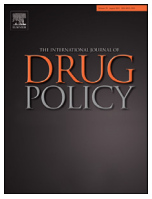
International Journal of Drug Policy 117 (2023) 104065

Contents lists available at ScienceDirect

International Journal of Drug Policy

journal homepage: www.elsevier.com/locate/drugpo



Research Paper

Early warnings and slow deaths: A sociology of outbreak and overdose

Tim Rhodes [a,b,*], Kari Lancaster [b]

[a] London School of Hygiene and Tropical Medicine, London, UK
[b] University of New South Wales, Sydney, Australia

ARTICLE INFO

Keywords:
Overdose
Outbreak
Early Warning
Slow violence
Slow emergency
Slow death
Prediction

ABSTRACT

In this paper, we offer a sociological analysis of early warning and outbreak in the field of drug policy, focusing on opioid overdose. We trace how 'outbreak' is enacted as a rupturing event which enables rapid reflex responses of precautionary control, based largely on short-term and proximal early warning indicators. We make the case for an alternative view of early warning and outbreak. We argue that practices of detection and projection that help to materialise drug-related outbreaks are too focused on the proximal and short-term. Engaging with epidemiological and sociological work investigating epidemics of opioid overdose, we show how the short-termism and rapid reflex response of outbreak fails to appreciate the slow violent pasts of epidemics indicative of an ongoing need and care for structural and societal change. Accordingly, we gather together ideas of 'slow emergency' (Ben Anderson), 'slow death' (Lauren Berlant) and 'slow violence' (Rob Nixon), to re-assemble outbreaks in 'long view'. This locates opioid overdose in long-term attritional processes of deindustrialisation, pharmaceuticalisation, and other forms of structural violence, including the criminalisation and problematisation of people who use drugs. Outbreaks evolve in relation to their slow violent pasts. To ignore this can perpetuate harm. Attending to the social conditions that create the possibilities for outbreak invites early warning that goes 'beyond outbreak' and 'beyond epidemic' as generally configured.

Introduction

Our focus in this paper is early warning and outbreak. Early warning is a form of scientific surveillance which assembles together multiple forms of data and indicators to detect and anticipate emergent threats, and in so doing, constitute these as 'outbreaks'. Early warning is an 'anticipatory governance' (Adams et al., 2009; Guston, 2014), which promises preparedness, precautionary control, and rapid response (Anderson, 2010, 2016). While the drugs field has long held interest in researching new drug trends (Agar and Reisinger, 2001; Clatts et al., 2002; Griffiths & McKetin, 2003; Hartnoll, 2003), and has developed now well-established early warning systems at national as well as regional level (Artigiani and Wish, 2020; EMCDDA, 2022), there is little sociological reflection on how configurations of 'outbreak' through early warning problematise and govern. How do configurations of outbreak enact drugs as problems in particular ways? What does it mean to enact outbreak as a particular kind of problem?

Our substantive concern is opioid overdose. Engaging with epidemiological and sociological accounts, we trace opioid overdose as a 'slow emergency' (Anderson et al., 2020) and 'slow violence' (Nixon, 2011), and in so doing, reconfigure outbreak in 'long-view'. We argue that the practices of detection and projection that help to materialise drug-related outbreaks are too focused on the proximal and short-term. The short-termism of outbreak proffers reactive and rapid reflex responses of technological and precautionary control which can fail to appreciate the slow violent pasts of outbreak conditions. Our analysis promotes an alternative view of early warning; one less narrowly focused on the drug and the immediate appearance of hazard but also focused on the long-view of harm indicative of an ongoing care for structural and societal change.

Early warning

Early warning practices seek to detect and anticipate emergent threats, which in epidemiology is configured as 'outbreak detection' (Houlihan and Whitworth, 2019; Rivers et al., 2019; Southall et al., 2021; Yang, 2017). Examples of early warning indicators in relation to new drugs, trends and harms include: self-reported and other measures of drug use; seizures; price; purity; arrests; treatment demand; hospital and emergency reports; poisonings; deaths; and sales (Buxton et al., 2019; EMCDDA, 2016, 2019). Examples of early warning technology include: routine surveillance and surveys; wastewater-based epidemiology; toxicovigilance and forensic analysis; community-based alerts; rapid assessment; analysis of open source information; and mathematical and computational models (EMCDDA, 2016, 2019;

* Corresponding author at: Professor of Public Health Sociology, London School of Hygiene and Tropical Medicine, UK.
E-mail address: tim.rhodes@lshtm.ac.uk (T. Rhodes).

https://doi.org/10.1016/j.drugpo.2023.104065

Enghoff and Aldridge, 2019; Gushgari et al., 2019; Marks et al., 2021; UNODC, 2020a). Early Warning Systems (EWSs) are infrastructures which bring together multiple forms of data and indicators across technologies of detection and projection into networks of expertise and response. Such systems can operate at national, regional and global level to anticipate threats in relation to disease, epidemic, disaster, environmental hazard, climate, and security (Alcántara-Ayala and Oliver-Smith, 2019; National Research Council, 2001; Southall et al., 2021; WHO, 2023; Yang, 2017). The World Health Organization's (WHO) Early Warning and Alert Response System (EWAR), for instance, creates a global platform for rapid response in relation to "disease outbreak detection in emergency settings" (WHO, 2023). The United Nations Office of Drugs and Crime (UNODC) similarly coordinates a global platform for early warning on the emergence of new drugs across over 130 countries, based on a mix of international drug enforcement and intelligence, global survey and health authority data, and toxicological reports (UNODC, 2022).

One of the earliest EWSs in the drugs field, developed in 1972, is the Drug Abuse Warning Network (DAWN) in the United States (U.S.). DAWN is a nationwide surveillance system that seeks to integrate reports of substance use and harm, including overdose, from the electronic health records of non-federal emergency hospital departments (Jones and McAninch, 2015). DAWN was discontinued between 2011 and 2018, creating a national drug surveillance "blind spot" (Sevigny & Fuleihan, 2016), in a period when the U.S. overdose epidemic was intensified by shifts from opioid prescription use to heroin, and as fentanyl entered opioid markets (Cerdá et al., 2021; Ciccarone, 2019; Zoorob, 2019). DAWN was complemented by a network of research experts known as the Community Epidemiology Work Group (CEWG) in an effort to incorporate community-based reports of drug trends across U.S. states, but this initiative discontinued in 2014 (Artigiani and Wish, 2020; Kozel et al., 2002). In Europe, the European Union's EWS was developed in 1997 in response to the emergence of ecstasy (MDMA) and is coordinated by the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) in collaboration with Europol, the European Medicines Agency, and a network of 29 countries (EMCDDA, 2022). The focus of the EU EWS is the detection of new psychoactive substances, including fentanyl, fentanyl analogues, and synthetic opioids implicated in opioid overdose risk (Evans-Brown et al., 2018). There is an urgency to improve early warning efforts to detect, anticipate and prevent opioid overdose (Buxton et al., 2019; Borquez & Martin, 2022; Chiang et al., 2020; Marks et al., 2021; Marshall et al., 2017, 2022).

Outbreak

'Outbreak' is one particular configuration of early warning science. In epidemiological accounts of emergent disease, outbreak signals epidemic potential, a threat of epidemic to come (Rivers et al., 2019; Southall et al., 2021; Yang, 2017). This also means that outbreak is often held as distinct from conditions that are established, ongoing or endemic (Southall et al., 2021). In this paper, we want to consider critically the configuration of outbreak in early warning practices, especially as it relates to temporality, and in relation to outbreaks which can also be understood as crisis, as well as endemic. Thinking about the temporal framings of outbreak is partly a question of how 'early' warnings can be. The temporal framing of EWSs has arguably shifted historically from systems and indicators designed to anticipate the risk of problems well in advance to early warning efforts which emphasise reactive and rapid technological responses in 'near real-time' prompted by hazards occurring (Alcántara-Ayala and Oliver-Smith, 2019). In the field of disasters early warning, for instance, it is said that EWSs have become "late by definition" as a consequence of a narrowing "physicalist" focus on the appearance of hazard, away from original conceptions of early warning oriented towards a "long-term perspective" incorporating "historical investigation" to generate an "understanding of vulnerability" and "social context" (Alcántara-Ayala and Oliver-Smith, 2019: 322). Earlier warning is foreshortened when temporality is understood as speed of onset and response rather than in relation to the longer-term evolution of outbreak's emergence. As Alcántara-Ayala and Oliver-Smith write of disasters (2019: 322):

> "Current EWSs are focused on shorter-term occurrences of events—hurricanes (days), eathquakes (seconds), landslides (minutes, hours, days), volcanic eruptions (minutes, hours, days). They also lack a historical analytical perspective […], and hence do not consider root causes and disaster risk drivers".

We might similarly question the temporal framing of early warning and outbreak in the field of drug policy. We wish to argue that another approach to early warning and outbreak is possible (Stengers, 2018); an approach which attempts to see outbreak in 'long-view'; one that can see the 'slow emergency' and 'slow violence' of outbreak (Anderson et al., 2020; Nixon, 2011; Lancaster and Rhodes, 2023). An endemic or enduring condition is one that has evolved in time, space and scale beyond that ordinarily enacted within the short-term temporality and rapid response of early warning. An unfolding crisis of many years – like that of opioid overdose in the U.S. – may not be captured adequately by the rubric of outbreak as configured in epidemiological early warning. Focusing on early warning in the drugs field, especially in relation to opioid overdose, we speculate that early warning might *extend its focal point*—looking into a longer past and longer future, as well as *broaden its field of vision*—seeing more ecologically.

Opioid overdose

Our case for exploring how outbreak might be remade in 'long-view' is opioid overodse. Epidemiological data generated by the Centers for Disease Control (CDC) in the U.S. illustrates a "long entrenched" epidemic of overdose (Ahmad et al., 2022; Humphreys et al., 2022). Since 1999, according to the CDC, more than 932,000 people in the U.S. have died of drug overdose. Deaths have quadrupled over the past decade, with overdose now the leading cause of death in the under 50s in North America (Wilson et al., 2020). The narrative of this epidemic is often told in three waves (Ciccarone, 2019; Cerdá et al., 2021). Wave 1, in the late 1990s, saw the rapid rise of prescription opioids to treat chronic pain, linked to aggressive marketing of opioids for pain relief by pharmaceutical companies, enabled by weak regulations on prescribing and dispensing. Wave 2, from 2010 onwards, saw prescription opioid overdoses stabilise, at high levels, but with a sharp rise in heroin overdose, as opioid prescription misuse morphed into heroin use, also given expanded heroin availability. Wave 3, from about 2013, saw fentanyl and synthetic drugs spike overdose rates further still (Ciccarone, 2019; Dart et al., 2015; Zoorob, 2019). Since 2020, and following a short decline in 2018 linked to reduced carfentanil availability, there has been more hyper-exponential growth, linked to poly-use of stimulants and opioids, possibly exacerbated by the Covid-19 pandemic (Jalal and Burke, 2021, 2022). A further half million overdose deaths were forecast between 2021 and 2025 (Burke and Jalal, 2022).

The evidencing of opioid overdose in long-view presents deaths as a "dismayingly predictable exponential growth trajectory over more than four decades" (Jalal and Burke, 2022). In the epidemiological projections of Jalal and colleagues (Jalal and Burke, 2022; Jalal et al., 2018), we can see the ups and downs of differential hazard rates of overdose spikes connected to different epidemic waves, for instance linked to shifts in prescription and fentanyl supply, which then return to the smooth, but slow and deadly, exponential of epidemic, which is anything but short-term. Jalal and colleagues have described this 40 year exponential as "a purely statistical observation", suggesting that "the drivers of this remain largely unknown", yet note that there are "long-term processes" at work, which they speculate are "social and economic" in orientation (Jalal and Burke, 2022; Jalal et al., 2018, 2021).

The 40 year exponential of opioid overdose in the U.S. was declared a 'national emergency' by Government in 2017 (Christie et al., 2017),

decades after such outbreaks had become epidemic as well as endemic in some affected communities and geographies (Case and Deaton, 2020). The moment-in-time declaration of a 'national emergency' and its making of 'outbreak' of one kind is held in tension with another, which is here extended as slow emergency and crisis, with the mobilisation of emergency response by governing institutions anything but early or rapid, and neither at the scale that declarations of emergency or crisis can otherwise muster (Anderson, 2010; Lakoff, 2017). The case of opioid overdose helps our analysis here precisely because it blurs how configurations of early warning and outbreak can be produced and used, including in relation to speed of response and to making visible or obscuring outbreak's long-term evolution. This hits home that configurations of outbreak, emergency and crisis are "far from […] transparent and objective", but create a malleable "problem-space" in which disorder is problematised and managed away in uncertainty (Anderson et al., 2020: 622). Enacting outbreak is a problematisation with a politics (Barker, 2012).

Approach

Rather than seeing early warning science as the means by which we detect outbreak 'out there', we are instead looking for signals of outbreak's enactment within the shifting narratives and practices of early warning. Our approach is to treat the configuration of outbreak as a 'problematisation' which is made up in the field of early warning (Barker, 2012; Bacchi, 2018; Foucault, 1984). Our focus then, is not to consider early warning practices in relation to their methodological veracity or accuracy (an epistemological concern of epidemiology and surveillance in the field), but as forms of *enactment* which *problematise* in particular ways (Rhodes & Lancaster, 2019). This also makes our analysis distinct from parallel efforts to delineate the contribution of the social sciences to enhancing outbreak detection and response (Abramowitz et al., 2015; Janes et al., 2012). By engaging critically with the epidemiology and sociology of early warning, including in relation to opioid overdose, we trace outbreak's enactments. The science and practices of early warning thus become our means of 'detection' for tracing how outbreak 'comes to be', including how thinking and action in relation to outbreak might be shifting, or at points of potential change.

We approach outbreak as a form of governance (Anderson, 2010, 2016; Lancaster and Rhodes, 2023). The configuration of outbreak in early warning makes up problems and responses in particular ways, and this can limit alternative ways of seeing and acting. We are interested then, in how early warning *sees*; and specifically, in *seeing like outbreak* (Law, 2009). Here, we take inspiration from John Law, who invites us to trace how the methods of science 'see', and thus 'enact', particular realities, as a step towards knowing and acting otherwise (Law, 2004, 2009) .

In approaching outbreak as enacted in practices, we emphasise three introductory points (See also Lancaster and Rhodes, 2023). First, early warnings of outbreak are *problematisations* that bring to attention certain things as matters of political and policy concern. The very naming of something as outbreak garners attention and resources in particular ways, whilst the ending of things as outbreaks, or not naming them as such, can absent them from attention (Anderson, 2021; Collier and Lakoff, 2008; King, 2004). Noticing how enactments of outbreak constitute conditions as problems in need of sudden and urgent attention, may also alert us to concerns and crises otherwise out of sight or not previously recognised as outbreak. Second, early warnings *make ruptures* by generating and packaging evidence of occurrence in ways which contain what is being observed or imagined as a rupturing event, with temporal, spatial and other boundaries, which 'break' from the present, even while outbreaks may have a long and slow past, for instance, when viruses have been circulating for years (Anderson, 2016; Barker, 2012). Third, early warnings *make realities*, including by bringing imagined futures into the present, thereby altering the present, including through policy and other responses of outbreak control, for instance, in restrictions placed on population movement and behaviour, legal and border controls, lockdowns and containments, pharmaceutical investments, and so on.

Synopsis

Our paper is organised in five main sections. First, we look at configurations of outbreak in relation to disease epidemics and drugs. This accentuates how outbreak is enacted as a rupturing event enabling a rapid reflex response of precautionary control, based largely on short-term and proximal indicators. Second, we highlight some emergent shifts in practices of early warning in the drugs field. We suggest that these potentiate detection and projection opening-up 'beyond substances' as well as 'beyond the proximal' and 'beyond the local'. We then look at how opioid overdose is constituted as outbreak, focusing on the promise and pitfalls of prediction as a technology of early warning, before situating opioid overdose outbreak in 'long-view'. Engaging with sociological work, we re-assemble outbreak in relation to opioid overdose as 'slow emergency' (Anderson et al., 2020), 'slow death' (Berlant, 2007), and 'slow violence' (Nixon, 2011). We conclude that practices of early warning in the drugs field should not only focus on proximal and short-term indicators tailored to rapid reflex responses, but should open up in ways that enable outbreak to be seen in the 'long' and 'ecological' view of social and societal change.

Outbreak: drugs like virus?

Sociological accounts draw attention to the declaration of outbreak as a technique and rationality of governance which seeks to restore order by detecting, containing and curtailing events enacted as threats (Adey, 2016; Anderson et al., 2020; Lakoff, 2017; Lancaster and Rhodes, 2023). Outbreak eventuates a problem for risk management. When outbreaks are projected as big, presented as emergencies, or evolve into crisis, they can enable biosecurity responses of a scale, order and urgency that is distinct from routine risk management (Anderson, 2010; Rhodes & Lancaster, 2022a; Cooper, 2006; Lakoff, 2019;). Outbreak is a warning, like emergency, that "hinges on draining an event of its eventfulness, by reducing its potentiality to disrupt, end, or overturn" (Anderson et al., 2020: 624). As a technology which seeks restoration towards the familiar present, the configuration of outbreak moves between the exceptional and the everyday, the extraordinary and ordinary, the eventful and the uneventful (Anderson et al. 2020; Hu, 2018). In sociological view, outbreak thus signals disruption and restoration in relation to a norm. Importantly, including for our analysis which follows, there is fluidity and multiplicity in the enactment of outbreak, as not all outbreaks are rendered as extraordinary or as emergency, some may also become presented as crisis, and some outbreaks are only declared as such after some time, long after hazards or harms have been circulating (Anderson, 2016; Barker, 2012; Fine et al., 2020).

Here, we emphasise some dynamics affecting outbreak's enactment. First, and most obviously, there is the logic of epidemic. In epidemiology, an outbreak signals an emergent disease, infection or virus of epidemic potential (Southall et al., 2021; Rivers et al., 2019). These logics of epidemic, and of contagion, also shape the study and early warning of drug use and harm, constituting these as "epidemics" (Agar and Reisinger, 2001; Hughes et al., 1972). The configuration of outbreak then, extends an epidemiological reasoning which may govern drugs to some extent like infections. These logics arguably reside in the emergence of late-modern drug epidemiology which emphasised an infectious disease mentality centring the study of drug use on the 'natural history' of unfolding 'drug epidemics' themselves (Hughes et al., 1972). The epidemiological configuration of drugs like infections, and patterns of drug use like epidemics, has not only shaped the indicators and infrastructures of early warning systems (for instance, DAWN in the U.S.) but more general thinking of 'drugs' as an evolving problem of 'outbreak'

to be controlled. An outbreak mentality looks towards future epidemic potentials rather than back at what has become. The 'natural history' of evolving outbreak (Hughes et al., 1972) offers a myopic view of the past.

Second, there is novelty. Outbreak is characterised by emergence and indeterminacy (Cooper, 2006; Hinchliffe, 2001). The configuration of outbreak enacts an absence of knowable history and thus unpredictability. The harms potentiated in an outbreak event are imminent, yet to arrive, unfolding, not an 'if' but 'when', an anticipation (Caduff, 2019). All outbreaks therefore present as if 'new'. Whether framed as threats that are novel or familiar, large-scale or small, outbreak enables 'anticipatory governance' (Adams et al., 2009; Guston, 2014). Yet, as historical studies of recurring 'drug epidemics' have shown, today's declaration of so-called outbreak may be alternatively understood as an extension of endemicity and of what has gone before (Herzberg et al., 2016). Endemicity is *made epidemic* through the configuration of outbreak.[1] For instance, David Herzberg's history of three waves of pharmaceutical drug epidemic in the U.S. indicates how configurations of epidemic waves as 'new' outbreaks enables institutional governance as well as emergency measures, including through enforcement (Herzberg, 2020; Herzberg et al, 2016). In the case of recent waves of pharmaceuticalised drug outbreak, and how outbreak constitutes this threat, they write:

> "This presumed novelty is key to the epidemic's most culturally compelling narrative: that drug abuse has escaped its traditional home among the non-White urban poor and has, via the medicine cabinet, run amok in respectable White surburbia" (2016: 408).

Third, there is reach and scale. Outbreak, as epidemic potential, imagines beyond the contained local, with threats amplified and upscaled by globalised connections between people, things and infrastructures (Ali and Keil, 2008). This emphasises mutations of emergent threat at multiple scales, from the proximal to distal, local to global. Outbreaks draw attention to problems that can quickly extend (Anderson, 2010; King, 2004). This means that outbreaks can become big, exponential, and colonising events (Friedman et al., 2021; Zolopa et al., 2021). While starting slow or small, they can imagine catastrophe, an unknown threat of monstrous potential as well as moral panic, disrupting the ordinary and future as we know it (Lakoff, 2019). Outbreaks, whether in relation to diseases or drugs, constitute problems that, if left uncontrolled, extend beyond the near and now (Anderson, 2021; King, 2004; Rhodes and Lancaster, 2022a).

Fourth, and most germane to our analysis, there is speed. In outbreak, time is of the essence (Lancaster and Rhodes, 2023). Speed of detection and response is a taken-for-granted of early warning. Potential crises and imagined disasters demand it. Three tendencies in the governing logics of outbreak in relation to temporality include: a proximal and short-term horizon (outbreaks are new and now, of-the-moment); a sudden problematic rupture (outbreaks 'break-out' in unwanted and dangerous ways); and a rapid precautionary response (outbreaks require immediate control, before they get going). These tendencies shape normative configurations of outbreak, and thus how outbreak governs. Outbreak detection resides in a preparedness reflex accentuating precautionary control (Barker, 2012). Outbreak, as with emergency and crisis, encourages an enforcement reflex (Anderson, 2010; Hall et al., 1978; Lakoff, 2017).

Speedy control

We can trace these logics of 'speedy control' in the practices of drug early warning systems. The drug EWS of the EU, for instance, is contingent upon developing "more rapid risk assessment" to offer "round-the-clock access to information" (Evans-Brown et al., 2018: 19). The EU EWS governs through *time*, producing forewarnings in a "timely manner" to enable "timely and effective action" (EMCDDA, 2020). It is "thanks to such foresight", we are told, that "Europe has been well prepared and able to rapidly respond to protect public health" (EMCDDA, 2022: 30). And like the precautionary control of disease outbreak, precautionary drug controls seek to 'stamp out' new drugs as they outbreak. Here, for instance, fentanyl's emergence, a factor of risk in overdose, is constituted a problem of weak control, including of pharmaceutical global trade:

> "One of the reasons behind the increase in these fentanils is that they are not controlled under the United Nations drug control conventions. This means that in many countries they can be manufactured and traded relatively freely and openly – a situation which has been exploited by entrepreneurs and crime groups using companies based in China to make the substances" (Evans-Brown et al., 2018: 10).

And similarly, early warning indicators suggestive of a shift away from fentanyl derivatives in Europe since 2019, are speculated as a consequence of control:

> "While the causes of this shift away from fentanyl derivatives are unclear, the shift coincides with the introduction of generic control measures for fentanyl derivatives in China, where many of these substances are manufactured" (Evans-Brown et al., 2018: 12).

Sociological and historical analyses indicate the potential harmful effects of outbreak's enforcement reflex. Precautionary control resides in, and reproduces, existing institutional and legal infrastructures as the primary solution in uncertainty or crisis. This may perpetuate, and further entrench, the structuration of policy-induced harms. For instance, in each of the extending waves of pharmaceutical drug epidemic in the U.S. over the past century, supply-side enforcement and other policing interventions have been prompted (Herzberg et al., 2016). The intensification of policing, and the criminalisation of the sale and (mis)use of prescription drugs, in the face of declared opioid overdose outbreak have created conditions for new heroin markets perpetuating opioid overdose risk, including in new populations and places, especially among the marginalised (Ciccarone, 2019; Herzberg et al., 2016; Kolodny et al., 2015). Reflex responses to localised drug epidemic which centre on the stamping out of international illicit opioid supply, such as via Mexico and China in responses to fentanyl outbreak, as with efforts to control cocaine outbreak in previous decades, risk opening-up new drug markets, expanding health harm and insecurity (Ciccarone, 2019, 2020; Reinarman and Levine, 2004).

Alternative configurations

Sociological analyses thus emphasise outbreak and early warning as framing the scale and complexity of the problem as an urgent concern that can extend beyond the ordinary, beyond the local, and beyond the near and now. The call to make early warning speedier and outbreaks more controllable is a 'given' of outbreak science and policy. But just as there are costs and harms associated with enforcement efforts to 'stamp out' disease outbreaks, as with lockdowns and restrictions in population movement and behaviour, an enforcement reflex in the control of drugs and drug outbreaks is not harm neutral, as an overwhelming body of research shows, including in relation to overdose (El-Bassel et al., 2021; Fine et al., 2020; Herzberg et al., 2016; Jurecka and Barocas, 2023; Netherland and Hansen, 2017; Tyndall and Dodd, 2020). The enforcement reflex afforded by outbreak risks reproducing the unequal present, perpetuating patterns of problematisation, criminalisation and stigmatisation. Our proposal is to *slow down* our reasoning (Stengers, 2018), to resist a reflex response, to ask how we might think of early warning and outbreak differently. In what follows below, we trace outbreak's temporal enactments in relation to opioid overdose, looking first at epidemiological work on prediction, and second at sociological work on outbreak's social and ecological evolution. But first, we must note the potentials afforded by signals of change within the scientific field of early warning.

Early warning trends in the drugs field

There is a notable lack of social study interrogating early warning in the drugs field. This is despite 'new drug trends' and 'epidemics' being objects of attention in drug 'ethno-epidemiology' for many years (Agar and Reisinger, 2001; Clatts et al., 2002; Moore et al., 2009). Here, we attend specifically to what we detect as signals of shift or potential change within narratives of early warning in the drugs field; shifts which broaden the field of epidemiological vision beyond the myopia of substance, the local, the now, and the short-term, to a longer-term and broader envisioning, especially in relation to temporality.

Beyond substance

Early warning in the drugs field is fundamentally a technology of chemical identification (Evans-Brown et al., 2018: 18). With the drug the 'substance' of outbreak, surveillance technologies mobilise to detect the emergence of new and mutating substances, our variants-of-concern if you will. The material capture of substance largely relies upon seizures (from police, crime scenes and customs) and chemical analyses of samples (most often toxicological measures tracing the poisoning that substances leave behind). The most prominent innovations of technological promise in substance detection – such as wastewater-based epidemiology (WBE), the testing of drug residue in equipment, and toxicovigilance (EMCDDA, 2016; Gushgari et al., 2019; UNODC, 2020a) – present as measures, more or less directly, of substance. Recently up-scaled to detect viral outbreaks of Covid-19, there is particular currency in the promissory narratives of WBE (Bade et al., 2023; Erickson et al., 2021; Gitter et al., 2023; Gushgari et al., 2019; Lancaster et al., 2019). With less time lag than routinely reported data (for instance, in warning systems like DAWN), WBE is enacted as a "near real-time" and "unbiased" measure of substance that can "help prevent the next drug epidemic" (Margetts et al., 2020: 1,10). The claim of 'near real-time' substance capture affords technologies of detection like WBE an anticipatory imaginary in helping to "predict rather than react" (Margetts et al., 2020: 1), thereby "forecasting potential outbreaks", including in relation to "opioids and fentanyl analogues" (Erickson et al., 2021: 402). Detection here merges with prediction in the prevention of drug outbreak.

While this attention to the materiality of substance appears taken for granted, we can pick up on signals emerging within the field to speculate on how early warning might see *beyond substance*. How do we open-up early warning beyond chemical detection to a different problematisation? This potential – of early warning that moves 'beyond substance' to also bring other objects, social conditions, and ecologies into view – is made possible by an increasingly prominent narrative in early warning science: the 'problem of complexity' (Evans-Brown and Sedefov, 2017; UNODC, 2020b; Agar, 2003).

Substances are increasingly seen as *complex*. They are presented as less stable, and more fluid, open to mutation, masking and multiplicity, including via chemical syntheses, as well as easier to conceal and move, and also, smarter at evasion, including via their presentation as something other than what they really are. The speed of mutations among synthetic opioids, for instance, renders early warning that seeks to detect one drug at a time too slow, even obsolete, since singular traceable substances have dissolved in an ecology of interchangeable molecules (De Weerdt, 2019). Chemically masked substances also present as if they are 'non-controlled' before converting back into their 'actual self' or 'parent drug', sometimes with precursors. In this narrative, what are 'really drugs' "end up as 'legal highs', 'research chemicals', or 'food supplements' which are sold openly in the high street and online" as well as "on the illicit market" (Evans-Brown et al., 2018). In research on illicit heroin markets, street-based fentanyl in adulterated or substituted heroin, unbeknown to many users, was said to be the norm in areas of the U.S. reporting the highest rates of overdose (Mars et al., 2018). With substances and markets smarter and craftier, many 'drug indicators' are no longer fit for purpose (Peacock et al., 2019). Despite the promissory early warning claims of detection technologies like WBE, the substances implicated in opioid overdose risk, such as heroin and fentanyl, may escape detection given that these are "low concentration" samples that cannot easily be extracted from the "complex wastewater soup" (Burgard et al., 2017: 10). The troubled substance-based claims of early warning detection, especially evident in the molecules affecting opioid outbreak (Castiglioni, 2016; De Weerdt, 2019; Östman et al., 2014), invite speculating early warning beyond substance.

Beyond local

Second, there is a related narrative of *complex systems*. Drug markets have become fluid, dynamic and fast expanding, increasingly virtual, diversified, globalised, as well as pharmaceuticalised, making them "more challenging to disrupt" (EMCDDA, 2022: 29). The "greater complexity" of early warning is signalled, for instance, by technological developments intersecting with the pharmaceuticalisation of markets at global scale (EMCDDA, 2020). As noted of pharmaceutical threats: "companies churn out vast quantities of legal replacements to controlled drugs", which are shipped "cheaply and quickly", and where "a few grams [are] sufficient to make many thousands of doses for the drug market" (Evans-Brown et al., 2018: 5). Early warning of new drugs and how they "spread" across space and time, it is argued, "should not only be done at the national level" but "requires an organised global campaign" (Bade et al., 2023: 5). Technologies of detection must re-orientate, as well as up-scale, from concrete signs of substance in localised places and spaces to tracing diffusions among actors, chemical and otherwise, across infrastructures and networks, virtual and material. This complexity is said to be epitomised by the emergence and marketing of new synthetics, including fentanyl and its analogues that play a key role in overdose outbreak (Evans-Brown et al., 2018; Reuter et al., 2021; Zoorob, 2019).

We can take the narrative of complexity that presents as a problem in early warning as a signal of potential to speculate on how early warning might see *beyond local*. How do we open-up the practices of early warning beyond the near and proximal to eventuate a broader problematisation of globally connected drug outbreak emergent in a longer-term trajectory of market, technological and other trends? The pharmaceuticalisation of global drug markets, for instance, has fostered an environment of perpetual localised opioid overdose outbreak (Herzberg et al., 2016). But the invitation to speculate early warning 'beyond local' can be imagined in ways that look beyond the contingencies of glocalised drug market transformations (an immediate matter of concern in the science of early warning). Seeing beyond the local and proximal not only accentuates a shift from substance to harm but to the structuration of harm through social systems and conditions, including the localised effects of slow-moving 'mega trends' and 'big events' (Friedman et al., 2021; Rhodes and Lancaster, 2021; Zolopa et al., 2021).

Beyond now

Early warning that extends 'beyond the drug' and 'beyond the proximal' invites a longer, and more ecological, view (Rhodes and Lancaster, 2021). This is potential that at once widens the field of vision (scope) and stretches the focal point (reach); that is, an extending of the spatial and temporal relations of early warning. A key focus of concern in early warning being insufficiently agile and pre-emptive is how such efforts move between indicators of the retrospective into the prospective; a process described in sociological work as 'prospecting retrospects' (Brown and Michael, 2003). Of particular attention is how early warning can become more 'futures-oriented', including by tracing slower moving signals beyond those of the locally immediate present and near past (Rhodes and Lancaster, 2021). This returns the 'early' of early warning towards an emphasis on projecting "well in advance", including informed by analyses of the social and ecological conditions of risk, rather than in the 'near real-time' of speedy response prompted by hazards

occurring (Alcántara-Ayala and Oliver-Smith, 2019: 317). How then, might early warning and outbreak temporality be opened-up beyond the near and now into a longer view? How might a longer view of past and future extend the 'early' of early warning as well as situate outbreak more ecologically?

Beyond the near and now

In the epidemiological reasoning of early warning science, the anticipatory governance afforded by declaration of outbreak is 'evidence-based' in enumerated predictions and projections (Rhodes et al., 2020, 2022a,b). Predictive models are said to hold particular promise, not only for planning and preparedness but as a basis for outbreak response decisions (George et al., 2019), including potentially in efforts to prevent overdose (Borquez and Martin, 2022; Bharat et al., 2021; Chiang et al., 2020; Lo-Ciganic et al., 2022; Marks et al., 2022). Investing in technologies of prediction and forecasting as part of coordinated national responses promises to "anticipate outbreak and respond pre-emptively" (Marks et al., 2022), thereby "bending the curve" of the overdose exponential (Burke and Jalal, 2022).

Here, we characterise emergent signals of shift in early warning temporality as moves between the 'future familiar' – short-term forecasts, based on proximal indicators in-the-now, that extend the near present as we know it – and the 'future less familiar' – long-view speculation that reaches beyond the near, now and empirically known to also signal 'breaks' in what might become. The future familiar, the epidemiological mainstream, is a stable and controllable present, which, unlike the future less familiar, tends to neglect speculation on the otherwise, such as the potential for radical change (Hu, 2018; Savransky, 2017).

Prediction: the future familiar

Prediction is a taken for granted technique of short-term forecast in epidemics, presented as grounded in the more-or-less known via empirical indicators whose veracity and certainty is said to enable reasonable statements of probability (George et al., 2019; Huppert & Katriel, 2013). In fast-moving epidemics, short-term forecasts are typically restricted to weeks (Funk et al., 2019). In efforts to predict opioid overdose, an outbreak might be forecast based on the past six months or year (Borquez and Martin, 2022; Marks et al., 2021). Claims of prediction as evidence-based rely specifically on their capacity for validation in empirical observations to protect against the undue uncertainty and contingency of longer-term scenarios which are inevitably more speculative (Funk et al., 2019).

Efforts to use prediction in early warning of opioid overdose combine various surveillance sources to show that recent detection of changes in drug supply, such as the presence of fentanyl, can be linked to subsequent overdose presentations and deaths (Campo et al., 2020; Chiang et al., 2020; Marks et al., 2021; Sumetsky et al., 2021). These are largely retrospective analyses which show that overdose deaths are predictable in the next year based on those reported in the recent past (Borquez and Martin, 2022). For the first time, in the U.S., there are published models predicting geographically targeted future overdose death rates as an early warning device for national policy, anticipating where outbreaks will next occur (Marks et al., 2022). Overdose rates in the past year become predictors of next year's overdose rates in a given locality, with the spatial and temporal diffusion of overdose projected largely in relation to indicators of the distribution of drug supply.

While forward-looking, this, however, is no 'long-view' of opioid overdose. Predicting to prevent accentuates a short-term prospective to enable a rapid and targeted local response:

> "Most prediction studies examine timescales of one year or less, which is justified given the urgent need for guidance to prevent further overdose and infectious disease outbreaks" (Borquez and Martin, 2022: 3)

> "Short-term prediction (ie. in the year preceding the outbreak) could allow us to mount a pre-emptive response and prevent deaths" (Borquez and Martin, 2022: 2)

Short-term prediction thus gives sufficiently nuanced warning locally to enable emergency response, such as providing fentanyl test strips, or creating low threshold supervised spaces for drug use (Borquez and Martin, 2022). The focus is 'emergency' with rapid response projected in a temporal framing of about a 'year or less', that is, the time in which epidemiological probabilistic forecasts are feasible. Yet, as is acknowledged, such short-term prediction occurs in the context of a long-term and "dismayingly predictable" epidemic of opioid overdose which extends 40 years (Jalal et al., 2018; Jalal and Burke, 2022). Here, we can see how the apparatus of early warning residing in short-term prediction delimits the temporality of outbreak to the near present, unhinging outbreaks from their long and slow violent pasts as well as possible futures.

Prediction, like outbreak, enacts temporal cuts in the long-view of epidemics. Problems become configured as short-term in their origins as well as solutions. Early warning itself is constituting outbreak and its ecology in particular ways, according to what is presented as *measurable*. These temporal cuts thus reside in an epidemiological epistemology in part made possible by the claim that so-called 'macro' environmental factors can be held as distinct from so-called 'micro' environmental ones when considered in temporal perspective, to suggest, for instance, that there is an insufficiently measurable pathway of timed connection between individuals' local material situations in relation to risk and national or global economic flows which might shape these (Borquez and Martin, 2022).

Enacted differently, however, outbreak need not separate or unhinge from its long and slow ecological trajectory, and neither might the individuals and communities affected be disentangled from these slower-moving (and ongoing) processes. The challenge facing prediction as prevention, as Borquez and Martin point out, is how to better incorporate what is often bundled together as part of the 'problem of complexity' in epidemiological research which presents as a 'black box' of 'social-structural determinants'. How, Borquez and Martin ask, is a 40 year ongoing epidemic of opioid overdose to 'flatten its curve'? What kind of early warning can help? This brings us to the question of how early warning might see the 'future less familiar', a future arguably otherwise carved out, made absent, from the short-term temporalities of outbreak prediction.

Speculation: the future less familiar

In addition to becoming more predictive, we suggest that there might be signals that the field of early warning is opening-up to speculation. An "inattention to the future" said to characterise the drug policy field, and perpetuated by short-term probabilistic forecast, can mean that "researchers write only about what they can be sure of" (Caulkins et al, 2003). Unlike prediction, speculation is oriented to possibilities rather than probabilities (Savransky, 2017). Here, the focus of early warning is developing scenarios of possible future that stretch beyond the capacities of 'evidence-based' and 'measurable' predictions. Speculation presents as part solution to the 'problems of complexity' troubling the early warning of outbreak.

A move towards speculation can be seen, for instance, in the growing interest and use of Foresight methods in global health and drug policy (Rhodes and Lancaster, 2021). Though variously defined, Foresight is usually done through workshops and deliberation events among experts, as well as through research, and generally includes: horizon scanning (of emerging drivers and signals of change); scenario development (to build narratives of alternative plausible and possible futures); and action planning (to map how to get to the futures preferred). Foresight thus incorporates: speculation of the plausible as well as possible, across alternative scenarios; multiple forms of expertise, including beyond the

epidemiological; a participative approach of dialogue, across multiple expertise; techniques to map, visualise and narrate scenarios; and looking back, in long-view, and at mega-trends, to anticipate social change (Giaoutzi and Sapio, 2013). Foresight methods have been re-energised post Covid-19. The World Health Organization, for instance, recently launched a Foresight initiative "to set futures-thinking in motion", "to provoke imagination, to think beyond today's reality to a better tomorrow, and to take active steps to get there" (2022). In the same year (2022), the EMCDDA launched a Foresight toolkit to better prepare in relation to drug outbreaks and futures.

Foresight is but one example of a speculative approach which moves between slower moving signals of the past into the present and future as a means of 'prospecting retrospects' in long-view. Speculative efforts stretch beyond reasonable prediction, but in the field of policy nonetheless reside in the "shadow of probabilities" (Savransky, 2017). Whilst speculative, such efforts are cast as 'actionable' interventions to enable 'future proofing', idealising a relatively unproblematic translation of 'evidence-based' intervention (WHO, 2022; EMCDDA, 2022). There is the need to investigate the use and potential of speculative methods in drug policy, including how they draw on sociological and historical expertise to re-configure outbreak otherwise, including in long-view.

Opioid overdose in long-view

The long trajectory of overdose epidemic hits home how the apparatus of early warning residing in a short-term outbreak rationality unhinges some outbreaks from their long and slow violent paths. We move then, from the predictable to the speculative, from the probable to the possible, from the empirically measurable to that which cannot so easily be epidemiologically empirically grounded. And in doing so, we move beyond the near past and now of epidemiological prediction linked to specific substances towards speculating on a "fundamental longer-term process" (Jalal et al., 2018). The speculative question is what we might work with – as evidence, as expertise, as narrative – that stretches our epidemiological and sociological imaginations of the past and future beyond the short-term predictable.

Deaths of despair and deaths of supply

There are two prime narratives enacted in the science of causation on the U.S. epidemic of opioid overdose: 'deaths of despair'; and 'deaths of supply'. Our aim here is not to appraise these (see: King et al., 2022; Seltzer, 2020; Thombs et al., 2020), but to consider how they are working to enact outbreak in longer-term perspective.

First coined by economists Case & Deaton (2015, 2020), in the 'deaths of despair' narrative, the opioid epidemic resides in a half-century process of deindustrialisation, entangling unemployment, under-employment, reduced pay and weakening labour unions, community and family disintegration, and increased stress and ontological insecurity, to foster precarious conditions conducive to drug demand, including as pain relief. Multiple epidemiological studies claim to support different elements of this scenario (Dwyer-Lindgren et al., 2018 ; Mclean, 2016; Monnat, 2019; Peters et al., 2020; Thombs et al., 2020 ; Venkataramani et al., 2020). One such study specifically tailored to investigate the association between manufacturing decline and opioid mortality between 1999 and 2017, concluded thus:

> "The findings provide strong evidence that the restructuring of the U. S. labour market has played an important upstream role in the current drug crisis. Up to 92,000 overdose deaths for men and up to 44,000 overdose deaths for women are predicted by the decline of state-level manufacturing over this nearly two-decade period." (Seltzer, 2020: 1).

The narrative of 'demand in despair' entangles with one of 'supply' (Currie and Schwandt, 2021; Hadland et al., 2019; Mackary, Overton, & Wang, 2017; Ruhm, 2019). Here, the opioid epidemic resides in a three decade process linked to the pharmaceuticalisation of society (Abraham, 2010). Tectonic style shifts in opioid prescribing for pain relief followed the US Food and Drug Administration's deregulation of Purdue Pharma's OxyContin in 1995 (Hadland et al., 2019; Mackary et al., 2017). Purdue and other pharmaceutical companies profited massively from their aggressive marketing of opioids, especially in areas of social and economic precarity, seen as affording demand potential (Monnat, 2019; Peters et al., 2020; Thombs et al., 2020). Prescription opioid sales, as well as deaths attributable to prescription opioids, increased fourfold between 1999 and 2008 (Paulozzi et al., 2011). In 2015, there were enough prescription opioids dispensed to medicate every adult in the United States with 5mg of hydrocodone every 4 hours for 3 weeks (Guy et al., 2017). Around this time, 80% of people using heroin surveyed nationally said that their opioid use began with pain relief (Muhuri et al., 2013). When compared with healthcare systems globally, the U.S. was prescribing more than 50 times the opioids than the rest of the world combined (Tick et al., 2017). In one much quoted study, Ruhm argued that 85% of the increase in overdose deaths between 2002 and 2015 linked to prescription opioids (Ruhn, 2019). Fentanyl, linked to the globalisation of this synthetic and its analogues in multiple opioid markets (Reuter et al., 2021; Suzuki and El-Haddad, 2017), has accounted for an increasing share of overdose mortality in the years to 2018 (Dart et al., 2015; Jalal and Burke, 2021; Zoorob, 2019). Here, a narrative of 'deaths of supply' also emphasises drugs made toxic and unsafe for use (Ivsins et al., 2020).

Whilst some have pitched the problematisations of 'deindustrialised despair' and 'pharmaceuticalised supply' against each other, in efforts to retrospectively account for, as well as quantify or predict, how the share of mortality falls (for example, Ruhm, 2019), narratives of demand and supply have generally settled in most accounts as inseparable. Here is one such example:

> "We conclude by reiterating that the drug-related mortality is a likely deleterious 'downstream' consequence of changes in the U.S. economy over the past half-century that have led to increased income inequality and an exploitative private health care and pharmaceutical industry." (Thombs et al., 2020: 286)

And here is another:

> "The ecological, demand-side influence of structural economic change remains a salient predictor of rising drug and opioid deaths even in states that had adopted strict drug control policies in the 1990s which would ultimately reduce the supply of legal prescription opioids over the next two decades" (Seltzer, 2020: 10-11).

A sociological long-view

The relative weight given to problematisations of despair and supply vary in the narratives that science produces. Speculations give rise to possibilities, that is, alternative contingencies, conditions and trajectories of outbreak. Let us next speculate the long-view of opioid overdose as enacted in sociological work. We highlight three intersecting enactments: class; race; and pharmocracy.

First, class. Here, overdose outbreak is narrated as an effect of sustained class-based economic inequalities (Friedman et al., 2020). This scenario traces the long-view of overdose back to post-war shifts in neoliberal society enabling the rights of companies to make profits where production is cheapest, thereby producing economic inequalities, recessions, weakened unions, weakened worker protections, as well as weakened social and public institutional supports (Harvey, 2013; McNally, 2011; Paley, 2015). In this narrative, which Friedman and colleagues cast as a "one-sided class war", economic inequalities are materialised through pathways of reduced work opportunity and fragile working conditions, characterised by workplace injury, which taken together produce "communities of despair", managed through pain relief (Friedman et al., 2020; Ikeler, 2020; Sered, 2019). The workplace be-

comes an embodiment and cause of pain (Buer, 2020; Harduar Morano et al., 2018). Intervention accordingly extends beyond the immediacy of harm and proximity of the drug to invite longer lasting, sustainable, and radical social change:

> "One-sided class war has been a major contributor to the opioid/overdose epidemic by facilitating pharmaceutical companies in their push to increase profits through selling addictive pain medications, specifically opioids; creating communities of despair; and contributing to pain in the population. This suggests that ending (or at least reducing) the one-sided class war might help address the opioid/overdose epidemic." (Friedman et al., 2020: 10)

Class-based inequality is reproduced also, according to sociological and historical accounts, in how drug policy and health care interventions value and distribute their care as well as envision their access to citizenship (Fine et al., 2020; Herzberg et al., 2016; Hansen et al., 2023; Netherland & Hansen, 2017). As journalist Beth Macy reflects, in her book *Dopesick,* on the slow national emergency response in the face of unprecendeted deaths, it was "working-class families who were traditionally depending on jobs in high-risk industries to pay their bills", who "weren't just the first to experience the epidemic of drug overdose" but "also happened to live in politically unimportant places, hollows and towns and fishing villages where the treatment options were likely to be hours from home" (2018: 7-8).

Sociological and historical work also accentuates the racialised structuration of overdose epidemic (Fine et al., 2020; Kunins, 2020; López et al., 2022). Here, multiple forms of entangling racialised inequality affecting work, education, housing and life opportunity are said to shape social capital and risk resistance to produce community contexts of attrition and despair (Bailey et al., 2017; Case and Deaton, 2020; Friedman et al., 2020). These studies emphasise marked exponential spikes in overdose death among Black and Latinx adults in recent years in the U.S. (Cano, 2021; El-Bassel et al., 2021; Furr-Holden et al., 2021). As concluded in one ethnographic study: "The overdose crisis escalates in communities where various forms of racialised exclusions are firmly entrenched" (López et al., 2022: S180). Unequal exposure to 'death-in-life' (Davies, 2018), where premature death becomes an anticipation, are traced to legacies of racialised social exclusion and trauma, reproduced locally in the interventions of drug-related policy, enforcement, criminalisation, and treatment (Fine et al., 2020; Kunins, 2020; López et al., 2022). In these accounts, "abandonment in overdose death" situates inside the "constant threat of differential and harsher enforcement" and "a historic consciousness of the racialised trauma of deprioritisation" (López et al., 2022: S179).

Sociological and historical analyses of prescription-driven opioid epidemics in the U.S., which largely affected White populations in the 2000s, are also accentuated as racialised (Fine et al., 2020; Hansen et al., 2023; Netherland and Hansen, 2017). Here, opioid overdose resides in a mix of privileged access to pharmaceuticals for pain relief and impoverished communities of despair (Netherland and Hansen, 2017). In contrast to an enforcement reflex response seeking to control drug outbreak as a problematic of race through criminalisation and intensified policing – for which policy responses to crack cocaine in the 1980s present as the epitome (Reinarman and Levine, 2004) – the 'drug epidemic' of prescription (White) opioids is traced in critical analyses of science and policy as 'white-washed' (Fine et al., 2020). Here, there is relative compassion, alongside the policing of supply (Herzberg et al., 2016), with overdose outbreak (belatedly) enacted as emergency (Christie et al., 2017), in response to a "biomedical disease" presented as "the war on drugs that wasn't" (Netherland and Hansen, 2017). In the "White drug war" opioid outbreak is "decriminalised", with "whiteness preserved", thus "leaving intact more punitive systems that govern the drug use of people of color" (Netherland and Hansen, 2017: 217). This, it is argued, is a pattern of racialised outbreak response in the U.S. with a "long history" (Fine et al., 2020; Herzberg et al., 2016;). The reflex short-termism of outbreak response anticipates futures differentially in racialised outbreaks. As Anderson notes, rapid responses that fail to see the structuration of racialised harms presume the "open-ended futurity of the white liberal subject and the repetitive and durative temporalities of black and indigenous subjects […] that denies these subjects the possibility of a future" (Anderson et al., 2020: 629).

A third illustration of sociological enactment enjoins ideas of pharmocracy (Szasz, 2001; Rajan, 2017) with necroeconomy (Haskaj, 2018; Mbembe, 2003). Here, overdose presents as collateral. In a pharmocracy, health is appropriated by capital, with well-being materialised as a speculative interest of pharmaceutical and other industries. It is said, for instance, that in the case of OxyContin, Purdue "created a new market of exploitation based on addiction and death" (Darian-Smith, 2021: 70). Here, it is posited, there is a blurring of lines between "letting die" and "making die" (Haskaj, 2018). In a necroeconomy, the accumulation of capital does not accrue through the surplus value of cheap labour, but "rather through surplus population" (Haskaj, 2018: 1163). It might be seen as the "last hope to extract a 'quantum of value' from populations" (Haskaj, 2018: 1155). Here, death becomes a "source of value", a "new space in capital", a "commodity itself" (Haskaj, 2018: 1149), around which "monetary value and late capitalist activities flourish" (Darian-Smith, 2021: 61). As Mbembe asked of necropolitics in the face of wars: "under what practical conditions is the right to kill, to allow to live, or to expose to death exercised?" (2003: 12). A necroeconomy is not only produced in exceptional and extreme violence – such as the killing that is done in the name of wars – but also in the everyday and mundane, that is, in the slow structural violence of attrition said to reside in a war on drugs and peoples (Bourgois and Scheper-Hughes, 2002; Bailey et al., 2017; Zigon, 2018). Anthropologist Andrea López, for example, has explored how homeless women who use drugs in San Francisco, a city more compassionate than many, embody the *anticipation* of death in their everyday lives even as they seek to manage their risk of *actual* death through harm reduction (López, 2020). Again, Darian-Smith:

> "While not necessarily engaged in 'economies of death', they reinforce a sensibility that some human lives are worth more than others. Collectively, these industries foster the political and social conditions in which a new type of economy based on the 'monetization of death' may seem even reasonable and practical… There are only degrees of culpability separating 'letting die' and 'making die'… While the (opioid) epidemic is extreme in terms of scale, it should not be considered an anomaly with respect to what it says about the global pharmaceutical industry's casual disregard for human life, and more disturbingly, its aggressive exploitation of human death" (Darian-Smith, 2021: 67)

While some of the weak regulatory structures supporting the pharmocracy that gave rise to overdose epidemics have been belatedly tamed – for instance, through supply-side prescription monitoring programmes – the effects of these in relation to opioid overdose outcomes are questionable (Dickson-Gomez et al., 2021; Rhodes et al., 2019), and do not undo the social forces creating the conditions for epidemics and endemics (Fine et al., 2020). At the same time, pharmaceuticals present as a critical ingredient in emergency harm reduction efforts to make a contamined drug supply safer, for instance, from fentanyl and its analogues (Ivsins et al., 2020). Here, the enactment of emergency has the effect of enabling a legalised and regulated pharmaceuticalised supply as the "pragmatic" and "ethical" rapid response (Tyndall, 2020).

Slow death, slow violence, slow emergency

There is some affinity in these sociological accounts with what Lauren Berlant describes as 'slow death': the "physical wearing out of a population and the deterioration of people in that population that is very nearly a defining condition of their experience and historical existence" (2007: 754). Berlant's case study is the U.S. obesity epidemic which she emphasises as *endemic*; ongoing as well as indirect and dispersed in its

pathways of causation and impacts, so much so that the everyday effects of its socially structured habitation are not stand-out nor even especially memorable, but *wearing* over time. Here agency, including that which appears to run counter to the accumulation of power or capital, such as perhaps the self-medication of drugs as pain relief in the face of reduced opportunity (Friedman et al., 2020; Zigon, 2018), is a 'practical sovereignty' of survival in an ongoing, long-term and even predictable, trajectory of constraint. In our case, surveillance indicators of ongoing 'predictable' overdose 'endemic' become ecological signals of long-term, diffuse and entangled processes of structural, material and racialised violence. Slow death is affected by a "regime of crisis ordinariness" rather than dramatic "crisis management" (Berlant, 2007: 779). In endemics, efforts to build life and survive become indistinguishable from deterioration and attrition, as does habit from deliberate action. In Berlant's account, the "attrition of the subject of capital articulates survival as slow death", wherein:

> "activity toward reproducing life is not identical to making it or oneself better, or to a response to the structural conditions of a collective failure to thrive, but to making a less bad experience. It's a relief" (Berlant, 2007: 779)

Sociological thinking in relation to 'slow deaths' links with that of 'slow violence' (Nixon, 2011). In his book *Slow Violence and the Environmentalism of the Poor*, Rob Nixon writes:

> "By slow violence I mean a violence that occurs gradually and out of sight, a violence of delayed destruction that is dispersed across time and space, an attritional violence that is typically not viewed as violence at all. Violence is customarily conceived as an event or action that is immediate in time, explosive and spectacular in space, and as erupting into instant sensational visibility. We need, I believe, to engage a different kind of violence, a violence that is neither spectacular nor instantaneous, but rather incremental and accretive, its calamitous repercussions playing out across a range of temporal scales." (Nixon, 2011: 2)

Slow violence, then, does not merely accentuate violence as structural, a familiar idea in political-economic analyses of harm (Bourgois and Scheper-Hughes, 2002; Rhodes et al, 2011), but provokes a temporal reorientation to notice the "slow unfolding environmental catastrophes" that diffuse and detach from their proximal causes and that can go unseen or obscured by the "dramatic packaging" and "attosecond pace" of the now (Nixon, 2011: 200). Attending to the slow-burn of epidemics emphasises an alternative problematisation which cautions against outbreak constituted as a singular dramatic event prompting a pre-prepared bureaucratic reflex (Barker, 2012). Rapid response is, of course, *of our time*; the proffering of quick technological fixes to problems, which may not disappear even if made less visible, as time moves on:

> "Ours is […] an era of enclaved time wherein for many speed has become self-justifying, propulsive ethic that renders 'uneventful' violence (to those who live remote from its attritional lethality) a weak claimant on our time" (Nixon, 2011: 200)

An ecology of 'crisis ordinariness' habituated in slow violence has markedly different effects to the configuration of outbreak as a short-term rupture demanding rapid precautionary interruption. Critically, there is no "interval" (Anderson, 2016). The maintstream configuration of outbreak enacts an illusion of interval, a distinction between the everyday normal and the threat of a disrupting event, creating a time-space to act, in order to bring about the preservation of the present as quickly as possible. In slow death (Berlant, 2007), and in slow emergency (Anderson et al., 2020), there is no such distinguishable interval in the habituated embodiment of harm, which is neither abrupt nor bounded, and consequently, not even necessarily memorable (Berlant, 2007). Ben Anderson defines 'slow emergency' as marked by the disjuncture between an emergency claim, like that enacted by the short-termism and rapid response of outbreak, and the slow-burn embodied experience of outbreak made otherwise which has its origins elsewhere (Anderson, 2016; Anderson et al., 2020). The belated declarations of 'crisis' and 'national emergency' in response to the opioid outbreak in the U.S., for instance, exposes an imagined boundary between the endemic and the eventual, in which the problematisation of the now is detached from its long-term contingencies. In Berlant's account of slow death there is no distinction between the extreme or spectacular and the mundane or ordinary. This is why slow emergency and slow violence is hard to see, as well as kept out of sight, by the short-termism of early warning practices and outbreak rationality. Anderson's 'slow emergency' is a re-configuration of emergency that enables incorporation of the ordinary and the 'uneventful'. Re-configuring outbreak in long-view likewise considers the 'attritional lethality' and 'imperceptibility' of slow violence and the limits this may place on 'the capacity to become otherwise' (Anderson et al., 2020: 634).

Conclusion

Engaging with epidemiological and sociological work on early warning and its enactment of outbreak, our aim has been to consider critically how configurations of outbreak govern, especially in relation to temporality. Our approach has not been to question the accounts and speculations of epidemiology and sociology in relation to opioid overdose outbreak as right or wrong, or as more or less probable, but to work with their potentials. Questioning how early warning science enacts and sees outbreak invites the possibility of *seeing differently* (Law, 2009). We have re-assembled outbreak in sociological 'long-view' as a way of seeing opioid overdose outbreak differently. In doing so, we have drawn attention to signals of shift and potential in practices of early warning, both within and beyond the field of drugs, as well as specifically in relation to opioid overdose, which accentuate how outbreak might be remade as an event which extends beyond the immediacy of substantive hazard, as well as beyond the proximal, the local, the now, and the short-term. We have offered a sociological analysis of opioid overdose in long-view via ideas of slow death (Berlant, 2007), slow violence (Nixon, 2011) and slow emergency (Anderson et al., 2020). This has helped to imagine outbreak otherwise, beyond the logics and practices of epidemiological early warning. Assembled in long-view, opioid overdose conditions are seen as 'beyond outbreak' as well as 'beyond epidemic'.

The long-view of outbreak is a warning of an ecological kind, inviting social changes towards ongoing sustainable care, and not only technoscientific fixes delivered in reflex rapid response (Lancaster and Rhodes, 2023). We imagine 'warning' here in relation to societal contingencies and transformations, not merely in relation to particular substances and their proximal effects. There is an urgency for harm reduction responses to deliver emergency interventions in response to overdose outbreak to enable safer supply and use among affected communities, and this has become possible with such outbreak claimed as crisis and emergency (Ivsins et al., 2020; Tyndall, 2020). Harm reduction also calls for sustainable care embedded in long-term societal transformations (Campbell, 2020; Cerdá et al., 2021; El-Bassell, et al., 2021; Friedman et al., 2020). The slow violence of structural inequality and endemicity of despair may not be undone by the rapid and short-term technological fix. While side-lined by mainstream early warning approaches, community responses bear witness to the slow violence of outbreak – an outbreak made otherwise through this witnessing – demanding social transformation and structural change (Campbell, 2020; Tyndall and Dodd, 2020; Watson et al., 2020).

Assembling opioid overdose as 'slow violent outbreak' attends to what is *put out of sight* by mainstream configurations of outbreak as enacted in the practices of early warning systems and narratives in the field. Seeing outbreak in long-view reveals how rapid reflex responses and attention on proximal indicators in-the-now can fail to address, as well as perpetuate, the ongoing slow violence of harm. As we have argued, the science of early warning in the drugs field gives primary em-

phasis on what is epidemiologically empirically measurable and predictable in the short-term. Yet we need a long and situated view; indicators, signals, evidence, and narratives of an ecological kind. We need to move out of the 'shadow of probabilities' to speculate as well as detect and predict (Savransky, 2017). This requires re-thinking the mainstream logics and empirics which make up outbreak in epidemiological early warnings to speculate and deliberate alternative ways of seeing across multiple forms of expertise, including qualitative, experiential and sociological. We need, especially, to better incorporate what might be described as 'slow observations' in early warning (Davies, 2022); ethnographic, qualitative, informal, community and activist accounts of slow violence as it is lived incrementally, variably, and over time (Bourgois and Schonberg, 2009; Campbell, 2020; Hansen et al., 2023)). Re-configuring early warning and outbreak in sociological long-view helps bear witness to the slow violence and slow emergency of harm, focusing our attention to warn of societal change. The short-termism and reflex precautionary control of early warning, and the particular 'outbreak' it shapes, risks perpetuating the harms of the past into the present and future.

Endnote

1 We are grateful to peer reviewer comments which have helped crystallise this point.

Declaration of Competing Interest

None.

CRediT authorship contribution statement

Tim Rhodes: Conceptualization, Formal analysis, Writing – original draft, Writing – review & editing. **Kari Lancaster:** Conceptualization, Writing – review & editing.

Acknowledgements

This paper is dedicated to the memory of Richard Hartnoll, a pioneer in the field of drug epidemiology, and a colleague and friend to Tim Rhodes. A version of this paper was presented as the inaugural *Richard Hartnoll Memorial Lecture* at *Lisbon Addictions*, November 2022. We thank the European Monitoring Centre for Drugs and Drug Addiction, and Paul Griffiths, for their support. This work is also supported by the Australian Research Council (DE230100642), and through University of New South Wales SHARP (Tim Rhodes) and Scientia (Kari Lancaster) schemes. We would like to thank the anonymous peer reviewers for their helpful comments.

References

Abraham, J. (2010). Pharmaceuticalization of society in context: Theoretical, empirical and health dimensions. *Sociology, 44*, 603–622.
Abramowitz, S. A., Bardosh, K. L., Leach, M., et al., (2015). Social science intelligence in the global Ebola response. *Lancet, 385*, 330.
Adams, V., Murphy, M., & Clarke, A. E. (2009). Anticipation: Technoscience, life, affect, temporality. *Subjectivity, 28*, 246–265.
Adey, P. (2016). Emergency mobilities. *Mobilities, 11*, 32–48.
Agar, M., & Reisinger, H. S. (2001). Trend theory: Explaining heroin use trends. *Journal of Psychoactive Drugs, 33*, 203–212.
Agar, M. (2003). Toward a Qualitative Epidemiology. *Qualitative Health Research, 13*, 974–986.
Ahmad, F. B., Cisewskis, J. A., Rossen, L. M., & Sutton, P. (2022). *Provisional drug overdose death counts*. Center for Disease Control and Prevention: National Center for Health Statistics.
Alcántara-Ayala, I., & Oliver-Smith, A. (2019). Early warning systems: Lost in translation or late by definition? *International Journal of Disaster Risk Science, 20*, 317–331.
Ali, S., & Keil, R. (Eds.). (2008). *Networked disease: emerging infections in the global city*. London: Blackwell.
Anderson, B. (2010). Pre-emption, precaution, preparedness: Anticipatory action and future geographies. *Progress in Human Geography*, 1–22.
Anderson, B. (2016). Governing emergencies: The politics of delay and the logic of response. *Transactions of the Institute of British Geographers, 41*, 14–26.
Anderson, B., Grove, K., Rickards, L., & Kearnes, M. (2020). Slow emergencies: Temporality and the racialized biopolitics of emergency governance. *Progress in Human Geography, 44*, 621–639.
Anderson, W. (2021). The model crisis, or how to have critical promiscuity in the time of Covid-10. *Social Studies of Science, 51*, Article 167188.
Artigiani, E. E., & Wish, E. D. (2020). Introducing the National Drug Early Warning System. *Current Opinion in Psychiatry, 33*, 319–325.
Bacchi, C. (2018). Drug problematizations and politics: Deploying a poststructural analytic strategy. *Contemporary Drug Problems, 45*, 3–14.
Bade, R., Rousis, N., Adhikari, S., Baduel, C., Bijlsma, L., Bizami, E., et al., (2023). Three years of wastewater surveillance for new psychoactive sustances from 16 countries. *Water Research, 19*, Article 100179.
Bailey, Z. D., Krieger, N., Agénor, M., Graves, J., Linos, N., & Bassett, M. T (2017). Structural racism and health inequities in the USA: evidence and interventions. *Lancet, 389*, 1453–1463.
Barker, K. (2012). Influenza preparedness and the bureaucratic reflex: Aniticpating and generating the 2009 H1N1 event. *Health and Place, 18*, 701–709.
Berlant, L. (2007). Slow death (sovereignty, obesity, lateral agency). *Critical Inquiry, 33*, 754–780.
Bourgois, P., & Scheper-Hughes, N. (2002). *Violence in war and peace*. Malden, MA: Blackwell Publishing.
Bourgois, P., & Schonberg, J. (2009). *Righteous dopefiend*. University of California Press.
Bharat, C., Hickman, M., Barbieri, S., & Degenhardt, L. (2021). Big data and predictive modelling for the opioid crisis: existing research and future potential. *Lancet Digital Health, 3*, e397–e407.
Borquez, A., & Martin, N. K. (2022). Fatal overdose: Predicting to prevent. *International Journal of Drug Policy, 104*, Article 103677.
Brown, N., & Michael, M. (2003). A sociology of expectations: Retrospecting prospects and prospecting retrospects. *Technology Analysis and Strategic Management, 15*, 3–18.
Buer, L-M. (2020). *Rx appalachia : Stories of treatment and survival in rural Kentucky*. Chicago, IL: Haymarket Press.
Burgard, D. A., Bisceglia, K., & Banta-green, C. (2017). Wastewater testing as a pipeline to public health data. In A. Keshaviah (Ed.), *The potential of wastewate testing for public health and safety*. Washington, DC: Mathematica Policy Research.
Burke, D. S., & Jalal, H. (2022). Reply. *International Journal of Drug Policy, 104*, Article 103674.
Buxton, J. A., Spearn, B., Amlani, A., Kuo, M., Lysyshyn, M., Young, S., et al., (2019). The British Columbia drug overdose and alter partnership: Interpreting and sharing timely illicit drug information to reduce harms. *Journal of Community Safety and Well Being, 4*, 4–9.
Caduff, C. (2019). Great anticipations. In A. Kelly, F Keck, & C. Lynteris (Eds.), *The anthropology of epidemics* (pp. 43–58). London: Routledge.
Campbell, N. (2020). *OD: Naloxone and the politics of overdose*. Cambridge, MA: MIT Press.
Campo, D. S., Gussler, J. W., Sue, A., Skums, P., & Khudyakov, Y. (2020). Accurate spatiotemporal mapping of drug overdose deaths by machine learning of drug-related web-searches. *PLoS One, 15*, Article e0243622.
Cano, M. (2021). Racial/ethnic differences in US drug overdose mortality, 2017-2018. *Addictive Behaviors, 112*, Article 106625.
Case, A., & Deaton, A. (2015). Rising morbidity and mortality in midlife among white non-hispanic Americans in the 21st century. *Proceedings of the National Academy of Sciences, 12*, 15078–15083.
Case, A., & Deaton, A. (2020). *Deaths of despair and the future of capitalism*. Princeton University Press.
Castiglioni, S. (2016). *Assessing illicit drugs in wastewater*. Luxembourg: Publications Office of the European Union.
Caulkins, J. P., Reuter, P., Iguchi, M. Y., & Chiesa, J. (2003). *Drug use and drug policy futures, Issue Paper*. Santa Monica: RAND Drug Policy Research Centre.
Cerdá, M., Krawczyk, N., Hamilton, L., Rudolph, K. E., Friedman, S. R., & Keyes, K. M. (2021). A critical review of the social and behavioural contributions to the overdose epidemic. *Annual Review of Public Health, 42*, 95–114.
Chiang, W-H., Yuan, B., Li, H., Bertozzi, A., Carter, J., Ray, B., & Mohler, G. (2020). SOS-EW: System for overdose spile early warning using drug mover's distance-based Hawles Processes. In P. Cellier, & K. Drieessens (Eds.), *Machine learning and knowledge discovery in databases* (pp. 538–554). Springer.
Christie, C., Baker, C., Cooper, R., Kennedy, P., Madras, B., & Bondi, P. (2017). *The President's commission on combating drug addiction and the opioid crisis* https://trumpwhitehouse.archives.gov/sites/whitehouse.gov/files/images/Final_Report_Draft_11-15-2017.pdf (Accessed 25 April 2023).
Ciccarone, D. (2019). The triple wave epidemic: Supply and demand drivers of the US opioid overdose crisis. *International Journal of Drug Policy, 71*, 183–188.
Ciccarone, D. (2020). No moral panic: Public health responses to illicit fentanyls. *DePaul Law Review, 70*, 229–244.
Clatts, M. C., Welle, D. L., Goldsamt, L. A., & Lankenau, S. E. (2002). An ethno-epidemiological model for the study of trends in illicit drug use: reflections on the 'emergence' of crack injection. *International Journal of Drug Policy, 13*, 285–295.
Collier, S., & Lakoff, A. (2008). The problem of securing health. In A. Lakoff, & S. Collier (Eds.), *Biosecurity interventions* (pp. 33–60). New York: Columbia University.
Cooper, M. (2006). Pre-empting emergence: The biological turn in the war on terror. *Theory, Culture and Society, 23*, 113–135.
Currie, J., & Schwandt, H. (2021). The opioid epidemic was not caused by economic distress but by factors that could be more rapidly addressed. *ANNALS of the American Academy of Political and Social Science, 695*, 276–291.
Darian-Smith, E. (2021). Dying for the economy: Disposable people and the economies of death in the global north. *State Crime, 10*, 61–79.

Dart, R. C., Severtson, S. G., & Bucher-Bartelson, B. (2015). Trends in opioid analgesic abuse and mortality in the United States. *New England Journal of Medicine, 372*, 1573–1574.
Davies, T. (2018). Toxic space and time: Slow violence, necropolitics, and petrochemical pollution. *Annals of the American Association of Geographers, 108*, 1537–1553.
Davies, T. (2022). Slow violence and toxic geographies: 'Out of sight' to whom? *Environment and Planning C: Politics and Space, 40*, 409–427.
De Weerdt, S. (2019). The natural history of an epidemic. *Nature, 573*, S10–S12.
Dickson-Gomez, J., Christenson, E., Weeks, M., Galletly, C., Wogen, J., Spector, A., et al., (2021). Effects of implementation and enforcement differences in prescription drug monitoring programs in 3 states: Connecticut, Kentucky, and Wisconsin. *Substance Abuse, 25*(15), Article 1178221821992349.
Dwyer-Lindgren, L, Bertozzi-Villa, A, Stubbs, RW, et al., (2018). Trends and patterns of geographic variation in mortality from substance use disorders and intentional injuries among US counties, 1980-2014. *Journal of the American Medical Association, 319*, 1013–1023.
El-Bassel, N., Shoptaw, S., Goodman-Meza, D., & Ono, H. (2021). Addressing long overdue social and structural determinants of the opioid epidemic. *Drug and Alcohol Dependence, 222*, Article 108679.
Enghoff, O., & Aldridge, J. (2019). The value of unsolicited online data in drug policy research. *International Journal of Drug Policy, 73*, 210–218.
Erickson, T. B., Endo, N., Duvallet, C., Ghaeli, N., Hess, K., Alm, E. J., et al., (2021). Waste not, want not: Leveraging sewer systems and wastewater-based epidemiology for drug use trends and pharmaceutical monitoring. *Journal of Medical Toxicology, 17*, 397–410.
European Monitoring Centre for Drugs and Drug Addiction. (2016). *Assessing illicit drugs in wastewater: Advances in wastewater-based drug epidemiology, Insights 22*. Luxembourg: Publications Office of the European Union.
European Monitoring Centre for Drugs and Drug Addiction. (2019). *Using open-source information to improve the European Drug Monitoring System*. Lisbon: EMCDDA.
European Monitoring Centre for Drugs and Drug Addiction. (2020). *New psychoactive substances: Global markets, glocal threats and the Covid-19 pandemic*. Lisbon: EMCDDA.
European Monitoring Centre for Drugs and Drug Addiction. (2022). *New psychoactive substances: 25 years of early warning and response in Europe*. Lisbon: EMCDDA.
Evans-Brown, M, & Sedefov, R (2017). New psychoactive substances: driving greater complexity into the drug problem. *Addiction, 112*, 36–38.
Evans-Brown, M., Gallegos, A., Christie, R., Sofia, S., Almeida, A., Jorge, R., et al., (2018). *Fentanils and synthetic cannabinoids: Driving greater complexity into the drug situation*. Luxembourg: EMCDDA.
Fine, D. R., Herberg, D., & Wakeman, S. (2020). Societal biases, institutional discrimination, and trends in opioid use in the USA. *Journal of General Internal Medicine, 36*, 797–801.
Foucault, M. (1984). Polemics, politics and problematizations. In P. Rabinow (Ed.), *The foucault reader*. New York: Pantheon Books.
Friedman, S. R., Krawczyk, N., Perlman, D. C., Mateu-Gelabert, P., Ompad, D. C., Hamilton, L., et al., (2020). The opioid/overdose crisis as a dialectics of pain, despair, and one-sided struggle. *Frontiers in Public Health, 8*, Article 540423.
Friedman, S. R., Mateu-Gelabert, P., Nikolopoulos, G. K., Cerdá, M., Rossi, D., Jordan, A. E., et al., (2021). Big Events theory and measures may help explain emerging long-term effects of current crises. *Global Public Health, 16*, 1167–1186.
Funk, S., Camacho, A., Kucharski, A., Lowe, R., Eggo, R., & Edmunds, W. J. (2019). Assessing the performance of real-time epidemic forecasts: A case study of Ebola in the Western Area region of Sierra Leone, 2014-15. *PLoS Computational Biology, 15*, Article e10006785.
Furr-Holden, D., Milam, A. J., Wang, L., & Sadler, R. (2021). African Americans now outpace whites in opioid-involved overdose deaths: a comparison of temporal trends from 1999 to 2018. *Addiction, 116*, 677–683.
George, D. B., Taylor, W., Shaman, J., Rivers, C., Paul, B., et al., (2019). Technology to advance infectious disease forecasting for outbreak management. *Nature Communications, 10*(2), 3932.
Giaoutzi, M., & Sapio, B. (2013). *Recent developments in foresight methods*. Springer.
Gitter, A., Oghuan, J., Rajendra Godbole, A., Chavarria, C. A., Monserrat, C., Hu, T., et al., (2023). Not a waste: Wastewater surveillance to enhance public health. *Frontiers in Chemical Engineering, 4*, Article 1112876.
Griffiths, P., & McKetin, R. (2003). Developing a global perspective on drug consumption patterns and trends: The challenge for drug epidemiology. *Bulletin of Narcotics, LV*, 1–8.
Gushgari, AJ, Venkatesan, AK, Chen, J, Steele, JC, & Halden, RU. (2019). Long-term tracking of opioid consumption in two United States cities using wastewater-based epidemiology approach. *Water Research, 161*, 171–180.
Guston, D. H. (2014). Understanding 'anticipatory governance. *Social Studies of Science, 44*, 218–242.
Guy, G. P., Zhang, K., Bohm, M. K., et al., (2017). Changes in opioid prescribing in the United States, 2006-2015. *Mortality and Morbidity Weekly Reports, 66*, 697–704.
Hadland, SE, Rivera-Aguirre, A, BDL, Marshall, & Cerdá, M. (2019). Association of pharmaceutical industry marketing of opioid products with mortality from opioid-related overdoses. *Journal of the American Medical Association Network Open, 2*, Article e186007.
Hall, S., Critcher, C, Jefferon, T, Clarke, J., & Roberts, B. (1978). *Policing the crisis*.
Hansen, H., Netherland, J., & Herzberg, D. (2023). *Whiteout: How Racial Capitalism Changed the Color of Opioids in America*. Oakland, CA: University of California Press.
Harduar Morano, L, Steege, AL, & Luckhaupt, SE. (2018). Occupational patterns in unintentional and undetermined drug-involved and opioid-involved overdose deaths - United States, 2007–2012. *Morbidity and Mortal Weekly Reports, 67*, 925–930.
Hartnoll, R. (2003). Drug epidemiology in the European institutions: Historical background and key indicators. *Bulletin on Narcotics, 55*, 53–71.
Harvey, D. (2013). *The new imperialism*. Oxford: Oxford University Press.
Haskaj, F. (2018). From biopower to narcoeconomics: Neoliberalism, biopower and death economies. *Philosophy and Social Criticism, 44*, 1148–1168.
Herzberg, D. (2020). *White market drugs: Big pharma and the hidden history of addiction in America*. Chicago University Press.
Herzberg, D., Guarino, H., Mateu-Gelabert, P., & Bennett, A. S. (2016). Recurring epidemics of pharmaceutical drug abuse in America: Time for an all-drug strategy. *American Journal of Public Health, 106*, 408–410.
Hinchliffe, S. (2001). Indeterminacy in-decisions: Science, policy and politics in the BSE crisis. *Transactions of the Institute of British Geographers, 26*, 184–204.
Houlihan, C. F, & Whitworth, J. A. (2019). Outbreak science: Recent progress in the detection and response to outbreaks of infectious diseases. *Clinical Medicine, 19*, 140–144.
Hu, C. (2018). A jungle that is continually encroaching': The time of disaster management. *Environment and Planning D: Society and Space, 36*, 96–113.
Hughes, P. H., Barker, N. W., Crawford, G., & Jaffe, J. H. (1972). The natural history of a heroin epidemic. *American Journal of Public Health, 62*, 995–1001.
Humphreys, K., Shover, C. L., Andrews, C. M., Bohner, A. S. B., Brandeau, M. L., Caulkins, J. P., et al., (2022). Responding the opioid crisis in North America and beyond: Recommendations of the Stanford-Lancet Commission. *Lancet, 399*, 10324.
Huppert, A., & Katriel, G. (2013). Mathematical modelling and prediction in infectious disease epidemiology. *Clinical Microbiology and Infection, 19*, 999–1005.
Ikeler, P. (2020). Labor relations and the overdose crisis in the United States. *Addiction Research and Theory, 29*, 271–278.
Ivsins, A., Boyd, J., Beletsky, L., & McNeil, R. (2020). Tackling the overdose crisis: The role of safe supply. *International Journal of Drug Policy, 80*, Article 102769.
Jalal, H., Buchanich, J. M., Roberts, M. S., Balmert, L. C., Zhang, K., & Burke, D. S. (2018). Changing dynamics of the drug overdose epidemic in the United States from 1979 through 2016. *Science, 361*(6408), eaau1184.
Jalal, H., & Burke, D. S. (2021). Carfentanil and the rise and fall of overdose deaths in the United States. *Addiction, 116*, 1593–1599.
Jalal, H., & Burke, D. S. (2022). Exponential growth of drug overdose poisoning and opportunities for intervention. *Addiction, 117*, 1200–1202.
Janes, C. R., Corbett, K. K., Jones, J. H., et al., (2012). Emerging infectious diseases: The role of social sciences. *Lancet, 380*, 1884–1886.
Jones, C. M., & McAninch, J. K. (2015). Emergency department visits and overdose deaths from combined use of opioids and benzodiazepines. *American Journal of Preventive Medicine, 49*, 493–501.
Jurecka, C. A., & Barocas, J. A. (2023). Using evidence to inform legislation aimed at curbing fentanyl deaths. *JAMA Health Forum, 4*, Article e225202.
King, N. B. (2004). The scale politics of emerging diseases. *Osiris, 19*, 62–76.
King, L., Scheiring, G., & Nosrati, E. (2022). Deaths of despair in comparative perspective. *Annual Review of Sociology, 48*, 299–317.
Kolodny, A., Courtwright, D. T., Hwang, C. S., et al., (2015). The prescription opioid and heroin crisis: A public health approach to an epidemic of addiction. *Annual Review of Public Health, 36*, 559–574.
Kozel, N. J., Robertson, E. B., & Falkowski, C. L. (2002). The community epidemiology work group approach. *Substance Use and Misuse, 37*, 783–803.
Kunins, H. V. (2020). Structural racism and the opioid overdose epidemic: the need for antiracist public health practice. *Journal of Public Health Management and Practice, 26*, 201–205.
Lancaster, K., Ritter, A., valentine, k., & Rhodes, T. (2019). "A more accurate understanding of drug use": A critical analysis of wastewater analysis technology for drug policy. *International Journal of Drug Policy, 63*, 47–55.
Lancaster, K., & Rhodes, T. (2023). Problematising the emergence of outbreak in the governance of global health: Making time for slow disease. *Critical Public Health* (forthcoming).
Lakoff, A. (2017). *Unprepared: Global health in a time of emergency*. University of California Press.
Lakoff, A. (2019). What is an epidemic emergency?. In A. H. Kelly, F. Keck, & C. Lynteris (Eds.), *The anthopology of epidemics* (pp. 59–69). London: Routledge.
Law, J. (2004). *After method: Mess in social science research*. Oxon: Routledge.
Law, J. (2009). Seeing like a survey. *Cultural Sociology, 3*, 239–256.
Lo-Ciganic, W. H., Donohue, J. M., Yang, Q., et al., (2022). Developing and validating a machine-learning algorithm to predict opioid overdose among Medicaid beneficiaries in two US states: A prognostic modelling study. *Lancet Digital Health, 4*, e455–e465.
López, A. M. (2020). Necropolitics in the "compassionate" city: Care/brutality in San Francisco. *Medical Anthropology, 39*, 751–764.
López, A. M., Thomann, M., Dhatt, Z., Ferrera, J., Al-Nassir, M., Ambrose, M., & Sullivan, S. (2022). Understanding racial inequities in the Implementation of harm reduction initiatives. *American Journal of Public Health, 112*(S2), S173–S181.
Mackary, M. A., Overton, H. N., & Wang, P. (2017). Overprescribing is major contributor to opioid crisis. *British Medical Journal, 359*, j4792.
Margetts, M., Keshaviah, A., Hu, X. C., Troeger, V., Sykes, J., Bishop, N., et al., (2020). Using wastewater-based epidemiology with local indicators of opioid and illicit drug use to overcome data gaps in Montana. *medRxiv*. 10.1101/2020.04.
Marks, C., Carrasco-Escobar, G., Carrasco-Hernández, R., Johnson, D., Ciccarone, D., Strathdee, S. A., Smith, D., & Bórquez, A. (2021). Methodological approaches for the prediction of opioid use-related epidemics in the United States: A narrative review and cross-disciplinary call to action. *Translational Research, 234*, 88–113.
Marks, C., Abramowitz, D., Donnelly, C. A., Ciccarone, D., Martin, N., Strathdee, S. A., … Borquez, A. (2022) Predicting county-level overdose death rates amid the escalating overdose crisis in the United States: A statistical modeling approach predicting deaths through 2022, doi.org/10.31219/osf.io/83zk.
Mars, S. G., Ondocsin, J., & Ciccarone, D (2018). Sold as heroin: Perceptions and use of an evolving drug in Baltimore. *Journal of Psychoactive Drugs, 50*, 167–176.

Marshall, B. D. L., Yedinak, J. L., Goyer, J., Green, T. C., Koziol, J. A., & Alexander-Scott, N (2017). Development of a statewide, publicly accessible drug overdose surveillance and information system. *American Journal of Public Health, 107*, 1760–1763.

Marshall, B., Alexander-Scott, N., Yedinak, J. L., Hallowell, B. D., Goedel, W. C., Allen, B., et al., (2022). Preventing overdose using information and data from the environment (PROVIDENT): Protocol for a randomized, population-based, community intervention trial. *Addiction, 117*, 1152–1162.

Mbembe, J. A. (2003). Necropolitics. *Public Culture, 15*, 11–40.

McLean, K. (2016). There's nothing here": Deindustrialization as risk environment for overdose. *International Journal of Drug Policy, 29*, 19–26.

McNally, D. (2011). *Global slump: The economics and politics of crisis and resistance*. Oakland, CA: PM Press.

Monnat, S. M. (2019). The contributions of socioeconomic and opioid supply factors to U.S. drug mortality rates: Urban-rural and within-rural differences. *Journal of Rural Studies, 68*, 319–335.

Moore, D., Dray, A., Green, R., Hudson, S. L., Jenkinson, R., Siokou, C., Perez, P., Bammer, G., Maher, L., & Dietze, P. (2009). Extending drug ethno-epidemiology using agent-based modelling. *Addiction, 104*, 1991–1997.

Muhuri, P. K., Gfroerer, J. C., & Davies, M. (2013). *Associations of nonmedical pain reliever use and initiation of heroin use in the United States*. Centre for Behavioural Health Statistics and Quality, Washington, DC: US Department of Health and Human Services.

National Research Council. (2001). *Under the weather: Climate, ecosystems and infectious disease*. Washington: National Academies Press.

Netherland, J., & Hansen, H. (2017). White opioids: Pharmaceutical race and the war on drugs that wasn't. *Biosocieties, 12*, 217–238.

Nixon, R. (2011). *Slow violence and the environmentalism of the poor*. Harvard University Press.

Östman, M., Fick, M., Nasstrom, E., & Linberg, R. H. (2014). A snapshot of illicit drug use in Sweden acquired through sewage water analysis. *Science of the Total Environment, 472*, 862–871.

Peacock, A., Bruno, R., Gisev, N., Degenhardt, L., Hall, W., Sedefov, R., White, J., Thomas, K. V., Farrell, M., & Griffiths, P. (2019). New psychoactive substances: challenges for drug surveillance, control, and public health responses. *Lancet, 394*, 1668–1684.

Paley, D. (2015). *Drug war capitalism*. CA: AK Press.

Paulozzi, L. J., Jones, C. M., Mack, K. A., & Rudd, R. A. (2011). Vital signs: overdoses of prescription opioid pain relievers—United States, 1999-2008. *Morbidity and Mortality Weekly Reports, 60*, 1487–1492.

Peters, D. J., Monnat, S. M., Hochstetler, A. L., & Berg, M. T. (2020). The opioid hydra: Understanding overdose morality epidemics and syndemics across the rural-urban continuum. *Rural Sociology, 85*, 589–622.

Rajan, K. S. (2017). *Pharmocracy: Value, politics and knowledge in global biomedicine*. North Carolina: Duke University Press.

Reinarman, C., & Levine, H. G. (2004). Crack in the rearview mirror: Deconstructing drug war mythology. *Social Justice, 31*, 182–199.

Reuter, P., Pardo, B., & Taylor, J. (2021). Imagining a fentanyl future: Some consequences of synthetic opioids replacing heroin. *International Journal of Drug Policy, 94*, Article 103086.

Rhodes, E., Wilson, M., Robinson, A., et al., (2019). The effectiveness of prescription drug monitoring programs at reducing opioid-related harms and consequences: A systematic review. *BMC Health Services Research, 19*, 784.

Rhodes, T., Wagner, K., Strathdee, S., Shannon, K., Davidson, P., & Bourgois, P. (2011). Structural violence and structural vulnerability within the risk environment: Theoretical and methodological perspectives for a social epidemiology of HIV risk. In J. Campo (Ed.), *Social Epidemiology and Public Health*. London: Wiley.

Rhodes, T., & Lancaster, K. (2019). Evidence-making interventions in health: A conceptual framing. *Social Science and Medicine, 238*, Article 112488.

Rhodes, T., Lancaster, K., Lees, S., & Parker, M. (2020). Modelling the pandemic: Attuning models to their contexts. *BMJ Global Health, 5*, Article e002914.

Rhodes, T., & Lancaster, K. (2021). Futures-oriented drugs policy research: Events, trends, and speculating on what might become. *International Journal of Drug Policy, 94*, Article 103332.

Rhodes, T., & Lancaster, K. (2022a). Making pandemics big: On the situational fit of Covid-19 mathematical models. *Social Science and Medicine, 301*, Article 114907.

Rhodes, T., & Lancaster, K. (2022b). Uncomfortable science: How mathematical models, and consensus, come to be in public policy. *Sociology of Health and Illness, 44*, 1461–1480.

Rivers, C., Chretien, J. P., Riley, S., Pavlin, J. A., Woodward, A., et al., (2019). Using "outbreak science" to strengthen the use of models during epidemics. *Nature Communications, 10*, 3102.

Ruhm, C. J. (2019). Drivers of the fatal drug epidemic. *Journal of Health Economics, 64*, 25–42.

Savransky, M. (2017). The wager of an unfinished present: Notes on speculative pragmatism. In A. Wilkie, M. Savransky, & M. Rosengarten (Eds.), *Speculative research* (pp. 25–38). London: Routledge.

Seltzer, N. (2020). The economic underpinnings of the drug epidemic. *Social Science and Medicine Population Health, 12*, Article 100679.

Sered, S. S. (2019). The opioid crisis and the infrastructure of social capital. *International Journal of Drug Policy, 71*, 47–55.

Sevigny, E. L., & Fuleihan, B. (2016). Measurement and design challenges in the study of drugs and society. In H. H. Brownstein (Ed.), *The handbook of drugs and society* (pp. 258–281). Malden, M.A.: Wiley Blackwell.

Southall, E., Brett Tobias, S., Tildesley, M. J., & Dyson, L. (2021). Early warning signals of infectious disease transitions: A review. *Journal of the Royal Society Interface, 18*, 20210555.

Stengers, I. (2018). *Another science is possible: A manifesto for slow science*. Cambridge: Polity Press.

Sumetsky, N., Mair, C., Wheeler-Martin, K., Cerda, M., Waller, L. A., Ponicki, W. R., & Gruenewald, P. J. (2021). Predicting the future course of opioid overdose mortality: An example from two US states. *Epidemiology, 32*, 61–69.

Suzuki, J., & El-Haddad, S. (2017). A review: Fentanyl and non-pharmaceutical fentanyls. *Drug and Alcohol Dependence, 171*, 107–116.

Szasz, T. (2001). *Pharmacracy: Medicine and politics in America*.

Thombs, R. P., Thombs, D. L., Jorgenson, A. K., & Harris Braswell, T. (2020). What is driving the drug overdose epidemic in the United States? *Journal of Health and Social Behavior, 61*, 275–289.

Tick, H., Nielsen, A., Pelletier, K., et al., (2017). *The pain task force of the academic consortium for integrative medicine and health: Evidence based nonpharmacologic strategies for comprehensive pain care* A Consortium Pain Task Force White Paper.

Tyndall, M. (2020). A safer drug supply: a pragmatic and ethical response to the overdose crisis. *Canadian Medical Association Journal, 192*, E986–E987.

Tyndall, M., & Dodd, Z. (2020). How structural violence, prohibition, and stigma have paralyzed north American responses to opioid overdose. *American Medical Association Journal of Ethics, 22*, E723–E728.

United Nations Office of Drug Control. (2020a). *The role of drug analysis laboratories in early warning systems*. Geneva: UNODC.

United Nations Office of Drugs and Crime. (2020b). *World drug report, Report 4: Evolving trends and new challenges*. Vienna: UNODC.

United Nations Office of Drugs and Crime. (2022). *Early warning advisory on new psychoactive substances* https://www.unodc.org/LSS/Page/About (Accessed April 2023).

Venkataramani, AS, Bair, EF, O'Brien, RL, & Tsai, AC. (2020). Association between automotive assembly plant closures and opioid overdose mortality in the United States. *Journal of the American Medical Association Internal Medicine, 1802*, 254–262.

Yang, W. (Ed.). (2017). *Early warning for infectious disease outbreak: Theory and practice*. Amsterdam: Elsevier.

Watson, T. M., Kolla, G., van der Meulen, E., & Dodd, Z. (2020). Critical studies of harm reduction: Overdose response in uncertain political times. *International Journal of Drug Policy, 76*, Article 102615.

Wilson, N., Kariisa, M., Seth, P., Smith, H., & Davis, N. L. (2020). Drug and opioid-involved overdose deaths—United States, 2017-2018. *Morbidity and Mortality Weekly Reports, 69*, 290–297.

World Health Organization. (2022). *Imagining the Future of Pandemics and Epidemics*. Geneva: World Health Organization.

World Health Organization. (2023). *Early Warning Alter and Response (EWAR) in emergencies: An operational guide*. Geneva: WHO.

Zigon, J. (2018). *A war on people: Drug user politics and a new ethics of community*. Oakland, CA: University of California Press.

Zolopa, C., Hoj, S., Bruneau, J., Meeson, J-S., Minoyan, N., Raynault, M-F., Makarenko, L., & Larney, S. (2021). A rapid review of the impacts of Big Events on risks, harms, and service delivery among people who use drugs: Implications for responding to COVID-19. *International Journal of Drug Policy, 88*, Article 103127.

Zoorob, M. (2019). Fentanyl shock: The changing geography of overdose in the United States. *International Journal of Drug Policy, 70*, 40–46.