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Research paper

"A more accurate understanding of drug use": A critical analysis of wastewater analysis technology for drug policy

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ABSTRACT

The idea of identifying and monitoring urinary excretion of illicit drugs and their metabolites in wastewater has been seen by governments and international organisations as 'promising'. It is claimed that such approaches will enable governments to effectively direct resources to priority areas, monitor the progress of demand and supply reduction strategies, as well as identify emerging trends. Drawing on poststructural approaches to policy analysis and insights from science and technology studies, we consider how the technology of wastewater analysis may be seen as a kind of *proposal* with productive capacity and constitutive effects. Through this analysis, we seek to raise ontopolitical questions about the production of data by interrogating the claims to 'accuracy' promoted in wastewater analysis, and illuminating the assumptions underpinning such pursuits. By taking an approach which sees method as performative rather than as descriptive of a pre-existing reality, we consider how wastewater analysis *enacts* realities into being in the drugs field. Taking Australia's National Wastewater Drug Monitoring Program as a case example, we argue that wastewater analysis constitutes drug use as measurable, countable and comparable and, in doing so, enacts a homogenous drug using population in a bounded geographical space, with implications for drug policy. Furthermore, the claim to 'accuracy' constitutes people who use drugs as lacking in knowledge and unaware, and relates to a range of practices which work to continually re-produce people who use drugs as criminal, untrustworthy and in need of surveillance. Through this analysis, we seek to generate critical discussion about practices of 'evidence-making', the privileging of 'scientific data' in drug policy processes (especially as it relates to population prevalence of drug use), and the hitherto unexamined effects of wastewater analysis for drug policy.

Introduction

Wastewater analysis has emerged as a novel approach to monitoring illicit drug use. This technology involves identifying and quantifying concentrations of human metabolites of illicit drugs in collected samples of raw sewage, and then back-calculating the amount of illicit drugs consumed in a community by taking into account daily flow rates of sewerage systems, average excretion rates, and the size of the population served by the treatment plant from which the sewage samples were drawn (Daughton, 2001a; EMCDDA, 2016; van Nuijs & Castiglioni et al., 2011). By assuming a mean dose, the value calculated is often expressed in "daily amounts" or "daily dose" "per thousand population" (EMCDDA, 2016, p.7). Also called 'wastewater-based drug epidemiology' or 'sewage epidemiology,' this approach has been seen by governments and international organisations as "promising" (EMCDDA, 2008, p.6) with "clear advantages" over existing epidemiological methods (EMCDDA, 2016, p.7). The European Monitoring Centre for Drugs and Drug Addiction (EMCDDA), for example, has stated that it quickly "recognised that this fast-developing discipline had the potential to complement and extend the existing epidemiological tools for estimating illicit drug use" (EMCDDA, 2016, p.5). Indeed, in less than a decade, this "promising tool" (van Nuijs & Castiglioni et al., 2011, p.3576) has been taken up and used to monitor illicit drug use in multiple jurisdictions around the world, including China, South Africa, Switzerland, Norway, Italy and other European nations (e.g. Archer, Castrignanò, Kasprzyk-Hordern, & Wolfaardt, 2018; Been, Esseiva, & Delémont, 2016; Bramness, Reid, Solvik, & Vindenes, 2015; Du et al., 2015; EMCDDA, 2016; Löve et al., 2018; Mastroianni, López-García, Postigo, Barceló, & López de Alda, 2017; Ort et al., 2014; Thomas et al., 2012; van Nuijs & Castiglioni et al., 2011; van Nuijs & Mougel et al.,

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2011; Zuccato et al., 2005). It is regarded as a "fast, inexpensive, and anonymous way" of evaluating trends in drug use in a community (Mastroianni et al., 2017, p.925).

While wastewater analysis technology has been the subject of significant discussion amongst epidemiologists and embraced with gusto by policy makers, to date there has been little critical attention paid to the implications and effects of this epidemiological method for drug policy. Although discussions continue unabated about what wastewater analysis might afford drug epidemiology as a new and better method, and how this approach might be refined (e.g. Bruno et al., 2018; Gracia-Lor, Zuccato, & Castiglioni, 2016), we wish to make a critical intervention by asking what wastewater analysis *performs*. Drawing on poststructural approaches to policy analysis and insights from science and technology studies, we consider how the technology of wastewater analysis may be seen as a kind of *proposal* with productive capacity and constitutive effects. We seek to raise ontopolitical questions about the production of data by interrogating the claims to 'accuracy' promoted in wastewater analysis, and illuminating the assumptions underpinning such pursuits. By taking an approach which sees method as performative rather than as descriptive of a pre-existing reality, we consider how wastewater analysis *enacts* realities into being in the drugs field. In doing so, we seek to generate discussion about practices of 'evidence-making', the privileging of 'scientific data' in drug policy processes (especially as it relates to population prevalence of drug use), and the hitherto unexamined effects of wastewater analysis for drug policy.

Background

The idea of identifying and quantifying concentrations of human metabolites of illicit drugs in wastewater was first posited in 2001, not necessarily with an eye to monitoring drug use per se. Originally, the idea was driven by environmental scientists' concerns about the unknown impact of excreted metabolites of drugs, pharmaceuticals and personal-care products on aquatic environments and ground-water (Daughton, 2001a,b). The idea of using these new methods to simultaneously inform discussions about environmental pollutants *and* illicit drug use was regarded as a "rare opportunity" which "merely capitalise[d] on science's technical capabilities in analytical chemistry" (Daughton, 2001a, pp.348–349). Thus, an approach which was designed to advance one of the ten goals set out in the United States Environmental Protection Agency's 2000 Strategic Plan relating to improving environmental data collection by deploying real-time monitoring (Daughton, 2001a), ended up serendipitously contributing to the advancement of illicit drug epidemiology. It was the view of environmental scientists that "public discourse over the last decades on the various issues involving illicit drugs has been less than fully informed" due to the lack of what they regarded as quality data (Daughton, 2001a, p.353). Having conducted a series of studies showing that prescription pharmaceutical and veterinary drugs excreted by humans and animals did make their way to aquatic environments via the sewerage system, environmental scientists then sought to test the theory that such approaches could be used to estimate population-level consumption of illicit drugs (Zuccato et al., 2005). Significantly, this early study did more than simply report the concentration of excreted drug metabolites in collected wastewater samples. The authors extrapolated estimates from these concentrations and presented these data as "the number of doses per day per 1000 people, assuming 100 mg as an average dose (the equivalent of four 25-mg 'lines' of cocaine)" (Zuccato et al., 2005, p.5). This approach to "normalising" daily consumption rates and "assuming a mean dose" continues to be used (EMCDDA, 2016, p.17).

The proposal that population drug use could be monitored using these methods was said to be "ground-breaking" at the time, with its implementation thought to offer a "radically innovative approach and totally new dimension to the decades-old quest of understanding the overall issue of illicit drug use" (Daughton, 2001a, p.349). The methods used in wastewater analysis have developed considerably over the last decade, and while this technology could be used to monitor any number of excretions (e.g. caffeine, nicotine, aspirin, fragrances and sunscreens: Daughton, 2001b), it has proven to be most popular for estimating illicit drug use in the community (EMCDDA, 2016). This rapidly advancing technology is now regarded as having "the potential to become an important adjunct to established drug monitoring tools" (EMCDDA, 2016, p.5) and has attracted significant investment and interest in the drug policy field.

It is perhaps unsurprising that wastewater analysis methods have been taken up with such enthusiasm in a field characterised by illegal markets, illicit behaviours, stigma, ambiguity, controversies and uncertainties. Illicit drug use (and its monitoring) is, in Law's (2005, p.333) terms, a "messy object" which in many ways "defies knowing." The promise of wastewater analysis ostensibly lies in its ability to simplify this 'mess' by technically addressing what are seen to be the three fundamental limitations of current approaches to drug epidemiology. First, epidemiological estimates of illicit drug consumption derived via general population surveys are thought to "lack […] objectivity because the information gathered in the population surveys comes from the consumers themselves" (Mastroianni et al., 2017, p.917). In advancing wastewater analysis approaches, environmental scientists have suggested that "since self-reporting of socially censured behaviour is likely to be unreliable, the figures obtained by interviewing known or potential users [sic] may be underestimates" (Zuccato et al., 2005). Researchers carrying out wastewater analysis have argued that surveying a "biased selection of the population" may lead "not just to an underestimate of rates of illicit drug use, but also to incorrect estimates" raising questions about the "reliability, validity and utility" of data obtained through existing epidemiological tools (van Nuijs & Castiglioni et al., 2011, p.3565). While these concerns have been raised by scientists subsequently taking up and using wastewater analysis methods, the original proponent of the approach was additionally motivated by the idea that "objective data" might be obtained "without the risk of implicating or incriminating individuals" (Daughton, 2001a, p.350).

Second, existing epidemiological methods are seen to be limited by their "insufficient spatial resolution to allow realistic drug use estimation at [a] regional level" (Mastroianni et al., 2017, p.917). Given that drug use surveillance tends to focus on metropolitan areas (van Nuijs & Castiglioni et al., 2011), wastewater analysis is regarded as a more "flexible tool" as this approach can be used to compare across different geographical locations (EMCDDA, 2016, p.11). Third, population surveys and statistical analyses of other routinely collected administrative data tend to have a "delayed response time" (Mastroianni et al., 2017, p.917), with years passing between data collection waves. These time consuming survey methods require "the investment of considerable resources if they are to produce reliable results" (EMCDDA, 2016, p.4). Indeed, it has been said that the strength of wastewater analysis technology rests in its ability to deliver "near-real-time data," which according to the EMCDDA is "particularly relevant to the mercurial nature of today's drug problem" (EMCDDA, 2016, p.5). In keeping with this view, organisations such as the Australian Criminal Intelligence Commission have claimed that such approaches will enable governments to effectively direct resources to priority areas, monitor the progress of demand and supply reduction strategies, as well as identify emerging trends (Australian Criminal Intelligence Commission, 2017a). In this way, wastewater analysis technology might be read as a technical response – a new method or "discipline" (EMCDDA, 2016, p.5) – which addresses the problem of how we come to know the 'mess' of illicit drug use at a population level. In this paper, we consider what realities this new technology *performs* in its attempts to 'clean up' the 'mess' of illicit drug epidemiology (Law, 2004). We focus on the production of scientific data, and of populations of interest, afforded by this technology.

Approach

Our analysis of the use and uptake of this novel epidemiological method is informed by Carol Bacchi's poststructural approach to policy analysis, as well as the work of science and technology studies scholars (in particular, John Law's work on the performativity of method). As other critical drug studies scholars have observed, there is a general theoretical orientation towards performative ontologies evident in Bacchi's work (Moore, Fraser, Keane, Seear, & valentine, 2017), which accords with the analytic concerns in this paper. Bacchi's (2009; 2016) approach is premised on the claim that policy does not 'solve' pre-existing self-evident problems. Rather, policies are *proposals* about how things should be or what needs to change, and thus contain within them implicit representations about what is problematic (Bacchi & Goodwin, 2016; Bacchi, 2018). Bacchi argues that the problem representations (or – following Foucault – *problematisations*) produced in policy proposals "become part of how governing takes place. They are *enacted* as part of 'the real'" (Bacchi, 2018, p.4). In this way, policy proposals are *constitutive* of realities. This analytic approach enables an interrogation of the deep-seated assumptions underpinning these problematisations to provide insight into modes of governing (Bacchi, 2009, 2018; Bacchi & Goodwin, 2016). The study of problematisations also offers "a key link" in analysing the constitutive effects of specific kinds of governing practices by drawing attention to the ways in which 'objects' and 'subjects' are "produced as 'real'" through the "collecting together of things, actions, gestures, behaviours [and] words" (Bacchi, 2018, p.7). To be 'made real' as an 'object for thought' specific elements come together, and the focus of analysis becomes what Annemarie Mol (2002, pp.55, 84–85) calls "forms of coordination." Thus, Bacchi's work makes a critical contribution by shifting the analytic emphasis "from presumed objects to the *relations* involved in their becoming" (Bacchi & Goodwin, 2016, p.33, emphasis original). Crucially, showing how realities are made in practice also opens up space for "contestation and *unmaking*" (Bacchi & Goodwin, 2016, p.15, emphasis original). That is, by showing how things *become* real it becomes possible to see that things *could be otherwise* (Law & Singleton, 2000; Mol, 1999).

While Bacchi's 'What's the Problem Represented to be?' approach provides seven interrelated questions and steps as a framework for analysis, it is as much a way of thinking as it is a method for analysis (Bacchi, 2018). Importantly for the purposes of our analysis, in her recent work Bacchi (2018; 2016, p.18) has suggested that this approach "can also be applied to phenomena that are not literally textual and 'objects' not found in formal documents, such as ceremonies (as spoken and acted text), organizational culture (as symbols), buildings, and mechanisms of government" as well as other governmental and non-governmental technologies and practices. We suggest that wastewater analysis technology is another phenomenon that may be analysed as a form of *proposal.* That is, we can interrogate the implicit problematisations, underlying assumptions and constitutive effects of wastewater analysis in the same way we might analyse policy or law.

In our analysis, we also draw on John Law's work on the performativity of scientific method (Law & Singleton, 2005; Law, 2004, 2009). The performative understanding of method explored in Law's work in many ways accords with the theoretical orientation of Bacchi's work on policy. Both Law and Bacchi eschew an assumption that realities are fixed and stable, exogenous to the specific practices and relations which enact them. Law (2009, pp.239–240, emphasis original) argues:

> There are two great views of method in science and social science. On the one hand it is usual to say that methods are techniques for *describing* reality. Alternatively, it is possible to say that they are practices that do not simply describe realities but also tend to *enact* these into being. The first approach represents the received wisdom. It works on the assumption that in one way or another reality has a definite form that is substantially independent of and prior to the tools used to inquire into it. Then it assumes that it is the job of inquiry to discover and describe this reality as best may be. […] The second approach – the idea that methods are practices that tend to *enact* realities as well as describing them – treats knowledge practices as more or less *performative*.

Law (2009, p.240) is careful to point out that knowledge practices must do two things in order to be sustainable: first, they must "create knowledge (theories, data, whatever) that *work*, that somehow or other hold together, that are convincing and (crucial this) do whatever job is set for them"; and secondly (and, Law says, counterintuitively) they must "be able to *generate realities* that are fit for knowledge." From this perspective the familiar rules, techniques and practices of methods not only describe the realities they seek to understand, but rather are seen to "participate in the *making* of those realities" (Law, 2004, p.10, emphasis original). Here, Law draws on a body of science and technology studies work – including the seminal work of Latour and Woolgar (1986) – which has examined how scientific knowledge is produced and how scientific practices create realities, and extends these arguments to the social sciences as well. The argument is that realities are not necessarily fixed, stable, singular and anterior but if they appear to be so then "this itself is an effect that has been produced in practice"; it is "a *consequence* of method" (Law, 2004, p.38).

These enactments do not happen in a vacuum, however. Essential to Law's (2009, p.241) argument is the notion that "realities (as well as knowledge of realities) depend on practices that include or relate to a hinterland of other relevant practices." It is this hinterland of practices – this extending set of relations or, put simply, context – by which method is surrounded and in which it is performed that "enacts a topography of reality possibilities" (Law, 2004, p.160). Knowledge practices, inscription devices, instruments and representations all form part of this relatively stable hinterland (Law, 2004, 2009). The realities made through methodological practices *depend on* this larger network – this hinterland – of practices (Law, 2009).

Law (2009, p.240) suggests that such an understanding of method is "analytically productive because it asks us to explore what it is that our methods actually do, and then whether or not this is desirable." This way of thinking about method opens up a political space (as does Bacchi's approach, as we noted earlier). It makes possible "a politics of the real" (Law, 2009, p.243). Thus, taking wastewater analysis methods and their accompanying programs as our focus for analysis, our concern is to draw attention to the productive capacity and constitutive effects of wastewater analysis technology in the drugs field. Extending our work on 'evidence-making' practices (Lancaster, 2016; Rhodes, 2018; Rhodes, Lancaster, Harris, & Treloar, 2018), we seek to highlight the specific effects made through the implementation of this technology in the drugs field, recognising that the realities made cannot be understood separate from their associated practices (Gomart, 2002).

Method

While we note that wastewater analysis has been used around the world, to focus the scope of our analysis we take Australia's National Wastewater Drug Monitoring Program as a case example. The program is funded by the Australian Criminal Intelligence Commission and conducted in partnership with both the University of Queensland and the University of South Australia, and analyses wastewater from approximately 50 sites located within state capitals and regional areas across Australia. The program was introduced in response to Recommendation 35 of the National Ice Taskforce Report, which advised "establishing a national wastewater analysis capability […] to provide a more accurate analysis of drug use in Australia" (Department of the Prime Minister & Cabinet, 2015, p.153). The National Ice Taskforce was established in 2015, in response to growing concerns about what was perceived to be an "ice epidemic" in Australia (Prime Minister & Cabinet, 2015). To date, AUD$3.6 million in funding has been

allocated to the National Wastewater Drug Monitoring Program, over a three year period (Australian Criminal Intelligence Commission, 2017a).

As an entry-point into analysis we take as "practical texts" (Bacchi, 2009, p.54) a corpus of documents associated with the National Wastewater Drug Monitoring Program, including reports published in 2017 and 2018 (Australian Criminal Intelligence Commission, 2017a, 2017b, 2017c, 2017d, 2017e, 2017f, 2018a, 2018b, 2018c), as well as one-page infographic snapshot reports, media releases and responses. The National Wastewater Drug Monitoring Program will publish nine reports over a three year period (Australian Criminal Intelligence Commission, 2018c) and the texts which we take as the springboard for our analysis comprise the first in this series. As we have argued elsewhere (Lancaster, Seear, & Ritter, 2017; Lancaster, Seear, & Treloar, 2015) interrogating the productive capacity and constitutive effects of contemporary policies and governing practices, as processes unfold, is important as it can bring to light aspects and effects of these practices which may have hitherto been neglected. We use these texts merely as "levers" (Bacchi & Goodwin, 2016, p.18), seeking to extend our analysis beyond this specific Australian case example and open up reflections on wastewater analysis technology more generally, bringing to light implications worthy of consideration for the drug policy field internationally.

The analysis below is presented in two parts. First, we examine the assumptions underpinning the pursuit of 'accurate data'. Second, we consider the ways in which wastewater analysis makes drug consumption a measurable and knowable reality.

Analysis

'Accurate' data

Australia's National Wastewater Drug Monitoring Program was introduced in response to the recommendations of the National Ice Taskforce "to provide a *more accurate* analysis of drug use in Australia" (Department of the Prime Minister & Cabinet, 2015, p.153, emphasis added). This is in keeping with how wastewater analysis technology has been framed internationally, as a technical response to 'clean up the mess' of drug epidemiology. In the foreword to the Australian program's first report, this need for 'accuracy' was reiterated:

> The National Ice Taskforce found self-report user surveys, seizure and arrest data and medical statistics provide only a limited picture of drug consumption. Consequently, the Taskforce recommended that a national wastewater capability be established to provide *a more accurate and comprehensive understanding* of drug use in Australia. (Australian Criminal Intelligence Commission, 2017a, p.1, emphasis added)

Subsequent reports have emphasised "refinements" to the method that "increase both the precision and accuracy" of data (Australian Criminal Intelligence Commission, 2018a, p.1). Across the reports it is stated that wastewater analysis will provide "statistically valid datasets of drug use" (Australian Criminal Intelligence Commission, 2017c,e, 2018a) and "concrete data" (Australian Criminal Intelligence Commission, 2017a, p.1). Furthermore, it has been said that wastewater analysis will provide "the first national *evidence base* of illicit drug usage" (Australian Criminal Intelligence Commission, 2017a, p.1, emphasis added).

As a *proposal* (Bacchi & Goodwin, 2016), wastewater analysis purports to address (and therefore constitutes as a specific kind of problem) the need for 'accurate' 'valid' 'scientific data' about 'drug' consumption in the community. While this may on the surface appear to be an entirely obvious and natural pursuit, this quest for 'accurate' and 'comprehensive' data about 'drug' use relies on a range of assumptions. Moreover, as we will discuss in more detail below, this quest for accuracy is performative; it carries with it a range of material-discursive effects for how people who use drugs (their bodies, their communities, their knowledge, their trustworthiness, their drug use patterns, their treatment and service needs) may be imagined, thought about and addressed.

First, it is assumed that having an accurate and objective 'evidence base' would necessarily make a difference to drug policy-making. For example, it was noted that:

> The data provides a measure of the demand for a range of licit and illicit drugs. An understanding of this behaviour then permits governments to effectively direct resources to priority areas, and also to monitor the progress of demand and supply reduction strategies. […] These features permit governments to focus on areas which are deserving of particular attention. (Australian Criminal Intelligence Commission, 2017a, p.2)

This point has been made internationally as well. For example, the EMCDDA has suggested that the availability of 'accurate data' will make a difference even at a service provision level:

> By being able to detect changes in drug use patterns over time and as they occur, wastewater analysis can help health and treatment services in a number of ways. Alerting hospitals to the identities of new psychoactive substances being used in nightlife settings and predicting changes in treatment needs based on longer-term monitoring are but two potential examples (EMCDDA, 2016, p.5).

This assumed link between 'accurate data' and 'effective policy action' accords with a predominant (but nonetheless critiqued) view of policy-making as a process of 'authoritative choice' (see Colebatch, Hoppe, & Noordegraaf, 2010) as well as the requirements of the 'evidence-based policy' paradigm. However, these problem-solving paradigms carry with them multiple political implications, not least because they are underpinned by the assumption that "the 'problems' being 'addressed' are readily identifiable and uncontroversial" (Bacchi, 2018). Moreover, as Fraser, Moore, and Keane (2014, p.16) have noted, the 'evidence-based policy' paradigm tends to "take for granted that value-free, objective knowledge *can* be produced about the world." These problem-solving paradigms privilege "those who get to set the 'problems' to be 'solved'" and what kinds of knowledge may be regarded as legitimate and authoritative for policy (Bacchi, 2018, p.2; see also: Fraser & Moore, 2011; Lancaster & Seear et al., 2017; Lancaster & Treloar et al., 2017).

The assumption that value-free knowledge can be produced and that particular knowledges are more legitimate and authoritative than others in policy making is significant here. The requirement that a particular kind of knowledge – *accurate, comprehensive, scientific data* – be generated as a necessary basis for effective policy action points to not only concerns about the perceived partiality of existing epidemiological data but, more than this, produces these existing data generation methods as inherently *untrustworthy*. Without wastewater analysis to 'accurately' complete 'the picture of drug consumption', the value of existing epidemiological approaches becomes doubtful. The claim to accuracy and objectivity mobilises positivist assumptions, producing a binary in which data produced through social science methods (such as self-report surveys) are less valid, less valued and less trustworthy. Wastewater analysis performs its data as more 'accurate' because it imagines a direct, empirical and observable connection to physical 'drug objects' (through the scientific measurement of metabolites) thus absenting the need to find out what people who use drugs might know. This method produces 'drug objects' which are known physically, directly, substantively and scientifically, circumventing the need for (uncertain) interpretation of less material indicators (such as self-report). Wastewater analysis enacts 'drug objects' that speak for themselves, through direct observation.

The untrustworthiness of data obtained through self-report or

survey methods is also an effect of the way the problem of drugs – and the people who use them – are constituted within wastewater analysis programs. It is here that we see the particular significance of privileging objective scientific data over other self-report survey methods in the drugs field. It has been said that "[m]onitoring illicit drug use is difficult because of the *hidden and complex nature* of drug-using behaviours" and, as such, wastewater analysis has "clear advantages over other approaches, as it is not subject to the biases associated with self-reported data and can better identify the true spectrum of drugs being consumed, which is particularly important as users are often unaware of the actual mix of substances they take" (EMCDDA, 2016, p.7, emphasis added). Here, the claim to 'accuracy' not only produces drug use as a particular kind of 'hidden' problem, but also in turn constitutes people who use drugs as lacking in knowledge and unaware (that is, as unable to reliably contribute the kind of accurate knowledge necessary for policy action). Constituting people who use drugs in this way has multiple potentially deleterious effects. The claim to accuracy reinforces and re-makes people who use drugs as mendicants and criminals, reproducing the stigmatising subjectification effects in popular discourse about drugs. It brings into question the role that people who use drugs might play in contributing to understandings of drug consumption and drug policy by dismissing their contributions as biased or unaware, simply absenting them as unworthy knowers in favour of 'accurate' scientific measures. Constituting people who use drugs as *both* 'unknowing' and 'unworthy knowers' makes them as naïve subjects who require close surveillance. While being 'unknowing' might be rectified via the introduction of technologies such as drug-checking or pill-testing (which would give people who use drugs the tools to be knowledgeable about the mix of substances they take), being constituted simultaneously as 'unworthy knowers' absents this possibility.

The emphasis on real-time monitoring in wastewater analysis further embeds and re-produces this construction by constituting drug use as a problem that requires rapid, top-down policy responses. Drug use is constituted as a dangerous behaviour requiring government surveillance and intervention. It is perhaps unsurprising, then, that data produced by wastewater analysis methods are said to inform "demand reduction and supply reduction" (Australian Criminal Intelligence Commission, 2017a, p.5) strategies (that is, reducing the demand for and availability of illicit drugs) and not harm reduction strategies (through which people who use drugs might be enjoined to make choices to reduce harms and take care of their health).

While it is assumed that more 'accurate data' will necessarily better "inform" policy responses and "how governments respond to current and emerging drug trends" (Australian Criminal Intelligence Commission, 2017a), it is important to note that wastewater analysis cannot distinguish between: a large number of people in the community consuming a small quantity of drugs; a few people in the community consuming a large quantity of drugs; or changes in drug purity without changes in use. These limitations are acknowledged:

> Drug concentration is measured overall, and therefore cannot be used to distinguish occasional use by many people from heavy use by a few individuals. In the case of drugs such as methylamphetamine, different forms of the drug ('ice', powder) will yield the same result when measured in wastewater. (Australian Criminal Intelligence Commission, 2017a, p.14)

Given these limitations, the privileging of data generated through wastewater analysis due to its 'accuracy' is potentially highly problematic for drug policy. A particular kind of 'drug use' is being made through these methods. By measuring drug metabolite concentration overall, this method produces the *mere use* (or indeed *mere presence*) of illicit drugs as always already inherently problematic, necessarily requiring response and intervention, but without any understanding of drug use practices or harms:

> Finer demographic information such as gender, age or ethnicity cannot be ascertained by wastewater analysis, nor the administration route used (intranasal, oral, intravenous, etc.). (Australian Criminal Intelligence Commission, 2017a, p.14)

In the National Wastewater Drug Monitoring Program's first report, this limitation was acknowledged on the very same page of the report on which it was claimed that the "aim is to acquire data on the population-scale use of substances causing potential harm, either through addiction, health risks, or criminal and anti-social behaviour" (Australian Criminal Intelligence Commission, 2017a, p.14). The segue from mere use to harm is easily made here, without any reference to drug use practices.

The 'accuracy' promised by wastewater analysis methods erases the social, relational and contextual aspects of drug use. This is not only at odds with the harm minimisation framework underpinning Australia's National Drug Strategy (which emphasises not only use per se, but drug-related *harms*) but also a body of research which has sought to reconfigure how we think about drug-related harm (e.g. Dilkes-Frayne, 2014; Duff, 2013, 2014; Rhodes, 2009). While we note that caveats about the limitations of wastewater analysis methods are often included in the technical chapters written by scientists in many of the published reports, it is in many ways the translation of this method *into* drug policy (in describing how it might work *for* drug policy) that the implications and effects of these limitations are glossed over or erased. The way the method performs for and in drug policy (that is the way evidence-making is done in a specific context) shapes the realities produced and erased, made possible and silenced.

Made to be measurable; made to be knowable

At this juncture, following Law (2009), we consider in more detail what realities wastewater analysis methods are helping to generate. Following Law's (2009) approach, we respond to this question by examining successive 'layers'[1] of wastewater analysis and its reported results. We examine wastewater analysis and its reported results within a hinterland of practices in relation to 'evidence' and 'drugs' and consider how this shapes what kinds of subjects and objects are made possible.

The first layer we interrogate is the presentation of results. Following Law (2009, p.244), the results of the National Wastewater Drug Monitoring Program are treated as "lying on the surface", open to exploration – akin to "practical texts" (Bacchi, 2009, p.54). At the opening of each of the four reports produced as part of the National Wastewater Analysis Program, a 'snapshot' has been published. These are two-page, infographic representations of the findings contained

[1] Law uses the term 'layers' to describe a kind of Foucauldian archaeology, similar to the kind of analysis undertaken within question 2 of Bacchi's approach which aims to identify and interrogate the conceptual logics and "unexamined ways of thinking" underpinning problematisations, locating them within the networks of relations and practices that produce them, to understand how they acquire 'truth status' (Bacchi & Goodwin, 2016, pp.21-22). Law (2009) deploys the concept of 'layers' as a heuristic device to suggest several levels of influence and complexity in the generating and functioning of the Eurobarometer survey. Law analyses five successive layers in his archaeological reading of the survey: that which is lying on the surface (layer 1); local political hinterlands (layer 2); subjectivities and the location of politics (layer 3); the making of population in a conceptual and geographic space (layer 4); and enacting collectives (layer 5). We do not follow these five layers prescriptively in our analysis, but rather use Law's heuristic device as a conceptual tool to think-with to consider what realities wastewater analysis methods are helping to generate. Our analysis aligns most closely with Law's 'layers' 1, 2 and 3. Layers 4 and 5 could be explored in more depth in future analyses, expanding on our brief discussion of the making of drug use in a bounded geographical space and with a view to considering alternative ways of enacting collectives in drugs research (perhaps taking up the questions about method we raise in conclusion).

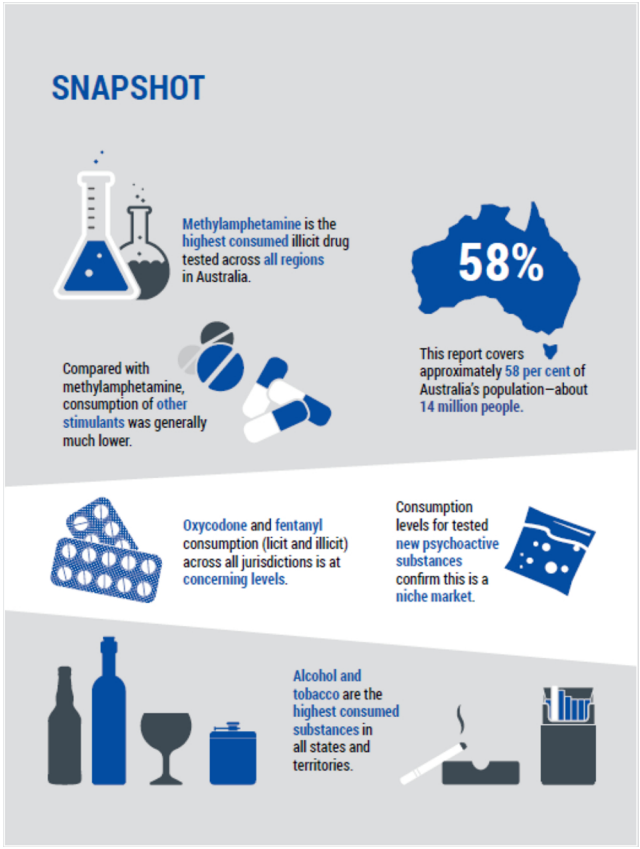

Fig. 1. Snapshot report, National Wastewater Drug Monitoring Program Report 1, March 2017 (Australian Criminal Intelligence Commission, 2017a, p.3).

within the 50-plus page reports. These infographics are presented as 'fact' (they are designed to speak for themselves). In three out of four of the infographics, methamphetamine is represented by the cartoon-like image of a bubbling chemistry test-tube and flask, captioned with the statement that "methylamphetamine is the highest consumed illicit drug tested across all regions in Australia" (Australian Criminal Intelligence Commission, 2017a, p.3) (see Fig. 1). A graphical outline drawing of a map of Australia is pictured, with the figure "58%" printed within the image, accompanied by the statement that "this report covers approximately 58 per cent of Australia's population – *about 14 million people*" (Australian Criminal Intelligence Commission, 2017a, p.3, emphasis original). A cartoon representation of a snap-lock plastic bag containing bubbles is captioned by the statement that "consumption levels for tested new psychoactive substances confirm this is a niche market" (Australian Criminal Intelligence Commission, 2017a, p.3).

Despite the apparent 'complexity' involved in measuring drug consumption, and the emphasis on accuracy and comprehensiveness, these representations erase the caveats and uncertainties of measurement. These cartoon graphic devices perform their work as translation between the hidden complexity of science and 'common-sense' understandings of drugs by simplifying and cleaning up the 'mess' of drug epidemiology, thus making complexity easily known and accessible. Through wastewater analysis drug use at a population level is *made to be measurable and knowable*. The reported findings and infographics presented enact population drug consumption as countable, comparable and objectively knowable. The ever present concerns of the drugs field regarding changes in purity, market shifts and unknown dosing of illicit substances are also neatly erased, as calculations presented later in the documents are reported as "doses per day per 1000 people" using a formula which has as its denominator "standard dose (mg)" (Australian Criminal Intelligence Commission, 2017a, p.21).

More than simply being measurable and knowable, the results presented in the wastewater analysis reports also enact a *homogenous* drug using population:

> All averages for state/territory or Australia-wide drug consumption data are presented throughout this report as population weighted averages. The number of people in the catchment population is used as the weighting for the respective drug consumption data for that population. […] Reported average values are therefore not skewed towards usage data from small, non-representative populations. […] The per capita consumption estimates presented in this report are calculated using the total estimated catchment population (which includes children). (Australian Criminal Intelligence Commission, 2017a, p.21)

Contrary to how we might usually expect epidemiological data to be presented, these findings are not stratified by sex, socio-economic status or any other demographic marker. These data make drug use to be *everywhere* in this bounded geographical space, enacting the subject of 'population'.

Whether or not the realities produced through this method – that population drug consumption is measurable, knowable and everywhere – hold beyond the context of its own data generation and reporting (that is, whether these realities are "transportable": Law, 2009, p.245), will depend on the network-hinterland of practices to which these enacted realities relate. Here, we interrogate a second layer, relating to political context and contests over 'evidence'. As noted earlier, the National Wastewater Monitoring Program was introduced in Australia in response to the findings of the National Ice Taskforce. This Taskforce was established by the Office of Prime Minister and Cabinet to "tackle the growing scourge of ice" and driven by the perception that Australia was in the grip of an 'ice epidemic' (Chalmers, Lancaster, & Hughes, 2016). It was the finding of the Taskforce that ice was "a drug like no other […] causing a great deal of harm across our community" (Department of the Prime Minister & Cabinet, 2015, p.ii). Despite heightened media attention and reports of increasing harms in the community, the findings of the 2013 National Drug Strategy Household Survey (Australia's general population survey measuring population drug consumption) had shown no general population increase in past year prevalence of methamphetamine use (Chalmers et al., 2016). Indeed, there is still much conjecture among researchers about the nature and extent of the so-called 'ice epidemic' in Australia (see Chalmers et al., 2016; Degenhardt et al., 2016; Dietze et al., 2018; Scott, Caulkins, Ritter, Quinn, & Dietze, 2015).

In this context, the infographic presented at the opening of the wastewater analysis report stating that "methylamphetamine is the highest consumed illicit drug tested across all regions in Australia" is likely to be a reality produced that links strongly with media, community, political, policy and indeed some scientific discourses in Australia. In many ways these findings (and the realities produced through them, that methamphetamine is indeed *everywhere* in this bounded geographical space and that no community in Australia is immune) resonates strongly with the version of methamphetamine being re-produced daily in other reality-practices and sites. What the reports do not explicitly mention is that cannabis metabolites are not measured (indeed, the reports are silent as to why that might be; in other jurisdictions, cannabis metabolites are measured). What is also not teased out is how the "standard dose" multiplier for methamphetamine might relate to changes in purity of methamphetamine which have been identified (Scott et al., 2015). Thus, while the aim of the wastewater analysis program is "to provide a more accurate analysis of drug use in Australia" this is necessarily a partial picture. Unlike the charges of untrustworthiness held against existing epidemiological methods, however, the partiality and ambiguity of the picture presented here is erased, because the reality produced – that of

methamphetamine use being highly prevalent and measureable – holds solid and links with a network-hinterland of other practices working with similar realities. As Law (2009, p.246) notes, "what is at stake is what is successfully connected with what, in particular practices of enacted network-hinterlands."

The third layer relates to a more general point about drugs and the people who use them. The realities performed by wastewater analysis also link to a hinterland of political, social, cultural, medical, legal, scientific and policy reality-practices in the drugs field. Wastewater analysis does not only seek to describe drug consumption, it "simultaneously mobilis[es] a series of *assumptions*" (Law, 2009, p.246, emphasis original) *about people who use drugs*. We noted earlier that the 'accuracy' of wastewater analysis is held distinct from, and privileged above, the apparently 'biased' and 'uncertain' nature of self-report data generated through surveys and social science methods. It has been said that "wastewater analysis has some clear advantages over other approaches, as *it is not subject to the biases associated with self-reported data*" (EMCDDA, 2016, p.7, emphasis added). Here, data produced by wastewater analysis methods *works as* knowledge because the reality generated – an 'accurate picture of drug use' – relates to a whole range of practices that continually produce people who use drugs as criminal, untrustworthy, deviant and in need of surveillance (be that through medical or treatment systems, criminal justice systems, or even welfare systems). As *The Australian* newspaper reported:

> Traditional methods of judging drug use, such as simply asking users, have been blamed for underestimating the scale of Australia's drug problem. The principal of testing wastewater is based on the idea that *while people may be able to conceal their habits* even from close friends and family, *fluids released into sewage systems nonetheless provide telltale signs* of community drug-use patterns as a whole. (Aikman, 2017, emphasis added)

Wastewater analysis results are 'telltale signs'; a reality that holds more stable than results gleaned by 'simply asking users' due to the practices of stigmatisation and criminalisation which continually produce people who use drugs as untrustworthy and unreliable. Even as formal efforts continue to recognise the rights and capabilities of people who use drugs, these ostensibly 'objective' and 'scientific' methods serve to uphold and perpetuate stigmatising subjectivities and realities.

Thus, following Law (2009, p.244), while it might be "tempting" to say that wastewater analysis is describing population drug use, we can see the ways in which the realities made hold within a "network-hinterland of practices" which also enact drug consumption and people who use drugs in more or less the same ways. The hinterland of practices in which these methods work is one in which methamphetamine is feared to be everywhere, where people who use drugs are untrustworthy and unknowing, and where the call for 'objective' and 'accurate' 'evidence' is paramount. The apparent 'innovation' of wastewater analysis masks its reliance on familiar and well-established drug-reality-practices. Like Law's (2009, p.245) study of the Eurobarometer survey, however, we can also imagine where points of disjuncture might emerge; where the realities made through wastewater analysis might function "only in the context of its own" method. The absence of cannabis use in this picture is one obvious point. Another question worthy of investigation is the extent to which this picture of drug use as prevalent and everywhere homogenous, necessarily productive of harm, and a problem to be managed, produces a drug use reality which links poorly to other drug-reality-practices, not least of all the experiences of the vast majority of people who use drugs.

Conclusion

By drawing on poststructural approaches to policy analysis and insights from science and technology studies, we have illuminated the ways in which methods or technologies such as wastewater analysis are not simply neutral ways of describing and measuring the world. Wastewater analysis might be seen as a proposal – a proposal which constitutes the problem it purports to address, relies on a range of assumptions to do so, and produces a range of effects in the real. If we understand method as performative, then it becomes important to critically consider *what* is being enacted (that is, what data produced via these methods *do*). As these enactments do not occur within a vacuum, it is also essential to examine the network of practices and relations which help make 'the real'. As we have demonstrated through our analysis of a new and increasingly popular technology in the drugs field, this is not necessarily a comfortable task. As Law notes, "if we are prepared to get into the technical specificities of knowledge production, then it is opening up a profoundly political space" (Law, 2009, p.243). Importantly, though, this way of thinking produces an "ontological politics", "in which we might try to strengthen some realities while weakening others, some systems of reality circulation rather than others" (Law, 2009, pp.242-243; Mol, 1999).

Opening up a political space and reflecting on the constitutive effects of wastewater analysis technology specifically, also prompts us to critically consider the methodological practices we use, engage with, and uphold as a field more generally. Given the many limitations of wastewater analysis, one might suggest that this method is an easy target for this kind of critical analysis (that 'better science' might stand up to the rigours of the analytic questioning we have subjected this method to herein). However, the issues we have illuminated in our analysis prompt a broader questioning (not only for the field 'out there' but also relating to our own critical analysis and engagement with method). Through critical analysis of wastewater analysis, we are reminded that the methods, concepts and categories we routinely (and often unquestionably) deploy in research "are not a way of opening a window on the world, but a way of interfering with it" (Mol, 2002, p.155). Mol (2002) suggests that as researchers we should direct our energy towards trying to understand what we are *doing* when we observe, count, measure, evaluate, publish and speak. As our analysis of the wastewater program demonstrates, method is productive of realities and, hence, is *creative* (Law, 2004). From this perspective, through research it is possible to continually make "new signals and new resonances, new manifestations and new concealments," none of which automatically fix or stay in place. The suggestion here, for us as researchers, is to find ways of working that "*apprehend* that multiplicity" (Law, 2004, p.152). Perhaps we need to find other ways of working (new methods) which set aside the dominant blinkered presumption of a prior, stable, observable, fixed, knowable and singular 'real' in favor of possible presences and gatherings, absences and relations; ways that "make and depict the world differently" (Law, 2004, p.148). In doing so, we might also need to think carefully about the nature of objects, resisting simplified models and technical fixes that end up erasing a messy and complex world "by insisting that it is clear" (Law & Singleton, 2005, p.350). Alongside this pursuit, it is also important "*politically* to *contest* the view that research produces disinterested, objective contributions to solving clearly observable societal problems" (Bacchi, 2012, p.150, emphasis original). Bringing into question the implicit assumption that policy 'problems' are exogenous to 'evidence-based policy' processes, is one generative starting point for such contestation.

Given the context from which wastewater analysis has emerged, we might also consider the possibilities for what an 'object of method' might produce or become as it moves across different disciplines and sites. While we have not explored this in detail here, we suggest that the program and reports analysed also bring *method* (as much as drug realities) into being. Wastewater analysis is also in-the-making, itself performed as a particular kind of 'method object' through these texts. Future analysis might examine the *transformation* of the object of wastewater analysis technology as it is translated from environmental science and into drug policy. What might be regarded as 'good' science for measuring pollutants in aquatic environments, in its re-application to drug policy might be remade into a different kind of method,

reconstituted by a different set of effects (Gomart, 2002). Like interventions (Rhodes, 2018; Rhodes et al., 2018), this method might be ontologically remade and transformed as it is taken from one site of application (environmental science) and taken up in a different way (to estimate population level drug consumption). Thus, while in this paper we have focused our analysis on the realities and effects this method *makes*, it is also worth considering the *remaking of this method* itself as it moves from one site (or discipline or policy area) and into another. What this method might become, do or perform in drug policy might be entirely different to that made possible by the hinterland of practices and discourses in other policy sites.

As epidemiologists and drug policy experts continue to discuss the promise of wastewater analysis and what this new technology might afford, by viewing this approach through a different lens we have highlighted the ways in which claims to 'accurate reporting' are performative rather than descriptive of a pre-existing reality. Given the potentially deleterious realities wastewater analysis enacts, we suggest that further careful and critical discussion of this new technology is imperative.

Conflict of interest statement

The authors report no conflicts of interest.

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