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A 'promising tool'? A critical review of the social and ethico-political effects of wastewater analysis in the context of illicit drug epidemiology and drug policy

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Abstract:

Wastewater analysis has been taken up with enthusiasm in the illicit drugs field. Through a critical social science lens, we consider claims to what these 'promising' methods might afford in the context of drug epidemiology and policy, recognising that all methods have social effects in their specific contexts of use. We outline several ethico-political issues, highlighting how methods can have different effects as they move from one discipline (environmental science or analytic chemistry) and into another (illicit drugs). Translated into the drugs field, wastewater analysis problematically shifts the focus of drug policy from harm reduction to drug use prevalence and entrenches stigma. Without comprehensive information about the social and contextual aspects of drug harms, effective drug policy is not possible.

Keywords:

Wastewater analysis; drug policy; illicit drugs epidemiology; monitoring and surveillance; ethics; evidence-making.

A 'promising tool'? A critical review of the social and ethico-political effects of wastewater analysis in the context of illicit drug epidemiology and drug policy

The development of wastewater analysis as a new method is arguably precipitating one of the most significant shifts in illicit drug epidemiology in decades. Also called 'sewage epidemiology' [1, 2] or 'wastewater-based epidemiology' [3, 4], these methods have quickly generated worldwide interest in the illicit drugs field given their potential to provide near "real-time data on geographical and temporal trends" in illicit drug consumption [3, 4]. Wastewater analysis is increasingly regarded as "an important adjunct to established drug monitoring tools" [4], complementing methods such as self-report population or household surveys and analysis of crime statistics and drug seizure data. Unlike established epidemiological methods, wastewater analysis is deemed "non-invasive" [3], "not subject to the biases associated with self-report data" and able to "better identify the true spectrum of drugs being consumed" by a community [4-7] while "preserving the anonymity of the individuals involved" [8]. While self-report survey methods are often expensive, take time to administer and tend to focus on metropolitan centres [2, 4, 5, 7], wastewater analysis is said to offer "prompt identification of changes in trends and habits" [2]. Given that drug use is an illicit and largely hidden practice it has also been suggested that wastewater analysis may provide more "realistic" and "objective" evidence [7] because "self-reporting of socially censured behaviour is likely to be unreliable" [6]. Through the lens of critical social science, in this review we consider claims to what wastewater analysis methods might afford as they are rapidly taken up in the context of illicit drug epidemiology and drug policy. In doing so, we situate current discussions regarding wastewater analysis within a body of literature which has illuminated the need for cross-methodological dialogue between social science and epidemiology if drug-related harms are to be understood and ameliorated [9, 10], recognising that all methods have social and ethico-political effects in their specific contexts of use [10-14].

Wastewater analysis was originally used by environmental scientists for the purposes of monitoring the potential ecological risks of excreted pharmaceutical drugs and personal-care products in aquatic environments [15-17]. Following speculation that this method might also be used to monitor illicit drug use [16], wastewater analysis approaches have subsequently been taken up and adapted purportedly to help estimate population-level consumption of illicit drugs. Early studies experimented with this approach by measuring human metabolic residue of illicit drugs in surface water and wastewater entering sewage treatment plants [6-8, 18, 19] (with the latter sampling method recommended for population studies [2]). Since its first experimental application in Italy in the mid-2000s [6], this approach has been used in numerous studies and integrated into drug monitoring systems around the world including in Australia, China, Canada, South Africa, Switzerland, the United States of America, and across Europe and the Nordic states [e.g. 4, 5-7, 20-34]. Data generated from these studies are also now being used to inform the United Nations Office on Drugs and Crime World Drug Report [35]. In a relatively short period of time, wastewater analysis has established itself as a "promising tool" [7] in the illicit drugs field. Indeed, it has been said that "the advantage of adding another tool to the epidemiological toolkit cannot be overestimated" [4].

In the context of illicit drug epidemiology, wastewater analysis involves collecting samples of raw wastewater which are then analysed to measure particular drug metabolic residues. To translate these data into evidence that can made useable and relevant in this specific policy context, total amounts of drug metabolic residues are converted into "average doses" [4]. To estimate the quantity of illicit drugs consumed in a community, expressed as "daily amounts (or daily doses) per thousand population", a back-calculation is performed which takes into account daily flow rates of sewage (to obtain the daily sewer load of metabolic residue), the size of the population served by the treatment plant, the average excretion rate of each drug target residue and the molecular mass of the parent drug/metabolite, and an assumed mean dose [2-4, 36]. The assumed mean dose is the

area of greatest uncertainty. The rationale underlying the approach is that the "concentrations of the metabolic residues of illicit drugs measured in raw communal wastewater can […] reflect the amount of a particular drug that has been used by a population served by a particular sewer network" [36].

The development of wastewater analysis as a technology of illicit drug epidemiology brings together multiple forms of expertise across disciplines, including between analytic chemists, environmental scientists, illicit drug epidemiologists and policy makers. The first multidisciplinary discussions were hosted by the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) in 2007, and considered how these newly developing approaches might be taken up in drugs monitoring efforts in Europe [2]. More recently, there have been efforts to coordinate and standardise approaches to wastewater analysis studies internationally through the establishment of a European network called the 'Sewage analysis CORe group – Europe' (SCORE) in 2010 [30, 37]. In 2013, the SCORE network published a consensus protocol for sampling, analysis and reporting of wastewater analysis studies, which has provided a foundation for the first comparative wastewater analysis studies across Europe [24, 37, 38]. As well as refining and developing the technical aspects of wastewater analysis methods, these discussions have been aimed at ensuring that data produced in different locations and by different research teams are comparable and therefore useful for drug monitoring and surveillance.

The processes led by the EMCDDA have also sought to raise key ethical and legal questions about the use of wastewater analysis in the context of illicit drug epidemiology given the sociopolitical sensitivities and possible risks associated with these approaches, including issues of privacy, consent and data protection [2]. The EMCDDA has noted that the purpose of wastewater analysis studies

ought to be made clear, in particular "whether the findings are to be used in the interests of public health or as part of law enforcement or political control measures" [2]. How these data are put to use (that is, made useful as evidence [39]) in the specific context of illicit drug policy is key to these ethical considerations. Concerns have been raised that data generated through these measures may "form the basis for potentially controversial decisions" [2] in drug policy and be easily misinterpreted by media if results are not carefully communicated. Sensationalised media reporting can perpetuate "stigmatisation and labelling of vulnerable groups, influencing how they are treated by society and the state" and may "generate political incentives to 'get tough' on drug use and crime" [40] contrary to the aims of evidence-based drug policy.

While it has been suggested that using wastewater analysis approaches in the context of illicit drug epidemiology "merely capitalises on science's existing technical capabilities in analytical chemistry" [16], the ethical questions raised by the EMCDDA and others [41-43] point to the ways in which methodological tools can have different effects as they move from one discipline (environmental science or analytic chemistry) and into another (illicit drugs epidemiology) [13]. An established body of critical social science literature in the drugs field has demonstrated why it is important to consider the specific context in which a method is put to use, the veracity of measures, and the socio-political effects of epidemiological approaches [10, 14]. This work has shown how purportedly more accurate measures of 'risk behaviours' often remain blind to complex relations, power and structural violence at work in the social worlds in which harms occur [9, 10]. What a new and 'promising' method might afford and how it might produce 'better evidence' will always relate to its specific implementation and policy context. What is required is critical consideration of how the method is used in relation to the 'problem' it is purportedly addressing. This requires translation work and multidisciplinary dialogue beyond engagement with methods experts, to explore how evidence generated through these approaches might be made to matter and put to use locally in specific policy contexts.

Although wastewater analysis approaches have been taken up with enthusiasm in the illicit drugs field, there are several ethico-political issues deserving of critical attention when we consider how these methods translate into this arena [13]. Our focus here is not on the technical, chemical or methodological uncertainties of wastewater analysis approaches (for these have been documented elsewhere, and continue to be the focus of ongoing scientific development: [e.g. 2, 3, 4, 44-47]). Rather, we wish to engage with some of the critical questions that arise when considering how wastewater analysis approaches are being mobilised specifically *for* and *within* drug policy [13]. These questions move beyond concerns about technoscientific capabilities or the 'promise' of these approaches, to focus on the implications of their use in the specific circumstances of illicit drug policy.

Illicit drug use remains criminalised in most jurisdictions around the world [48]. However, the local context in which drugs are used confers variable social and physical risks (including stigma and discrimination, social disadvantage, violence, and other harms) [49]. The variability of risk conferred in local environments of drug use complicates the potential and possible effects of evidence generated by particular methods as it is mobilised into policy. Features of the 'risk environment' are "ethically significant considerations" that ought to be taken into account when assessing the appropriateness and usefulness of particular research methods [49]. To date, wastewater analysis studies have had little ethical oversight. Wastewater analysis studies generally do not require approvals by human research ethics committees, or are considered to be 'low-risk' [40]. Ethical concerns have been raised about the use of wastewater analysis approaches in the context of monitoring a largely hidden and illegal practice like drug use, especially given that the informed consent of individuals is not required for this kind of research [2, 3]. These concerns have led to the development of ethical guidelines for undertaking wastewater analysis [3, 40] with the aim of fostering ethical practice across this new and burgeoning field of inquiry. An important ethical

dimension of wastewater analysis is the potential impact on groups of people, and this is not well captured in conventional frameworks governing ethical research with humans, which focus on individuals. For example, a number of studies have used wastewater analysis in small catchment areas such as schools [50, 51], prisons [52-54], and during short term events such as music festivals [55]. However, the recently published ethical guidelines note that there may be risks associated with conducting site-specific studies in settings such as schools, prisons and workplaces [40]. It has been suggested that site-specific studies can be unethical because data may be used to justify the introduction of punitive anti-drug strategies by prison authorities, unfair working conditions, and increase stigmatisation of targeted groups, inadvertently causing harm to participants who did not provide consent [40]. Indeed, these are not hypothetical concerns. In Australia, it has been suggested that sewage would be tested to identify specific geographic areas of high-drug use in order to implement a targeted strategy of drug testing welfare recipients in Australia [56].

While it has been suggested that wastewater analysis ought not raise ethical concerns when used to monitor illicit drug use in large populations [41], our own research has demonstrated that these methods are not simply neutral ways of describing drug use realities and have a range of potentially deleterious political effects [13]. Claims that wastewater analysis approaches are 'more accurate' than self-report survey methods tend to carry weight because illicit drug use is a largely hidden and stigmatised practice, and because people who use drugs are already regarded as untrustworthy, unreliable and undeserving of a meaningful voice in research and drug policy decision-making [13]. Wastewater analysis approaches tend to foster an image of people who use drugs as lacking in knowledge (unable to 'accurately' report on their own drug use) and reinforces an impression of people who use drugs as criminal and in need of surveillance, thus reproducing the stigma perpetuated in popular discourse about drugs [13]. In the context of illicit drug epidemiology, the

more 'scientific', 'direct' and 'accurate' methods of wastewater analysis operate as a means of truth-detection, revealing 'tell-tale' signs of otherwise hidden and illicit practices and populations [13].

It has been suggested that having access to the kind of 'objective' and 'accurate' data generated by wastewater analysis will make a difference to drug policy decision-making and planning, and allow governments to be more responsive to changing needs [3, 4, 29]. However, such a view relies on a range of problematic assumptions about how drugs are understood as a policy problem and how evidence is mobilised in policy decision-making [13]. While other epidemiological methods can provide information about patterns of use, routes of administration, and demographic characteristics of people who use drugs, wastewater analysis approaches cannot provide data about specific drug use practices or harms [13]. Reporting of wastewater analysis necessarily emphasises drug use *per se* (and not drug related harms) as a measure of a 'drug problem' in a community and homogenises drug consumption within that specific geographic location [13]. The erasure of the contextual aspects of drug use is a weakness of any evidence provided by wastewater analysis, as it cannot include any information on the specific, socially situated and contingent practices associated with drug-related risk and harm [57, 58]. Mobilising evidence generated through wastewater analysis approaches shifts the focus of drug policy discussion from harm reduction (where the overarching goal is to reduce the harms associated with drug use without necessarily reducing use per se) to a more narrow and punitive goal of reducing population drug use per se, primarily informing demand reduction and supply reduction strategies. The persistent focus on drug use prevalence as the primary outcome measure used to assess drug policy has been called into question by leading drug policy scholars, as it belies the complexity of patterns of use (not all drug consumption is associated with harm; and even as prevalence decreases, drug-related harms may increase amongst some groups or in some places) [59-61]. Amidst calls to revise the range of indicators used to assess drug policy and more meaningfully evaluate "so-called real-world

outcomes of relevance to communities" by using measures which better discriminate between "problematic and non-problematic forms of drug use" [62], the narrow focus of wastewater analysis on measuring prevalence is arguably antiquated. While wastewater analysis might be a useful tool for providing information about the size or nature of drug markets in particular spatial locations over time, used as a measure of per capita population consumption these data have the potential to skew the kinds of policy questions which can be asked and the range of responses deemed appropriate by shifting the focus from drug-related harms to the mere use of drugs as evidenced by metabolic residues [13, 62].

So long as the emphasis remains on generating evidence of illicit drug use per se, and not patterns of use or harms, the extent to which data generated via wastewater analysis can meaningfully inform harm reduction, treatment or health service planning is marginal. Even in early discussions about the potential of wastewater analysis approaches for illicit drug epidemiology it was acknowledged that "no single measure provides a full picture of the drug situation" [2]. However, the promise of technoscientific innovation, claims to 'accuracy' and 'objectivity', flexibility, timeliness and cost-savings might mean that wastewater analysis measures are increasingly privileged (and funded) over and above other established epidemiological methods. Ensuring that wastewater analysis approaches are ethically and carefully integrated to complement established methods of drug epidemiology, rather than simply replacing them, is important. While "research in this field is progressing very fast" [4], staying alert to both the potential promise and pitfalls of these approaches as they are mobilised in drug policy discussions and decision-making will be crucial in the coming years. Without comprehensive information about the social, relational and contextual aspects of drug harms, effective drug policy will not be possible.

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Conflict of interest statement

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