griffith University in User Documentation should you choose to go ahead with this request.

The quote of $2,260 (GST inc.) for extraction of these data includes the costs of:

* the AIHW Ethics Committee administration fee; and
* the Database Administrator, in creating de-identified data files for each collection period and streamlining them for Griffith University use.
Please let me know if you would like to accept this quote. For further information please contact Amber Jefferson on (02) 6244 1137 or amber.jefferson@aihw.gov.au or Anna White on (02) 6244 1086 or anna.white@aihw.gov.au.

Yours sincerely

Amber Jefferson
Head, Drug Surveys and Services Unit
Data Custodian, AODTS-NMDS
2 March 2011
Sections 1 & 2 from the AODTS-NMDS Documentation produced for the release of AODTS-NMDS Confidentialised Unit Record File Data to Griffith University

Alcohol and Other Drug Treatment Services National Minimum Data Set (AODTS–NMDS) confidentialised unit record file

Documentation produced for the release of 2007–08 and 2008–09 AODTS–NMDS data to Griffith University
This document was produced for Griffith University. The content of this document pertains to specifically constructed data files which are being released to Griffith University under specific conditions as imposed by the AIHW Ethics Committee, and reflecting conditions imposed by data providers. Griffith University users of the data files are limited to only those investigators who signed the AIHW confidentiality undertaking.
Conditions of release for AODTS–NMDS unit record data

1.1 Overall conditions of release and responsibilities

As stated in the September 2008 AIHW Ethics Committee submission, and reflecting previous and current conditions imposed by data providers, Griffith University are to comply with the following conditions.

Griffith University responsibilities

- Provision of an annual work plan to the AIHW (with copy to jurisdictions) describing which projects will be using NMDS data and for what purpose (Appendix 1: AIHW and data provider contact details);
- Griffith University are responsible for writing to the AIHW (with copy to jurisdictions) requesting any additional access or use of AODTS–NMDS data outside of the agreed annual work plan;
- Griffith University are responsible for providing the AIHW and jurisdictions with draft copies of any reports or papers (via email) involving the use of AODTS–NMDS data for comment with a 2–4 week turn-around. This needs to be in line with Griffith University’s media policy. Suggestions for changes will not be unreasonably ignored. If AIHW or a jurisdiction does not respond, Griffith University will follow-up by email;
- Griffith University are responsible for informing the AIHW and jurisdictions about any presentations that may include use of AOTDS–NMDS data. Draft presentations will be made available 2–4 weeks before the talks with more complete versions closer to the date;
- Griffith University are responsible for ensuring that any publications or presentations do not present data in cell sizes less than 5;
- Griffith University will acknowledge the AIHW and jurisdictions when AODTS–NMDS data are used;
- Griffith University are responsible for complying with the confidentiality and data security agreement;
- Griffith University are responsible for ensuring that no AODTS–NMDS data are matched to each other or to personal information from any other data source;
- Griffith University are responsible for complying with the NSW (and that pertaining to any other jurisdiction, as appropriate) Aboriginal Health Information Guidelines for any projects using data relating to Aboriginality; and
- Griffith University will inform the AIHW about any changes in the conduct of its research activity with NMDS data, and of any adverse effects or unexpected ethical issues that arise, so that the Ethics Committee can review the project appropriately.

Data provider and AIHW responsibilities

- Provide timely comments to Griffith University on draft copies of reports or papers involving AODTS–NMDS data (within a 2–4 week turnaround)
1.1 Privacy and confidentiality provisions

As part of the 2008 submission to the AIHW Ethics Committee, the investigators within Griffith University who would be accessing the data (see Appendix 2 for a list of authorised investigators), signed an undertaking in line with Section 29 of the Australian Institute of Health and Welfare Act 1987. In signing the undertaking the investigators have agreed to use all AODTS-NMDS data in accordance with the following conditions.

(Excerpt from the AIHW Undertaking in pursuance of Section 29 of the AIHW Act 1987)

1. The unit record file will not be matched, in whole or in part, with any other information for the purposes of attempting to identify individuals, nor will any other attempt to identify an individual be made.
2. The person/organisation will not disclose or release the information to any other person or organisation, except as statistical information that does not identify an individual.
3. Access to the unit record file will be restricted only to those employees of the organisation who have signed the confidentiality undertaking. The Principal Investigator will ensure that employees granted access to the information understand the provisions of the AIHW Act prohibiting release of the information to others.
4. Access will not be granted to any other organisation without specific approval of the AIHW Ethics Committee.
5. The information will be used for statistical purposes in health and/or welfare research.
6. The information will not be used as a basis for any legal, administrative or other actions that could directly affect any particular individuals or organisations as a result of their identification in this project.
7. The identifying information will be used only for the project proposed and described in this application. Use of any of this information in any other project will not be undertaken until a separate application form has been submitted to, and approved by, the Ethics Committee.
8. The recipient will cooperate with any surveillance procedures established by the Institute or its Ethics Committee and advised to the recipient in writing.
9. Results of the project will be made available for consideration by the Ethics Committee, if so requested prior to any public release.
10. The Institute will be acknowledged in all reports and publications resulting from this project, and will be provided with a copy of all such reports and publications.
11. The recipient will comply in all respects with the requirements of section 29 of the AIHW Act (and of Part III of (The Privacy Act 1988)).
12. Copyright in all data are vested in the Commonwealth and contributing states and territories. The collection is managed under contract by the AIHW.
13. Any publication which uses the data must identify the AIHW as the source.

Data specifications
2.1 Database model

The following figure illustrates the data files provided to Griffith University. The three files outlined have been provided for each year requested (2002–03 to 2006–07). For example, the file name for 2002-03’s episode file is aodts_episode_0203. Note that an establishment file has not been provided as the approved data items have been moved into the other files, removing the necessity for a separate establishment file.

```
<table>
<thead>
<tr>
<th>aodts_episode_yyyy</th>
</tr>
</thead>
<tbody>
<tr>
<td>aodts record id</td>
</tr>
<tr>
<td>geographical location</td>
</tr>
<tr>
<td>major ASGC</td>
</tr>
<tr>
<td>establishment sector</td>
</tr>
<tr>
<td>date commencement of treatment</td>
</tr>
<tr>
<td>state</td>
</tr>
<tr>
<td>sex</td>
</tr>
<tr>
<td>age</td>
</tr>
<tr>
<td>client type</td>
</tr>
<tr>
<td>source of referral</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>aodts_episode_other_tr_yyyy</th>
</tr>
</thead>
<tbody>
<tr>
<td>aodts record id</td>
</tr>
<tr>
<td>state</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>aodts_episode_other_drug_yyyy</th>
</tr>
</thead>
<tbody>
<tr>
<td>aodts record id</td>
</tr>
<tr>
<td>state</td>
</tr>
</tbody>
</table>
```
## 2.2 Data file specifications

Table 2.1: Specifications for each year's `episode` file (aodts_episode_yyyy)

<table>
<thead>
<tr>
<th>Data item</th>
<th>Description</th>
<th>Final domain values</th>
</tr>
</thead>
<tbody>
<tr>
<td>AODTS record Id</td>
<td>Unique identifier for each closed treatment episode.</td>
<td>Numeric</td>
</tr>
<tr>
<td>Major asgc</td>
<td>The Australian Standard Geographical Classification (ASGC), based on an enhanced measure of remoteness developed by the National Key Centre for Social Applications of Geographical Information.</td>
<td>0 = Major cities 1 = Inner and outer regional 3 = Remote and very remote</td>
</tr>
<tr>
<td>Establishment sector</td>
<td>A section of the health care industry.</td>
<td>1 = Government 2 = Non-government</td>
</tr>
<tr>
<td>Date commencement of treatment</td>
<td>Date on which a treatment episode for alcohol and other drugs commences.</td>
<td>01mmyyyy</td>
</tr>
<tr>
<td>State</td>
<td>An identifier for state or territory.</td>
<td>VIC = Victoria  QLD = Queensland</td>
</tr>
<tr>
<td>Sex</td>
<td>The sex of the person.</td>
<td>1 = Male  2 = Female  9 = Not stated/inadequately described</td>
</tr>
<tr>
<td>Age</td>
<td>The age of the person.</td>
<td>Numeric</td>
</tr>
<tr>
<td>Data item</td>
<td>Description</td>
<td>Final domain values</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Client type               | The status of a person in terms of whether the treatment episode concerns their own alcohol and/or other drug use or that of another person. | 1 = Own alcohol or other drug use  
2 = Other’s alcohol or other drug use |
| Source of referral        | The source from which the person was transferred or referred to the alcohol and other drug treatment service. | 1 = Self  
2 = Family member/friend  
3 = Medical practitioner  
4 = Hospital  
5 = Mental health care service  
6 = Alcohol and other drug treatment service  
7 = Other community/health care service  
8 = Correctional service  
9 = Police diversion  
10 = Court diversion  
98 = Other  
99 = Not stated/inadequately described |
| Method of use for principal | The client’s usual method of administering the Principal drug of concern as stated by the client. | 1 = Ingests  
2 = Smokes  
3 = Injects  
4 = Sniffs (powder)  
5 = Inhales (vapour)  
6 = Other  
9 = Not stated/inadequately described |
<table>
<thead>
<tr>
<th>Data item</th>
<th>Description</th>
<th>Final domain values</th>
</tr>
</thead>
</table>
| Injecting drug use              | The client’s use of injecting as a method of administering drugs. Includes intravenous, intramuscular and subcutaneous forms of injecting. | 1 = Last injected three months ago or less  
2 = Last injected more than three months ago but less than or equal to twelve months ago.  
3 = Last injected more than twelve months ago.  
4 = Never injected  
9 = Not stated/inadequately described |
| Principal drug of concern       | The main drug, as stated by the client that has led a person to seek treatment from the service. | NNNN  
Coded according to the Australian Standard Classification of Drugs of Concern (ASCDC). ABS Cat. No. 1248.0 (2000). |
| Treatment delivery setting      | The main physical setting in which the type of treatment that is the principal focus of their alcohol and other drug treatment episode is actually delivered to a client, irrespective of whether or not this is the same as the usual location of the service provider. | 1 = Non-residential treatment facility  
2 = Residential treatment facility  
3 = Home  
4 = Outreach setting  
8 = Other |
| Main treatment type             | The main activity determined at assessment by the treatment provider to treat the client’s alcohol and/or drug problem for the principal drug of concern. | 1 = Withdrawal management (detoxification)  
2 = Counselling  
3 = Rehabilitation  
5 = Support & case management only  
6 = Information and education only  
7 = Assessment only  
8 = Other |
<p>| Cessation date                  | Date on which a treatment episode for alcohol and other drugs ceases. | 01mmyyyy |</p>
<table>
<thead>
<tr>
<th>Data item</th>
<th>Description</th>
<th>Final domain values</th>
</tr>
</thead>
</table>
| Cessation reason    | The reason for the client ceasing to receive a treatment episode from an alcohol and other drug treatment service. | 1 = Treatment completed  
2 = Change in main treatment type  
3 = Change in delivery setting  
4 = Change in principal drug of concern  
5 = Transferred to another service provider  
6 = Ceased to participate against advice  
7 = Ceased to participate without notice  
8 = Ceased to participate involuntary  
9 = Ceased to participate at expiation  
10 = Ceased to participate by mutual agreement  
11 = Drug court and/or sanctioned by court diversion service  
12 = Imprisoned, other than drug court sanctioned  
13 = Died  
98 = Other  
99 = Not stated/inadequately described |
| Length of episode   | Length of episode in days.                                                  | Numeric                                                                              |
Appendix E Supplementary Analysis for Chapter 6
Table E.1: Closed Treatment Episodes by Collection Year, Australia, 2002/03 -2008/09.

<table>
<thead>
<tr>
<th>Collection Year</th>
<th>f</th>
<th>%</th>
<th>% point change</th>
<th>% change</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002/03</td>
<td>123,032</td>
<td>12.8</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>2003/04</td>
<td>129,331</td>
<td>13.5</td>
<td>0.7</td>
<td>5.1</td>
</tr>
<tr>
<td>2004/05</td>
<td>135,202</td>
<td>14.1</td>
<td>0.6</td>
<td>4.5</td>
</tr>
<tr>
<td>2005/06</td>
<td>144,963</td>
<td>15.1</td>
<td>1.0</td>
<td>7.2</td>
</tr>
<tr>
<td>2006/07</td>
<td>140,475</td>
<td>14.7</td>
<td>-0.4</td>
<td>-3.1</td>
</tr>
<tr>
<td>2007/08</td>
<td>147,721</td>
<td>15.4</td>
<td>0.7</td>
<td>5.2</td>
</tr>
<tr>
<td>2008/09</td>
<td>138,027</td>
<td>14.4</td>
<td>-0.1</td>
<td>-6.6</td>
</tr>
<tr>
<td>Total</td>
<td>958,751</td>
<td>100</td>
<td>1.6</td>
<td>2.0⁴</td>
</tr>
</tbody>
</table>

⁴This figure is the average annual percentage growth rate.
Table E.2: Closed Treatment Episodes for Principal Drugs of Concern, Australia, 2002/03-2008/09 (per cent).

<table>
<thead>
<tr>
<th>Principal drug of concern (%)</th>
<th>2002/03</th>
<th>2003/04</th>
<th>2004/05</th>
<th>2005/06</th>
<th>2006/07</th>
<th>2007/08</th>
<th>2008/09</th>
<th>Grand Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol</td>
<td>38.0</td>
<td>37.5</td>
<td>37.2</td>
<td>38.7</td>
<td>42.3</td>
<td>44.5</td>
<td>45.8</td>
<td>41.0</td>
</tr>
<tr>
<td>Amphetamines</td>
<td>10.7</td>
<td>11.0</td>
<td>10.9</td>
<td>11.0</td>
<td>12.3</td>
<td>11.2</td>
<td>9.2</td>
<td>11.0</td>
</tr>
<tr>
<td>Cannabis</td>
<td>22.0</td>
<td>22.0</td>
<td>23.0</td>
<td>24.6</td>
<td>22.8</td>
<td>21.6</td>
<td>22.5</td>
<td>23.0</td>
</tr>
<tr>
<td>Heroin</td>
<td>18.4</td>
<td>18.0</td>
<td>17.2</td>
<td>13.6</td>
<td>10.6</td>
<td>10.5</td>
<td>10.3</td>
<td>14.0</td>
</tr>
<tr>
<td>Total</td>
<td>123,032</td>
<td>129,331</td>
<td>135,202</td>
<td>144,963</td>
<td>140,475</td>
<td>147,721</td>
<td>138,027</td>
<td>958,751</td>
</tr>
</tbody>
</table>

Source: Tables 6.1 & 6.2 (Australian Institute of Health and Welfare, 2010a). Excludes treatment episodes for clients seeking treatment for the drug use of others. The total number of episodes for New South Wales has been under-reported owing to system issues for the reporting period of 2008-09.
Table E.3: Growth Rates of Closed Treatment Episodes for Selected Principal Drugs of Concern, Australia, (per cent change) 2002/03-2008/09.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol</td>
<td>3.7</td>
<td>3.8</td>
<td>11.4</td>
<td>6.1</td>
<td>10.5</td>
<td>-3.7</td>
<td>5.6</td>
</tr>
<tr>
<td>Amphetamines</td>
<td>7.5</td>
<td>4.0</td>
<td>7.8</td>
<td>7.8</td>
<td>-4.1</td>
<td>-23.2</td>
<td>-0.6</td>
</tr>
<tr>
<td>Cannabis</td>
<td>4.9</td>
<td>9.2</td>
<td>14.8</td>
<td>-10.3</td>
<td>-0.4</td>
<td>-2.4</td>
<td>2.5</td>
</tr>
<tr>
<td>Heroin</td>
<td>3.0</td>
<td>-0.6</td>
<td>-14.7</td>
<td>-24.8</td>
<td>4.7</td>
<td>-8.7</td>
<td>-6.2</td>
</tr>
</tbody>
</table>

A The denominators used to calculate these percentage-point and per cent changes year to year, are the total closed treatment episodes for each collection year in Australia for all principal drugs of concern (see Table A1.1), in order to maintain the relative proportions of the principal drugs of concern selected for examination here. (Source: Tables 6.1, 6.2, 6.3 & 6.4 AIHW 2010a).

b The total number of episodes for New South Wales has been under-reported owing to system issues for the reporting period of 2008-09.
Table E.4: Closed Treatment Episodes for Principal Drugs of Concern by Collection Year, Queensland, 2002/03-2008/09 (per cent).

<table>
<thead>
<tr>
<th></th>
<th>2002/03</th>
<th>2003/04</th>
<th>2004/05</th>
<th>2005/06</th>
<th>2006/07</th>
<th>2007/08</th>
<th>2008/09</th>
<th>Grand Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol</td>
<td>24.7</td>
<td>26.3</td>
<td>26.4</td>
<td>27.9</td>
<td>33.7</td>
<td>33.8</td>
<td>35.8</td>
<td>30.5</td>
</tr>
<tr>
<td>Amphetamines</td>
<td>8.9</td>
<td>10.3</td>
<td>8.7</td>
<td>10.2</td>
<td>9.9</td>
<td>8.8</td>
<td>7.7</td>
<td>9.2</td>
</tr>
<tr>
<td>Cannabis</td>
<td>50.3</td>
<td>39.5</td>
<td>42.8</td>
<td>41.1</td>
<td>36.8</td>
<td>36.8</td>
<td>36.4</td>
<td>39.7</td>
</tr>
<tr>
<td>Heroin</td>
<td>5.4</td>
<td>7.6</td>
<td>5.2</td>
<td>4.3</td>
<td>3.3</td>
<td>4.1</td>
<td>3.8</td>
<td>4.6</td>
</tr>
<tr>
<td>Totala</td>
<td>13,556</td>
<td>17,912</td>
<td>19,743</td>
<td>24,159</td>
<td>24,885</td>
<td>26,332</td>
<td>24,984</td>
<td>100.0</td>
</tr>
</tbody>
</table>

a The denominators used to calculate these percentage-point and per cent changes year to year, are the total closed treatment episodes for each collection year in Queensland for all principal drugs of concern in order to maintain the relative proportions of the principal drugs of concern selected for examination here.

Table E.5: Growth Rate of Closed Treatment Episodes for Selected Principal Drugs of Concern, Queensland, 2003/04-2008/09

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol</td>
<td>10.0</td>
<td>27.0</td>
<td>23.0</td>
<td>5.9</td>
<td>-1.2</td>
<td>16.0</td>
</tr>
<tr>
<td>Amphetamines</td>
<td>-5.9</td>
<td>40.3</td>
<td>-1.4</td>
<td>-6.3</td>
<td>-16.9</td>
<td>0.3</td>
</tr>
<tr>
<td>Cannabis</td>
<td>19.2</td>
<td>16.7</td>
<td>-7.7</td>
<td>4.8</td>
<td>-5.5</td>
<td>5.4</td>
</tr>
<tr>
<td>Heroin</td>
<td>-25.5</td>
<td>-0.1</td>
<td>-24.0</td>
<td>36.0</td>
<td>-13.3</td>
<td>-6.7</td>
</tr>
</tbody>
</table>
**Table E.6: Characteristics of Coerced Admissions for Amphetamines, Queensland, 2002/03-2008/09.**

<table>
<thead>
<tr>
<th>Demographics</th>
<th>2002/03</th>
<th>2003/04</th>
<th>2004/05</th>
<th>2005/06</th>
<th>2006/07</th>
<th>2007/08</th>
<th>2008/09</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (mean) (n=3,994)</td>
<td>27.7</td>
<td>28.2</td>
<td>28.7</td>
<td>28.5</td>
<td>29.0</td>
<td>29.5</td>
<td>30.3</td>
</tr>
<tr>
<td>Male (%) (n=3,999)</td>
<td>71.6</td>
<td>77.4</td>
<td>72.6</td>
<td>73.0</td>
<td>74.6</td>
<td>75.1</td>
<td>77.6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ingests</td>
<td>11.6</td>
<td>11.1</td>
<td>15.6</td>
<td>12.8</td>
<td>12.2</td>
<td>17.0</td>
<td>15.7</td>
</tr>
<tr>
<td>Smokes</td>
<td>0.8</td>
<td>1.3</td>
<td>4.5</td>
<td>10.8</td>
<td>15.6</td>
<td>12.3</td>
<td>13.0</td>
</tr>
<tr>
<td>Injects</td>
<td>87.2</td>
<td>87.7</td>
<td>77.7</td>
<td>73.9</td>
<td>70.6</td>
<td>69.2</td>
<td>69.7</td>
</tr>
<tr>
<td>Sniffs/Inhalers /Other</td>
<td>0.4</td>
<td>0.0</td>
<td>2.2</td>
<td>2.4</td>
<td>1.6</td>
<td>1.5</td>
<td>1.6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Current injector</td>
<td>58.1</td>
<td>62.7</td>
<td>62.8</td>
<td>58.6</td>
<td>52.2</td>
<td>43.7</td>
<td>43.3</td>
</tr>
<tr>
<td>3-12 months ago</td>
<td>26.4</td>
<td>16.9</td>
<td>12.5</td>
<td>12.1</td>
<td>14.2</td>
<td>14.4</td>
<td>14.7</td>
</tr>
<tr>
<td>More than 12 months ago</td>
<td>9.3</td>
<td>14.0</td>
<td>12.2</td>
<td>9.6</td>
<td>11.4</td>
<td>15.5</td>
<td>19.6</td>
</tr>
<tr>
<td>Never injected</td>
<td>6.2</td>
<td>6.5</td>
<td>12.5</td>
<td>19.7</td>
<td>22.1</td>
<td>26.3</td>
<td>22.4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Treatment (n=3,843)</th>
<th>2002/03</th>
<th>2003/04</th>
<th>2004/05</th>
<th>2005/06</th>
<th>2006/07</th>
<th>2007/08</th>
<th>2008/09</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compliant</td>
<td>36.7</td>
<td>54.3</td>
<td>64.2</td>
<td>78.4</td>
<td>74.9</td>
<td>70.6</td>
<td>68.6</td>
</tr>
<tr>
<td>Non-Compliant</td>
<td>48.5</td>
<td>37.8</td>
<td>30.1</td>
<td>17.6</td>
<td>19.8</td>
<td>20.0</td>
<td>23.7</td>
</tr>
<tr>
<td>Changed Mode of Tx</td>
<td>14.8</td>
<td>7.9</td>
<td>5.7</td>
<td>4.0</td>
<td>5.3</td>
<td>9.4</td>
<td>7.7</td>
</tr>
</tbody>
</table>
Appendix F Time-Series Analysis from Chapter 7
Figure F.1: ARIMA Analysis for Voluntary Methamphetamine Series - SAS/ETS® 9.22 OUTPUT

<table>
<thead>
<tr>
<th>Name of Variable = VMETH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period(s) of Differencing</td>
</tr>
<tr>
<td>Mean of Working Series</td>
</tr>
<tr>
<td>Standard Deviation</td>
</tr>
<tr>
<td>Number of Observations</td>
</tr>
<tr>
<td>Observation(s) eliminated by differencing</td>
</tr>
</tbody>
</table>

### Autocorrelation Check for White Noise

<table>
<thead>
<tr>
<th>To Lag</th>
<th>Chi-Square</th>
<th>DF</th>
<th>Pr &gt; ChiSq</th>
<th>Autocorrelations</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>17.54</td>
<td>6</td>
<td>0.0075</td>
<td>-0.469 -0.054 0.021 0.074 -0.001 -0.087</td>
</tr>
<tr>
<td>12</td>
<td>31.95</td>
<td>12</td>
<td>0.0014</td>
<td>0.153 -0.189 0.093 0.090 -0.260 0.162</td>
</tr>
</tbody>
</table>
Maximum Likelihood Estimation

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
<th>Standard Error</th>
<th>t Value</th>
<th>Approx Pr &gt;</th>
<th>Lag</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA1,1</td>
<td>0.70552</td>
<td>0.08599</td>
<td>8.20</td>
<td>&lt;.0001</td>
<td>1</td>
</tr>
</tbody>
</table>

Variance Estimate: 357.1134
Std Error Estimate: 18.89744
AIC: 620.5126
SBC: 622.7753
Number of Residuals: 71

Autocorrelation Check of Residuals

<table>
<thead>
<tr>
<th>To Lag</th>
<th>Chi-Square</th>
<th>DF</th>
<th>Pr &gt; ChiSq</th>
<th>Autocorrelations</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>2.21</td>
<td>5</td>
<td>0.8201</td>
<td>-0.049</td>
</tr>
<tr>
<td>12</td>
<td>9.88</td>
<td>11</td>
<td>0.5416</td>
<td>-0.141</td>
</tr>
<tr>
<td>18</td>
<td>14.65</td>
<td>17</td>
<td>0.6210</td>
<td>-0.022</td>
</tr>
<tr>
<td>24</td>
<td>15.77</td>
<td>23</td>
<td>0.8648</td>
<td>0.003</td>
</tr>
</tbody>
</table>
Model for variable VMETH

| Period(s) of Differencing | 1 |

No mean term in this model.

Moving Average Factors

| Factor 1: | 1 - 0.70552 B**(1) |

Outlier Detection Summary

| Maximum number searched | 5 |
| Number found | 0 |
| Significance used | 0.01 |
Table F.1: Impact Analysis of PROJSTOP on Voluntary Treatment Episodes for Amphetamines

Model I: Abrupt Temporary Impact of PROJSTOP – First-order pulse function

\[ (1 - B)Y_t = \left( \frac{\omega_{01}}{1 - \delta_1} \right)(1 - B)I_{29} + (1 - \theta_1 B)a_t \]

| Q | df | p | Parameter estimate | T-Value | Pr > |t| |
|---|----|---|--------------------|---------|-------|-----|
| 17.54 | 6 | >0.007 | \( \theta_1 = 0.72 \) | 8.26 | <.001 |
| 17.54 | 6 | >0.007 | \( \omega_{01} = 29.93 \) | 1.80 | 0.072 |
| 17.54 | 6 | >0.007 | \( \delta_1 = -0.71 \) | 2.39 | 0.017 |
| AIC=611.85 | | | | | |

Model II: Gradual Permanent Impact of PROJSTOP – First order step function

\[ (1 - B)Y_t = \left( \frac{\omega_{01}}{1 - \delta_1} \right)I_{29} + (1 - \theta_1 B)a_t \]

| Q | df | p | Parameter estimate | T-Value | Pr > |t| |
|---|----|---|--------------------|---------|-------|-----|
| 17.54 | 6 | >0.007 | \( \theta_1 = 0.69 \) | 6.73 | <.0001 |
| 17.54 | 6 | >0.007 | \( \omega_{01} = -0.05 \) | -0.38 | 0.705 |
| 17.54 | 6 | >0.007 | \( \delta_1 = 1.000 \) | 6.08 | <.0001 |
| AIC=622.15 | | | | | |

Model III: Abrupt Permanent Impact of PROJSTOP – Zero order step function

\[ (1 - B)Y_t = +\omega_{01}I_{29} + (1 - \theta_1 B)a_t \]

| Q | df | p | Parameter estimate | T-Value | Pr > |t| |
|---|----|---|--------------------|---------|-------|-----|
| 17.54 | 6 | >0.007 | \( \theta_1 = 0.73 \) | 8.71 | <.0001 |
| 17.54 | 6 | >0.007 | \( \omega_{01} = -1.01 \) | -1.26 | 0.206 |
| AIC=621.003 | | | | | |

Notes:
- \( Q \) = Test statistic for the null hypothesis that the model residuals are distributed as white noise
- \( B \) = Backward shift operator
- \( I_t \) = Intervention component
- \( \omega_0 \) = Zero-order input parameter estimate for the intervention
- \( \delta \) = Rate of change parameter estimate for the intervention
- \( \theta_1 \) = Moving average parameter
- \( a_t \) = Residual component
- AIC=Akaike’s information criterion

\( ^a \) The model defined by these estimates was unstable and did not converge.
Table F.2: Impact Analysis of PROJSTOP & REG1 on Voluntary Treatment Episodes for Amphetamines

Model I: Abrupt Temporary Impact of REG1 with the first-order pulse function PROJSTOP

\[(1 - B)Y_t = (\frac{\omega_{01}}{1 - \delta_1})(1 - B)I_{29} + (\frac{\omega_{02}}{1 - \delta_2})(1 - B)I_{31} + (1 - \theta_1 B)\alpha_t\]

\[Q=17.54\]  \(\text{df} = 6\)  \(p > 0.007\)

<table>
<thead>
<tr>
<th>Parameter estimate</th>
<th>(\theta_1)</th>
<th>(\omega_{01})</th>
<th>(\delta_1)</th>
<th>(\omega_{02})</th>
<th>(\delta_2)</th>
<th>AIC=615.73</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\theta_1)</td>
<td>0.72</td>
<td>31.79</td>
<td>-0.70</td>
<td>-1.82</td>
<td>0.71</td>
<td></td>
</tr>
<tr>
<td>T-Value</td>
<td>8.16</td>
<td>1.74</td>
<td>-2.32</td>
<td>-0.20</td>
<td>0.45</td>
<td></td>
</tr>
<tr>
<td>(p)</td>
<td>&lt;0.001</td>
<td>0.08</td>
<td>0.02</td>
<td>0.84</td>
<td>0.65</td>
<td></td>
</tr>
</tbody>
</table>

Model II: Gradual Permanent Impact of REG1 with the first order step function PROJSTOP\(^a\)

\[(1 - B)Y_t = (\frac{\omega_{01}}{1 - \delta_1})(1 - B)I_{29} + (\frac{\omega_{02}}{1 - \delta_2})I_{31} + (1 - \theta_1 B)\alpha_t\]

\[Q=17.54\]  \(\text{df} = 6\)  \(p > 0.007\)

<table>
<thead>
<tr>
<th>Parameter estimate</th>
<th>(\theta_1)</th>
<th>(\omega_{01})</th>
<th>(\delta_1)</th>
<th>(\omega_{02})</th>
<th>(\delta_2)</th>
<th>AIC=613.90</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\theta_1)</td>
<td>0.69</td>
<td>35.41</td>
<td>-0.62</td>
<td>-2.02</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>T-Value</td>
<td>6.63</td>
<td>2.08</td>
<td>-1.83</td>
<td>-1.10</td>
<td>-5.06</td>
<td></td>
</tr>
<tr>
<td>(p)</td>
<td>&lt;0.001</td>
<td>0.03</td>
<td>0.06</td>
<td>0.27</td>
<td>&lt;0.001</td>
<td></td>
</tr>
</tbody>
</table>

Model III: Abrupt Permanent Impact of REG1 with zero-order step function PROJSTOP

\[(1 - B)Y_t = (\frac{\omega_{01}}{1 - \delta_1})(1 - B)I_{29} + \omega_{02}I_{31} + (1 - \theta_1 B)\alpha_t\]

\[Q=17.54\]  \(\text{df} = 6\)  \(p > 0.007\)

<table>
<thead>
<tr>
<th>Parameter estimate</th>
<th>(\theta_1)</th>
<th>(\omega_{01})</th>
<th>(\delta_1)</th>
<th>(\omega_{02})</th>
<th>AIC=610.84</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\theta_1)</td>
<td>0.80</td>
<td>34.77</td>
<td>-0.68</td>
<td>-1.25</td>
<td></td>
</tr>
<tr>
<td>T-Value</td>
<td>10.37</td>
<td>2.29</td>
<td>-2.37</td>
<td>-2.06</td>
<td></td>
</tr>
<tr>
<td>(p)</td>
<td>&lt;0.0001</td>
<td>0.02</td>
<td>0.01</td>
<td>0.04</td>
<td></td>
</tr>
</tbody>
</table>

Notes:

\(Q\) = Test statistic for the null hypothesis that the model residuals are distributed as white noise
\(B\) = Backward shift operator
\(I_t\) = Intervention component
\(\delta\) = Rate of change parameter estimate for the intervention
\(\theta_1\) = Moving average parameter
\(\alpha_t\) = Residual component
AIC=Akaike’s information criterion
\(\omega_{0}\) = Zero-order input parameter estimate for the intervention

\(^a\) The model defined by these estimates was unstable and did not converge.
Table F.3: Impact Analysis of PROJSTOP, REG1 & CRIMLAW on Voluntary Treatment Episodes for Amphetamines

<table>
<thead>
<tr>
<th>Model I: Abrupt Temporary Impact of CRIMLAW with first-order pulse function PROJSTOP &amp; zero order step function REG1:</th>
</tr>
</thead>
<tbody>
<tr>
<td>((1 - B)Y_t = \left(\frac{\omega_{01}}{1 - \delta_1}\right) (1 - B)l_{29} + \omega_{02}l_{31} + \left(\frac{\omega_{03}}{1 - \delta_3}\right) (1 - B)l_{60} + (1 - \theta_1 B) \alpha_t)</td>
</tr>
<tr>
<td>Q=17.54</td>
</tr>
<tr>
<td>Parameter estimate</td>
</tr>
<tr>
<td>(\delta_1=0.72)</td>
</tr>
<tr>
<td>(\omega_{01}=32.66)</td>
</tr>
<tr>
<td>(\delta_1=0.69)</td>
</tr>
<tr>
<td>(\omega_{02}=1.71)</td>
</tr>
<tr>
<td>(\omega_{03}=31.99)</td>
</tr>
<tr>
<td>(\delta_3=-0.89)</td>
</tr>
<tr>
<td>AIC=608.71</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model II: Gradual Permanent Impact of CRIMLAW with first-order step function PROJSTOP &amp; zero order step function REG1:</th>
</tr>
</thead>
<tbody>
<tr>
<td>((1 - B)Y_t = \left(\frac{\omega_{01}}{1 - \delta_1}\right) (1 - B)l_{29} + \omega_{02}l_{31} + \left(\frac{\omega_{03}}{1 - \delta_3}\right) l_{60} + (1 - \theta_1 B) \alpha_t)</td>
</tr>
<tr>
<td>Q=17.54</td>
</tr>
<tr>
<td>Parameter estimate</td>
</tr>
<tr>
<td>(\delta_1=0.52)</td>
</tr>
<tr>
<td>(\omega_{01}=36.31)</td>
</tr>
<tr>
<td>(\delta_1=0.11)</td>
</tr>
<tr>
<td>(\omega_{02}=0.07)</td>
</tr>
<tr>
<td>(\omega_{03}=3.52)</td>
</tr>
<tr>
<td>(\delta_3=-1.00)</td>
</tr>
<tr>
<td>AIC=624.98</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model III: Abrupt Permanent Impact of CRIMLAW with first-order pulse function PROJSTOP &amp; zero order step function REG1:</th>
</tr>
</thead>
<tbody>
<tr>
<td>((1 - B)Y_t = \left(\frac{\omega_{01}}{1 - \delta_1}\right) (1 - B)l_{29} + \omega_{02}l_{31} + \omega_{03} l_{60} + (1 - \theta_1 B) \alpha_t)</td>
</tr>
<tr>
<td>Q=17.54</td>
</tr>
<tr>
<td>Parameter estimate</td>
</tr>
<tr>
<td>(\delta_1=0.99)</td>
</tr>
<tr>
<td>(\omega_{01}=37.24)</td>
</tr>
<tr>
<td>(\delta_1=0.66)</td>
</tr>
<tr>
<td>(\omega_{02}=-0.75)</td>
</tr>
<tr>
<td>(\omega_{03}=-2.24)</td>
</tr>
<tr>
<td>AIC=611.23</td>
</tr>
</tbody>
</table>

Notes:  
- \(Q\)=Test statistic for the null hypothesis that the model residuals are distributed as white noise  
- \(B\) = Backward shift operator  
- \(l_t\) = Intervention component  
- \(\omega_0\) = Zero-order input parameter estimate for the intervention  
- \(\delta\) = Rate of change parameter estimate for the intervention  
- \(\theta_1\) = Moving average parameter  
- \(\alpha_t\) = Residual component  
- AIC=Akaike’s information criterion  

*The model defined by these estimates was unstable and did not converge.*
REFERENCES


Queensland Government. Drug Misuse Amendment Act 2008 *Act No. 4 of 2008*.


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United Nations. (Convention Against Illicit Traffic in Narcotic Drugs and Psychotropic Substances, 1988 United Nations Office on Drugs and Crime (Ed.))


