Antibiotics online: digital pharmacy marketplaces and pastiche medicine

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ABSTRACT

The internet enables access to information and the purchasing of medical products of various quality and legality. Research and regulatory attention have focused on the trafficking of illicit substances, potential physical harms of pharmaceuticals, and possibilities like financial fraud. However, there is far less attention paid to antibiotics and other antimicrobials used to treat infections. With online pharmacies affording greater access, caution around antibiotic use is needed due to the increasing health risks of antimicrobial resistance (AMR). The COVID-19 pandemic has helped to normalise digital healthcare and contactless prescribing, amplifying the need for caution. Little is known of how antibiotics are consumed via digital pharmacy and implications for AMR prevention. To expand insight for AMR prevention policy in Australia and internationally, we use digital ethnographic methods to explore how digital pharmacies function in the context of health advice and policy related to AMR, commonly described as antimicrobial stewardship. We find that digital pharmacy marketplaces constitute 'pastiche medicine'. They curate access to pharmaceutical and information products that emulate biomedical authority combined with emphasis on the 'self-assembly' of healthcare. Pastiche medicine empowers the consumer but borrows biomedical expertise about antibiotics, untethering these goods from critical medicine information, and from AMR prevention strategies. We reflect on the implications of pastiche medicine for AMR policy, what the antibiotics case contributes to wider critical scholarship on digital pharmacy, and how medical humanities research might consider researching online consumption in future.

INTRODUCTION

Antimicrobial resistance (AMR) is a significant threat to global health. In 2019, the number of deaths associated with AMR were greater than HIV (Murray *et al*. 2022, 639). AMR is partially a consequence of the extensive use of antimicrobials in human and animal health, leading to efforts to reduce antimicrobial consumption to prevent and mitigate the development of resistance. The AMR prevention agenda employs a 'One Health' lens: a whole-of-system, intersectoral approach that is the guiding principle for health agencies including the WHO (Ticktin 2014, Australian Government Department of Health and Aged Care 2019, 2, 13; Kahn 2016; Lu, Sheldenkar, and Lwin 2020, 2). Complicating these mitigation efforts is the growth of online pharmacy services (Mackey and Nayyar 2016), and their marketing of antimicrobials (Boyd *et al*. 2017). This commercial activity has far-reaching implications for AMR policy: potential increased access to antimicrobials (both on and off prescription), transformation of the authority of prescribers and dispensers, and compromised surveillance of consumption and therefore AMR prevention.

Online acquisition of antimicrobials is a somewhat neglected dimension of social research on digital pharmacy. Literature has explored the consumer affordances of online pharmacy (Mackey and Nayyar 2016), the body/self as expressed through drug consumption (Martin 2006; Wolputte 2004), and the acquisition of HIV treatments (Davis and Flowers 2014) and sildenafil (Fox and Ward 2006; Potts 2004). Antimicrobial substances have not yet received the same attention. It is important to develop humanities and social science approaches to antimicrobial e-pharmacy to help inform policy and practice for AMR prevention (Frid-Nielsen, Rubin, and Baekkeskov 2019). Addressing this gap can also inform and nuance the social perspectives of e-pharmacy in general, extending insight to embrace a greater range of pharmaceuticals with different properties and implications for healthcare. Moreover, the COVID-19 pandemic has helped to centre digital technologies in healthcare, including the rise of online medical consultations and prescribing that include the treatment of infections with antimicrobials. Given the steady normalisation of this high-choice and high-availability pharmaceutical marketplace, it is vital to extend understandings of the social life of medicines (Whyte, van der Geest, and Hardon 2002) to digital pharmaceuticals.

This article uses online ethnographic methods (Hine 2015) to investigate how antimicrobial use is made possible in online pharmacies, with the aim of generating new insights for the prevention of AMR and future research. In what follows, we provide further detail regarding the AMR crisis, the implications of e-pharmacy for AMR prevention, and attempts to regulate e-pharmacy with reference to the Australian context. We then explain how we have engaged with antimicrobial e-pharmacy to generate insights for policy and research. As we will argue, online pharmacy for antimicrobials can be framed as 'pastiche medicine': by assembling a version of biomedical authority from plagiarised health information, and by valorising forms of consumer agency that include self-prescribing practices (of antibiotics and other pharmaceuticals). Pastiche medicine suggests itself as limitless and health giving; themes that work against the need

to reduce the use of antimicrobials to help prevent AMR. We conclude with implications for policy and regulation in the field of antimicrobial consumption and suggest directions for humanities and social science research on AMR prevention and e-pharmacy in general.

Situating antimicrobials in online pharmacy: a creeping crisis?

E-pharmacy is a ramifying healthcare practice that disrupts accepted modes of prescribing authority and expertise. Consumers can purchase medications—including antibiotics—from online pharmacies within or beyond their countries of residence. Many such pharmacies are legitimate online businesses or are an arm of brick-and-mortar chain stores. However, there is a large international 'grey' market facilitated by unregulated pharmacies (Mackey and Nayyar 2016). This market is 'grey' because traded goods may not adhere to local laws pertaining to the manufacturing, possession or distribution of pharmaceuticals, in either (or both) their countries of origin and destination (Huang 2022, 14). While we reject the morality implied in 'rogue', this term is regularly used in the literature to describe unregulated pharmacies that are evasive, deceptive and difficult to quantify. In their most unregulated form, online pharmacies allow consumers direct access to medications without gatekeepers (ie, doctors, pharmacists), and without documentation (ie, prescriptions, consumer medicine information). A 2015 database estimated 2000–3500 merchants operated ~35 000 sites (LegitScript 2016, 5). Concerns about these pharmacies include legal, medical, safety and security issues (Bernath 2003; Crawford 2003). Online pharmacies are also a manifestation of globalised pharmaceutical markets and market*ing* (Whyte, van der Geest, and Hardon 2002, 79–90; Delbaere 2013; Petryna and Kleinman 2006), where individual push factors, commercial imperatives and the pharmaceuticalisation of healthcare intersect (Dew 2019). Consumer demand may reflect the need for reliable and affordable healthcare in the context of growing austerity: when genuine healthcare is lacking, consumers demonstrate considerable self-sufficiency by sourcing healthcare on their own (Brijnath 2012, 296), and providers of alternatives find non-biomedical means to demonstrate the effectiveness of the medicines at their disposal (van der Geest and Whyte 1989; Langford 1999).

There is evidence that antimicrobials are available in direct-to-consumer (DTC) online channels, outside of regulatory frameworks. Interpol's 'Operation Pangea'—data collected from a dozen European nations—revealed that antibiotics procured from unregulated pharmacies were genuine, but lacked appropriate instructions and production markers (Venhuis *et al*. 2016). The same appears true of antibiotics imported into the USA (Mainous *et a*l. 2009; Veronin 2011). Antibiotics are also readily available in the UK, where researchers found 20 online pharmacies—15% of which were unregulated—selling multiple types (Boyd *et al*. 2017). In Australia, research has also pointed to regulatory gaps (Bernath 2003; Hope and King 2020) and noted that the extent to which antibiotics are available online is difficult to quantify.

Ethnographic research has explored unregulated consumption promoted by groups who circulate alternative and misinformed advice. Stockpiling antibiotics in US-based 'prepper' or 'survivalist' communities is one such subversive pathway (Howes-Mischel 2017) which, at its most extreme, is motivated by a belief in an impending societal collapse. Internet forums recommend 'fish mox' (amoxicillin intended for use in home aquariums), which can be purchased cheaply, in bulk, and without prescription (Howes-Mischel 2017). Another example is social media discussions where antibiotic treatments for acne are promoted by non-medical sources (Reddy *et al*. 2021).

Despite this research, it remains difficult to assess consumer behaviour and antimicrobial consumption in global unregulated markets. Kamiński, Łoniewski, and Marlicz (2019) used proxy data, comparing relationships between Google Trends (search queries related to antibiotics), national health expenditure data and rates of antibiotic consumption across the globe (including Australia). But there are no strong relationships between any of these: for example, nations with less public health expenditure do not have greater search volumes, and nations with higher antibiotic prescription rates do not have fewer searches. Moreover, regulated and unregulated e-pharmacy may be mutually reinforcing. Importantly for AMR prevention, Kamiński *et al* found that the term '*antimicrobial resistance*… was rarely used or linked with *antibiotics* and *probiotics*' (Kamiński, Łoniewski, and Marlicz 2019, 6—emphasis added), indicating that 'the topic antimicrobial resistance may be underrepresented in internet discourse' (Kamiński, Łoniewski, and Marlicz 2019, 7). This is especially concerning, given that broad-spectrum antibiotics, such as amoxicillin, contribute greatly to the AMR crisis (Boyd *et al*. 2017; Howes-Mischel 2017; Reddy *et al*. 2021; Venhuis *et al*. 2016).

The ability to purchase broad-spectrum antibiotics from unregulated sources indicates an important gap in the surveillance data used to set priorities for AMR prevention. Misuse and overuse of antibiotics can lead to AMR and may hasten the use of second-line and third-line antimicrobial treatments in clinical settings. The online environment—through volume, variety and questionable information—has the potential to further AMR.

Antimicrobial stewardship in Australia

Australia's health governing bodies, like many other nations, formally designate antimicrobials as controlled substances and have adopted antimicrobial stewardship (AMS) strategies to reduce overall consumption. However, stewardship mainly focusses on human and animal healthcare systems: encouraging doctors, nurses, pharmacists, veterinarians and other healthcare professionals to prescribe and administer antibiotics appropriately. Consumers are generally conceptualised as recipients of care or primary carers of children, dependent others and companion animals. The agential, self-treating consumer implied by e-pharmacy is somewhat overlooked. For example, *Australia's National Antimicrobial Resistance Strategy – 2020 and beyond* (see Australian Government Department of Health and Aged Care 2019) does not engage with consumer demand for e-pharmacy services. The strategy, like professional pharmacy publications (Lim *et al*. 2021), frames pharmacies and pharmacists as the front line of stewardship, with little regard for health consumer agency in pharmacy encounters.

Surveillance of antimicrobial use in Australia does not capture e-pharmacy particularly well. The Antimicrobial Use and Resistance in Australia report determined that surveillance captures 90% of antimicrobial prescriptions in Australia (Australian Commission on Quality and Safety in Health Care 2021, 63). The remaining 10% of antimicrobial prescriptions are attributed to other ways of accessing antimicrobials in community health settings, including through private prescriptions, some of which may be sourced online. This private prescription data are not collected because they do not attract a government subsidy under the Pharmaceutical Benefits Scheme (PBS) or the Repatriation Pharmaceutical Benefits Scheme (RPBS)—taxpayer funded

co-payment schemes designed to cap the cost of common pharmaceutical products (Australian Government Department of Health and Aged Care 2021). Once a consumer has decided to circumvent sanctioned pathways, there are fewer limitations on use (Bernath 2003).

The digital health environment is also diverse with implications for how consumers address themselves to healthcare. Smartphone applications for medical consultations and prescription-filling, apps to log and order medications from online retailers, and pathways to private prescriptions are all options available to digital health consumers that exist at the boundaries of regulation and pharmacovigilance. Consumers are now required to be 'digitally engaged' (Lupton 2018; Petersen 2019); *au fait* with websites, apps, telehealth consultations, digital health records, e-prescriptions, internet banking and postal tracking. This idealised self-sufficient, proactive and digitally engaged patient—who eases pressure on public healthcare systems (Ayo 2012) during crises—is also subject to potential harms of self-diagnosis and misinformation. Digital health services are an important aspect of contemporary healthcare, but how they facilitate pharmacy transactions represents a significant gap in current knowledge for AMS and e-pharmacy in general.

In Australia, consumer watchdogs (see Australian Competition and Consumer Commission 2018), health departments (Therapeutic Goods Administration 2016) and cybersafety agencies (see Khalife 2020) all warn of the dangers of online-sourced medicines. But regarding AMR, advice is fractured and non-specific. Global digital public awareness events like #KeepAntibioticsWorking (see Mackenzie, Ong, and Ashiru-Oredope 2020)) do not integrate with wider consumer resources promoting digital health literacy. An exception here is the National Prescription Service (NPS) MedicineWise initiative, which provides practical lay-language tips about buying from online pharmacies (NPS MedicineWise 2018), while also explaining how health consumers can combat AMR (NPS MedicineWise 2019). However, these explainers are only as successful as they are visible: in crowded internet-search results, health resources compete with the very retailers they warn about.

Undercutting AMR prevention, recent changes to the *Customs' Prohibited Imports Act* in late 2019 have removed some import controls on antibiotic substances (Office of Drug Control 2019). Public government reporting on online pharmacy and drug importation focuses on opioids, painkillers and human-growth hormones (see Australian Crime Intelligence Commission 2019, 83–117), prioritising drug safety at the level of the individual, rather than considering AMR as an issue of drug safety at a societal level. Moreover, they show disinterest in the social and cultural contexts of diagnoses and medicinal treatments (Langford 1999; Petryna and Kleinman 2006; Whyte, van der Geest, and Hardon 2002; Dew 2019), factors that may drive health consumers to seek antimicrobials online (Brijnath 2012).

Pandemic pressures

The COVID-19 pandemic has overshadowed longer-term threats like AMR, despite relationships between these: AMR has been exacerbated, through increased use of broad-spectrum antibiotics in primary care (Miranda *et al*. 2020; Zhu *et al*. 2021) and subsequent circulation of antimicrobials in human society and the natural environment (Comber *et al*. 2020; Knight *et al*. 2021). The pandemic has also complicated e-pharmacy prescribing practices, including those related to antimicrobials. In Australia, a $A2.4 billion response package expanded e-prescription services, added telehealth consultations to Medicare (Australian Government Department of Health and Aged Care 2020a; Dalzell and Macmillan 2020) and established a temporary 'Home Medicines Service' to expedite drug delivery (Australian Government Department of Health and Aged Care 2020b). Taking advantage of this newly subsidised digital market, private enterprises also expanded telehealth services to further integrate general practice and pharmacy into their software platforms. For example, e-prescribing smartphone apps such as 'InstantScripts' added general practitioner (GP) consultation features and saw significant growth during the pandemic (Maskiell 2021). The audience for e-prescriptions and online pharmacy has grown rapidly; accelerating and diversifying pharmacy pathways and drastically altering the flow of medications into society.

According to the Australian Medical Association, private 'pop-up' services are 'fragmenting patient care' (Australian Medical Association 2020) by focusing on fast digital prescribing rather than quality consultation (Nespolon qtd. in Liotta 2020). Further, concerns have been raised about the tendency of e-prescription services to default to manufacturer (as opposed to regulatory and clinical) recommendations regarding dosage and duration of treatments (Australian Commission on Safety and Quality in Health Care 2019, 90). Through these pandemic-induced challenges and commentary AMR is further neglected, compounding the extant stagnation of communication about the issue in both legacy and new media (Davis *et al*. 2020a; Djerf-Pierre and Lindgren 2021).

Reflecting on this landscape—in which institutional concern for the COVID-19 pandemic not only overshadowed AMR, but exacerbated resistance and deflected policy concern—our project aimed to explore consumer access to antibiotics through digital pharmacies and related advice about AMR. We sought to document the operation of the websites, how they address the consumer, and how they provide advice about the health risks associated with antibiotics. As we will see, digital pharmacies selling antibiotics are plentiful and diverse, with paradoxical effects in the communication of advice about the risks entailed in the use of antibiotics.

METHODS

We explored the online marketing of antimicrobials using online ethnographic methods (Hine 2015). Extending on previous pharmacy research (Boyd *et al*. 2017; Mainous *et al*. 2009), we navigated digital terrains from a consumer perspective: considering how antibiotics can be encountered online using search engines and online pharmacy sites. Our approach explored the multiplicity of consumer pathways, where orthodox healthcare services appear alongside unregulated channels. This approach engaged with the volatile fabric of digital media, documenting and describing antibiotics at their point of sale as well as information about antimicrobials within wider internet ephemera. We specifically focused on the visual, textual and paratextual elements of websites that may drive health consumer action and provide advice about the benefits and harms of antimicrobials. This method captures the wider cultural, political, economic and geographical conditions of globalised pharmacy trade (Whyte, van der Geest, and Hardon 2002), articulated by Petryna and Kleinman as the 'pharmaceutical nexus' (2006, 20–22). Such an approach recognises the indivisibility of healthcare and social meaning-making. Moreover, our method furthers the inclusion of visuality in medical humanities (Crawford *et al*. 2015), and more specifically, the growing body of literature that seeks to understand antimicrobials through textual and visual media culture (Hutchison 2022; Irwin 2022).

The research began with a comparative internet (Google) search that collected the top 100 results for a 'buy antibiotics' search query. Collected sources include news media, documents from regulatory bodies, medical advertising, pet stores, veterinary sites, food products, telehealth providers and online pharmacies (legitimate and unregulated; domestic and international). To assess search engine bias multiple authors conducted separate searches with different computers and using 'clean' research browsers (Rogers 2019, 33–34). Consistent with online ethnographic approaches to digital media objects (Hine 2015, 172), we gathered screenshots, written copy and 'captures' (using QSR International's NVivo software and 'NCapture' feature) to document both our research processes, and the ephemeral online materials. Our analysis of these materials considered how the digital ecology of searching for these medicines related to AMR and online pharmacy regulation. The first author (BL) and senior author (MD) thematically coded visual and textual (English language) features of pharmacy sites using NVivo, and shared insights with the wider author team to discuss, challenge and refine interpretations.

The materials we collected were then explored using additional tools to take us beyond content analysis and enrich understanding of the operation of the unregulated pharmacy sites. We drew on 'platform biography' methodology (Burgess and Baym 2020, 16–26) in exploring the evolution of site interfaces, wider digital ecosystems and infrastructures, and communicative content (and intent) over time. To do this, we inductively employed additional tools to explore the sites, as new questions arose, including:

- Making WHOIS (a database containing the registration details of web domains) queries to determine geographical locations of pharmacy sites, or to note if domain registrars are concealing this information.
- Using advanced Google Search features to translate text and reverse-search images to identify shared elements between pharmacies.
- Using web browser developer tools to find commonalities between site structures (ie, such as the use of e-commerce templates).
- Using the Internet Archive's *Wayback Machine* (see Rogers 2019, 89–91) to explore archived site versions and observe changes over time.
- Exploring the sitemaps of pharmacies to better understand instances of 'cybersquatting'.
- Comparing internet search alternatives (ie, DuckDuckGo) to gauge the impact of algorithmic personalisation, quality control and censorship on mainstream search providers.

As we discuss below, online pharmacies give rise to what we term pastiche medicine. Significantly, our digital ethnographic method was itself a response to the messiness of digital materials (Law 2004) reflecting how pastiche is both 'form (and) compositional technique' (Bowen 2012, 1005). Our approach here shares similarities to Seear (2014) use of 'pastiche'—derived from science and technology studies—which describes a method that brings together disparate elements and multiple experiential truths to not only analyse but *create* the subject of academic study (Seear 2014, 19–22). In considering online pharmacy and antibiotic consumption as it applies to internet users, health consumers, and wider publics, we reflect on current pharmacy design, outline policy and governance implications, suggest, and (as indicated above), *create* avenues for future research.

Our research is driven by concern for the impact of AMR, and as such we see an important connection between medical humanities approaches and the contemporary 'One Health' paradigm that informs science, drug policy, and healthcare provision (Kirchhelle *et al*. 2020; Lu, Sheldenkar, and Lwin 2020; Ticktin 2014). In medicine, 'One Health' approaches often address the practicalities of dispensing antimicrobials to humans in a range of settings, in conjunction with an awareness of the presence of antimicrobials in the wider environment (including veterinary, livestock and waste). Social science researchers use the term to additionally consider the sociopolitical and economic vectors of scientific and medical applications (Kahn 2016), and the multiscalar infrastructural issues at play (Chandler 2019). Alongside our interest in broader AMR implications and prevention, we are cognisant of the many cultures, communities and scales of economy at which pharmacy occurs, and that these are often impacted by patterns of inequality (Fox and Ward 2006; Petryna and Kleinman 2006; Whyte, van der Geest, and Hardon 2002). Humanities approaches such as our ethnography are useful because they work to further understand the multiple, social meanings of pharmaceuticals that complicate 'One Health', and do so through a novel conceptualisation of visual, textual and other discursive elements that shape medicine markets and avenues for consumption.

Accordingly, we follow the approach of other research that recognises the legal and ethical grey areas of drug acquisition (Boyd *et al*. 2017; Mainous *et al*. 2009; Pienaar *et al*. 2020; Huang 2022) and de-identify our data sources. As agencies such as the US Food and Drug Administration frequently issue takedown notices (see: Center for Drug Evaluation and Research 2022), we do not name specific unregulated pharmacy sites, web hosting providers or e-commerce services. Relatedly, we have chosen not to include images in this paper, as these proved to be readily reverse-searchable, and instead we employ an ethnographic gaze to describe visual elements, alongside select quoted text from websites.

Findings: online antibiotics as pastiche medicine

A key finding from our online ethnography was the plenipotential and self-assembled nature of the consumer experience. Across regulated and unregulated forms of pharmacy, consumers are presented with interfaces that express radical choice: online pharmacies resemble shopping sites. They typically feature a thin horizontal bar at the top of the page, allowing for navigation across primary sections: home, a product directory, specials, frequently asked questions (FAQs), shipping, search, and so on. The left side of pages are usually populated with vertical lists of categories, which detailing the range of available medicines in a mix of lay consumer and biomedical language. The remaining majority of the site is dedicated to a shop-like interface: a grid of images of the products, with key information like price, and typical consumer affordances like 'buy' or 'add to cart'. Site banners and footers are occupied by logos, medical iconography, images of pharmacists, and promotions related to package deals, special offers and shipping discounts. Consumers are free to browse or search these sites for categories, brands or specific medicines of interest. While doing so, consumers are ceaselessly reminded of site validity and trustworthiness: quick delivery, competitive prices, ample security features and quality products.

Across a spectrum of regulation, e-pharmacy addresses various personal circumstances, beliefs and literacies. Some sites offer orthodox digital health, precisely outlining the relationship between consumer, doctor, pharmacist, public health systems like the PBS and RPBS, and app intermediaries for consultation and prescription handling. Other sites are oriented towards ad hoc pathways, designed for vulnerable (uninsured or

marginalised) consumers to access the cheapest possible private prescriptions for generic medicines. A number of sites explicitly target fringe groups and derive their value from a lack of information gatekeeping and regulatory oversight: one unregulated pharmacy (still live at the time of writing) included a lengthy screed that began 'if you do not have a doctor's prescription […] do not despair', discussed viruses and bacteria, outlined payment options including cryptocurrency, and ended with 'we are not responsible […] for consequences of self-treatment'.

We use the term 'pastiche' to describe how online pharmacy presents an assemblage of disparate yet familiar responses to health information-seeking and consumption practices. We wish to primarily focus on the core meaning of pastiche, that is, 'a lack of originality or coherence, an imitative jumble (that) uses recognisable elements but offers no new substance' (Bowen 2012, 1005). However, we also see value in the concept for the way it connects to postmodernist critiques, insofar as pastiche is seen as a widespread characteristic—if not symptomatic—of late capitalism (Jameson 1991, 17–21). Akin to the mimesis Langford (1999) observed in healthcare, and the influence of metaphors and metonyms in illness experience (van der Geest and Whyte 1989) and pharmaceutical consumption (Delbaere 2013), we view online pharmacies as spaces where health information provision is bound up in the power relations and inequities of capitalism (Huang 2022). In pastiche, there are elements of mimicry and the taking of creative license with science, similar to practitioner performances of 'quackery' (Langford 1999). Through these visual elements, online pharmacies engage performatively with ideas of trust and efficacy; they aim to create authenticity by appearing to be clinical, informational and professional, including in ways that are difficult to discern between regulated and unregulated pharmacies. In drawing out the implications of this characterisation, we also engage with Brijnath (2012) portrait of 'pharmaceutical citizenship', and the ironies (vulnerability, plurality, the state) of this paradigm. We elaborate our findings through three key aspects of the Australian online pharmacy context: *internet regulation, pharmacy design* and *information provision*.

Internet regulation

As noted, a concern for researchers has been the easy discoverability of unregulated pharmacy. Internet search providers are routinely criticised in the UK, USA and Europe (Boyd *et al*. 2017; LegitScript 2016; Liang and MacKey 2009; Mainous *et al*. 2009; Orizio *et al*. 2010) for enabling unregulated pharmacies to promote themselves using typical publishing tactics. Web pages can be crafted for search indexing (often called search engine optimisation or SEO) and written to match as many user queries as possible. Unfortunately, the evidence base for these practices is ever-shifting, with constant updates to search algorithms, and in-kind responses from pharmacy operators. Google (along with other technology companies) have publicly expressed support for *The Centre for Safe Internet Pharmacies*. Microsoft (see Bing 2021)—whose Bing search engine also powers Yahoo!—and Google (see Google 2021; Underwood 2015) publicly state the quality controls they employ on health-related searches.

Despite these measures, our Google searches delivered many specific results where—among a patchwork of other consumer goods—news media, and advertisements, antibiotics could be purchased. These include the unregulated websites that dominate extant literature, as well as animal products and direct links to antibiotics on regulated domestic chain pharmacies. In many cases, products from chain stores appeared at the top of search listings as paid advertisements. We note, however, that in comparison to less algorithmic search providers (DuckDuckGo), Google results had fewer unregulated pharmacies, and included news results about antibiotics in human and animal contexts.

Pharmacy sites surfaced in our search used a range of consumer-facing, quasi-regulatory strategies, as documented elsewhere (Mavlanova and Benbunan-Fich 2010). These strategies included visual indicators (seals, badges and icons) to assert legitimate pharmacy operations in a given jurisdiction. Some stalwarts here include the US-based 'Verified Internet Pharmacy Practice Sites' (VIPPS) (Liang and Mackey 2012)—now known as the National Association of Boards of Pharmacy (NAPB) accreditation—and the international 'Health on the Net' (HON), which acts as both a code of practice and a visual seal of accreditation (Qin *et al*. 2021). These two examples harken from the late 1990s, and while recognisable, their iconography appears dated and illegible by modern standards. A more consistent contemporary application of this type of visual indicator is the UK's 'Distance Selling Logo', governed by the Medicines and Healthcare products Regulatory Agency. This logo appeared with regularity on UK and European Union (EU) pharmacies cleared to dispense within/into the UK via post.

In the Australian context, the websites of regulated domestic pharmacy chains often used plain-text footnotes to convey official licensing information, and some used logos and seals to indicate Quality Care Pharmacy Program (QCPP) certification (analogous to the use of VIPPS/NAPB/HON earlier). As in other jurisdictions, Australian accreditation occurs through self-regulating bodies that, when explored, quickly devolve into dense explanations likely to alienate consumers. Importantly, this accreditation seems at odds with the robust systems that govern practitioner and prescribing practices, such as those employed by the Australian Health Practitioner Regulation Agency (AHPRA). Unlike AHPRA, QCPP information is inward-looking: oriented towards the minutiae of accreditation rather than medical information and consumer safety.

Without widespread or universal iconography, verifications present an informational barrier for consumers. If unfamiliar with a particular certification system, consumers need to click-through multiple webpages to understand the source of accreditation. Consumers evidently ignore verification iconography—given the global unregulated exchange of human and animal antibiotics (Boyd *et al*. 2017; Howes-Mischel 2017)—and research that indicates more time is spent reading descriptive text when browsing pharmacies (Qin *et al*. 2021). Other visual 'trust features' (Mavlanova and Benbunan-Fich 2010) that are not pharmacy-specific are common to both regulated and unregulated vendors. Notably, the use of payment providers' logos and internet security verifications are almost identical. This includes payment logos (VISA, American Express) and security imagery (locks, keys, shields), which are displayed to achieve similar affective qualities, including familiarity, certification, legitimacy and security. Online pharmacies (both regulated and unregulated) arguably deploy forms of iconography or branding to perform trustworthiness to a generic consumer, asking them to assess whether the website is valid or authentic.

Pharmacy design

Befitting the 'late capitalist' pastiche, online pharmacies (regulated or otherwise) transform pharmaceutical healthcare, enabling prescription medications to be co-located with health products that do not require prescription. We find they allow consumers to essentially 'window shop' prescription

medications otherwise secured 'behind-the-counter'. In many jurisdictions (including Australia), there are restrictions on DTC advertising for prescription medication, yet online marketplaces allow products to be browsed and searched (Hope, Mayne, and King 2015), while also displaying cost estimates for both private prescriptions and government subsidies. This inverts standard treatment pathways, whereby consumers encounter medical advice *prior* to seeking a specific medication or knowing its cost. Even website structures and layout—collective categories like 'antibiotics'—subvert AMR prevention: broad categorisations undercut strategies which seek less and more accurate use of antibiotics. Again, it is particularly concerning for AMR, that we saw broad-spectrum antibiotics (like amoxicillin) prevalent in our online ethnography (as elsewhere: Boyd *et al*. 2017; Howes-Mischel 2017; Reddy *et al*. 2021; Venhuis *et al*. 2016).

We also found that the antibiotics market follows other drugs, particularly those already examined in previous online pharmacy research. In addition to antibiotics, we found 'antivirals' and 'HIV', 'weight loss' (presented as top-level categories on unregulated pharmacy sites), and various bulk purchasing options for tadalafil (Cialis) and sildenafil (Viagra) listed as erectile dysfunction 'ED packs'. These observations complement do-it-yourself approaches to HIV treatment (Davis and Flowers 2014), as well as continue to support the foundational findings of e-pharmacy research on sildenafil (Armstrong, Schwartz, and Asch 1999; Eysenbach 1999): including the way sildenafil permits normative understandings of health and bodily function to be maintained through diverse practices of consumption (Potts 2004). The browsability of antibiotics in a context of radical consumer choice, sees them follow other medicines in becoming 'commodities' (van der Geest and Whyte 1989, 350). Online, the widespread availability and low cost of antimicrobials paves pathways to alternative means of procurement, self-medication and polypharmacy (see Brijnath 2012).

Freed from brick-and-mortar pharmacy structures, online consumer pathways exist within personal, local and global contexts. Just as we did in our search process, consumers can navigate search engines, pharmacy sites and sources of user-shared information within the 'the digital patient experience economy' (Lupton 2014): a space supposedly comprised of, and designed for, 'digitally engaged patients' (Lupton 2018; Petersen 2019). Well-versed in 'savvy' consumption, these users are able to understand medical information, and balance their health and financial needs . Websites we explored used this kind of language, championing their own 'reliable information' and 'cheap but effective' goods, and calling on consumers to 'stop wasting time' and to 'forget about the old way'.

However, not all consumers match this empowered archetype (Brijnath 2012, 297; 304), and they likely bring health inequalities to bear on their consumption practices (Fox and Ward 2006). Increasingly, too, patient/consumer agency is augmented and shaped by the personalised, algorithmic, and non-linear online environment. Internet sites compete for user attention, drawing on extensive data histories generated by searching, shopping and consuming media. The algorithms used to personalise search results remain opaque, and consumer controls for filtering results are limited. This was readily apparent during our research process, and is ultimately what necessitated a comparison between two researchers' search results. Search companies are willing to apply some quality controls to health-related content (Google 2021; Underwood 2015), but not—it appears—at the expense of personalised and advertising-driven search results.

In this competitive search-driven environment, pharmacies are also highly commercialised. Regulated and unregulated sites adhere to visual tropes of e-commerce such as large banners to promote discounts and special offers. The only distinction is that regulated pharmacies can sell these banners as advertising space. Regulated sites feature recognisable products, while unregulated sites offer a pastiche of this: imitating the basic elements of branded promotion without the branding. Evidence suggests that this kind of presentation downplays the seriousness of medicine scheduling and prescribing: matters of availability, storage, and advice regarding dosage and side effects are given less attention than the consumer conveniences associated with online shopping (Orizio *et al*. 2011). In emphasising a commercial approach to medicine, both unregulated and regulated online pharmacies distance consumers from gatekeepers and healthcare conversations, reducing the figure of the pharmacist, for example, to stock images of white-coated, clipboard-holding individuals (see GlobalData Healthcare 2018 for an example of this imagery). Consumers, however, may view these marketing tropes as a sign of legitimacy and regard familiar products as safe and efficacious. In both typical and pastiche forms, these familiar commercial pharmacy motifs are harnessed to promote the quality, safety and value of medicines on offer.

While issues of drug provenance and safety are more immediate in unregulated spaces, chain pharmacies generate their own unique forms of confusion. Online arms of chain pharmacy operations offer large stock lists of medicinal and non-medicinal goods (including vitamins, skincare and perfumes). The breadth of product categories visible to consumers in such spaces only amplifies messiness: our pharmacy search results included tangential products surfaced by their linguistic similarity to 'antibiotics', such as probiotics and antibacterial soap. Moreover, consumer pathways with large chains are not always kept in-house. Many large pharmacies also use third-party sites, such eBay, to advertise and process their online sales (Hope, Mayne, and King 2015). These results suggest there are gaps in the oversight of pharmacy communications, undermining Australia's tight controls on DTC marketing, and eroding the distinctions between global unregulated marketplaces and the controlled domestic health systems. This is significant when, as recently as 2019, Australian pharmacy sites were found to be illegally advertising goods that had been cancelled from the Australian Register of Therapeutic Goods (the register that governs what products can be legally supplied to Australian consumers) (Therapeutic Goods Administration 2021). The presentation of antibiotics in context of general slippage in regulation further undercuts AMR prevention.

Information provision

Regulated online pharmacies usually provide little-to-no information about medication purposes, doses and side effects. This absence might be due to an assumption that such information is the domain of manufacturers, regulatory and administrative bodies, and GP or pharmacy prescribers. In contrast, and despite often not employing qualified pharmacists, unregulated pharmacies provide extensive information. Every medication promoted has extensive and uncited explanatory detail, with further general information at the category levels within sites (ie, 'antibiotics'). One site we found presented over 500 words of descriptive text about amoxicillin, including uses, directions, contraindications, effects and side effects, and drug interactions. This information was not attributed to a manufacturer, government regulator, qualified dispenser or healthcare provider.

Across unregulated pharmacies, information varies greatly in style and intent. Some texts are coherent, while some are jumbled (both semantically and semiotically). Texts sometimes feature tangents about the history of medicine or random clinical research findings. The authorial voice also varies between sites and site areas. In some cases, the shopfront conveys information (for example in FAQs), while in others, the voices of the (alleged) consumers speak through reviews and testimonials. It is unclear whether these texts are written, translated or assembled algorithmically from health-adjacent sources—or some combination of these possibilities. Moreover, the purpose is unclear. Pharmacies may seek to convince consumers using (seemingly random but real) evidence from scientific orthodoxy (see van der Geest and Whyte 1989; Langford 1999); conjure (or at least permit) alternate imaginaries of the self as consequence of medicine consumption (see Martin 2006); extend the metaphors (ranging from fantastical 'monsters' and 'magic' to the more banal 'illness journey') already present in manufacturer advertising (Delbaere 2013); and/or maximise search visibility through an excess of health-related language (the 'SEO' referred to earlier). Despite suggestions that the number of individual 'rogue' merchants is decreasing in favour of cartels (LegitScript 2016; Mackey and Nayyar 2016), our initial attempts to search and reverse-search for text and images (ie, of boxes and medicine blister packaging; distinctive text phrasing) did not reveal commonalities nor any systematic approach to the creation of this content.

Unregulated pharmacies are open to all-comers regardless of their e-health literacy. The information they share is especially dangerous when targeted towards specific populations, on vectors of rationality and emotion. We found several pharmacy stores engaged in practices of 'cybersquatting': either purchasing lapsed web domains (the whole website), or by exploiting security vulnerabilities to insert an unregulated pharmacy within an existing site (hiding an additional webpage within the broader website). Crucially, these cases appeared at websites that already hosted targeted health content. Examples included a hospital, chiropractor and a site about medication subsidies for social welfare recipients. From the perspective of search indexing, these sites are already associated with health-related language. Cybersquatters therefore leverage existing site SEO and search rankings to reach and exploit specific groups. Unregulated pharmacies, then, are not merely free-market opportunists or 'spam' tacticians (Brijnath 2012, 294) but may be conscious of how researchers or regulators might attempt to interrogate their operations. One site prevented us from right-clicking (an action that might allow copying of text or exploration of a site's code) by issuing a pop-up warning 'fuck off!!!'.

Unsurprisingly, the extant literature expresses concern and worry about 'rogue' pharmacy operations. However, we see unregulated pharmacy as a more polarised phenomenon: invaluable for *some* stigmatised communities (Davis and Flowers 2014), yet harmful to other marginalised consumers. We see AMR as a particular problem for the latter, given the evidence of misleading claims regarding the efficacy of antibiotics for some conditions (Reddy *et al*. 2021), antibiotic stockpiling as an expression of system failure (Howes-Mischel 2017), and the threat of resistance itself: localised antibiotic misuse by individuals or groups has ramifications at a societal level. Again however, ethnographic, cultural and networked approaches are a significant gap in current AMR prevention (Tompson, Manderson, and Chandler 2021 4-5; Hansson and Brenthel 2022).

In addition, we found, as others have (see Brijnath 2012; Brown 2018; Brown and Nettleton 2018), that AMR is implicated in the politics of nation states, borders and migration. In the same way the DTC drug marketing crosses borders (Delbaere 2013), unregulated sites openly play with the globalisation of pharmacy. Despite protections that are imposed on domains—for example, Australia's '.com.au' is closely administered by the .au Domain Administration Foundation—sites can simply include nations in their domain names: a web address can contain the word 'Australia' even when using an international domain with less stringent governance. Australia's official tourism website 'australia.com' provides an example of this practice. In a key difference to earlier research (LegitScript 2016), we experienced first-hand the waning utility of the WHOIS database under the Europe's General Data Protection Regulation (GDPR) (see Lu *et al*. 2021). The GDPR is EU legislation, designed to enhance user privacy. But pharmacy sites are also 'users' of web domains, and use these affordances to obscure their identity. In our research, we found the true location of pharmacy stores (or at least their registration location) was not hidden, and likely blocked at the request of vendors. For a health consumer, this lack of transparency further obfuscates how medicines might be sourced and dispensed, shapes interactions with pharmacists (if any), and may alter local importation and biosecurity requirements.

The visual signifiers discussed earlier are also used to pastiche geography: seeking to engage global audiences via the use of national flags, currencies and international shipping options. We found Canada-related iconography particularly prominent, used to signify a reliable, affordable and safe pharmaceutical market. This is particularly resonant with US consumers, but relevant globally (see Delbaere 2013). Brijnath (2012) and Venhuis *et al*. (2016) both consider how unregulated vendors might attempt to activate specific diaspora communities by promoting medicines based on cultural beliefs, or value assigned to the country of manufacture. However, this is harder to discern regarding antibiotics: they are misunderstood and misused but are not themselves 'alternative' medicines. Regardless, their transnational availability online is undoubtedly an expression of how AMR is produced at the intersections of medicine, global markets, nations states and border politics, as well as the kinds of individual meanings attached to generic imported medicines seen in existing e-pharmacy research (Fox and Ward 2006, 469). This is yet another wrinkle in the 'patient experience economy' (Lupton 2014) in which consumers' experiences are mediated by their personal biography, vendor tactics, and ability to parse and filter information.

Implications

The e-pharmacy landscape of antimicrobials constitutes pastiche medicine and is generated by the complexities of pharmacy store content and in the inherent messiness (Law 2004; Seear 2014) of online fora. Pastiche medicine has several implications and avenues for further inquiry, both in terms of AMR prevention, and for social science and medical humanities knowledge of e-pharmacy more widely. Given the sprawling and layered implications of AMR under One Health, wider issues could be considered. However, we focus here on matters that can be meaningfully addressed within the area of online consumption. Specifically, these are the regulation frameworks of digital markets, design implications for diverse consumers, and finally, suggested ways to approach humanities e-pharmacy research in the future.

Regulation and markets

A key finding is that the regulated/unregulated mix of e-pharmacies has a paradoxical effect in service of consumers. The

legitimate online pharmacy sector does seemingly little to engage consumers, assuming that their services are part of orthodox healthcare and the advice provided to patients therein. In contrast, unregulated e-pharmacies provide consumers with copious information of dubious soundness. The overall impact of this pattern of absence and overcompensation is to amplify poorly communicated advice that may compromise efforts to reduce the use of antimicrobials. In addition, some codes of practice (for internet companies, digital retailers or pharmacists) may be in place, but are often enforced by private accrediting agencies operating in consultation with the sector(s). Internet regulation—especially in the burgeoning prosumer-driven health data economy (Lupton 2014)—presents a particular impasse, running counter to profit motives. Site traffic generates revenue through hosting, searching, sharing and advertising. The workings of such processes are equally opaque: 'black-boxed', prized and protected by corporate interests. Such tensions—between opaque 'more is more' and transparent 'less is more' approaches to consumption—are amplified in connection with AMR prevention: it is *restricted* availability and *prudent* use that keeps antibiotics safe. In keeping with a holistic 'One Health' approach, we see these issues as extending beyond primary healthcare, with dispersed responsibility in areas of consumer medicines information provision, pharmacy governance, retail trade and internet content moderation.

Economic-focused strategies (such as the use of vendor permits in addition to consumer prescriptions) to combat AMR have been explored (see Coast, Smith, and Millar 1998). However, these strategies have not been reconsidered in a context where globalised e-commerce is normalised, let alone in the recent pandemic context in which health-related consumption has been exploited by financial scams (Kemp *et al*. 2021). Given that laws vary by jurisdiction, it has been suggested that 'rogue' pharmacy trade be the subject of a commercial (rather than pharmaceutical) crackdown (LegitScript 2016, 50). The means by which vendors register and purchase web domains (paying fees to hosting companies, engaging payment providers to handle transactions and so forth) create digital traces that could be monitored more closely to curtail unregulated pharmacy activity. However, the data sharing required here would, again, be at odds with the free-market drivers of the internet.

Blocking search results is another current strategy (Google 2021). However, the challenge for search companies and legitimate pharmacy providers is to *redirect* consumers on their information-seeking journeys—rather than seeking to halt them. There is evidence to suggest that searches for trending health news topics could be harnessed to provide timely health information to consumers. During a recent outbreak of AMR gonorrhoea in the UK, there was a significant correlation between search interest in the story, and increased clinic attendance (Smolarchuk *et al*. 2019). Significantly, this occurred organically, ahead of any specific partnerships between news media outlets, internet search providers, public health departments and health practitioners. This mirrors past examples, such as internet search during the swine influenza (H1N1 influenza) outbreak in 2009—patterns that mapped the spread of the virus well ahead of epidemiological data (Mayer-Schönberger and Cukier 2017)—and the increase in immunity-related Google searches at the beginning of the COVID-19 pandemic in 2020 (Davis 2022, 75). A more proactive stance from internet companies—not just silencing misinformation but amplifying relevant sources—could combat antimicrobial misinformation and potentially be harnessed to drive system and individual responses.

Because antimicrobials have been neglected by regulatory systems, it would be advantageous to disaggregate them from generalised 'rogue' drug imports (and the moral panics surrounding illicit substances) (see Australian Crime Intelligence Commission 2019) and gain a sense of the scale of the unregulated pharmacy trade for legal but dangerous potential reservoirs of antibiotics. In addition, it would be helpful to map the regulatory and governance context of nation states, and their role in constricting and/or enabling consumers (ie, health insurance and drug subsidy schemes, and DTC advertising restrictions). This could focus domestically on populations without access to public health systems (Smith e*t al*. 2021), or internationally, vis-a-vis current burdens of AMR (Murray *et al*. 2022). These approaches would enable understanding and quantification of the gaps in current public health systems globally, that could push groups of consumers to engage with unregulated pharmacy, including specific cases where digital health literacies can be improved.

Designing for consumer diversity

Our research also indicates the importance of online consumption pathways that enable care and reduce harms for consumers: beyond mere consumer conveniences, we re-emphasise that the 'grey areas' of online pharmacy provide vital access for some groups (Paparini *et al*. 2018; Smith e*t al*. 2021; Huang 2022). Crucial to establishing an AMR-specific focus, then, is to better understand consumer pathways, how pharmacy designs relate to these pathways, and to then advance novel ways to frame AMR while balancing consumer agency and safety. Establishing relevant databases of online dispensing (Australian Commission on Safety and Quality in Health Care 2021, 91), consumption and risk implications, can help inform communication tools and policy to promote regulation and harm reduction. This requires more public and more nuanced detail than currently provided in government reporting (Australian Crime Intelligence Commission 2019), which focuses largely on illicit substances.

Here, AMR-specific interests can draw from not only well-established cross-cultural medical anthropology perspectives on medicine (van der geest and van der Geest and Whyte 1989; Whyte, van der Geest, and Hardon 2002), but also from foundational cases from online pharmacy research. Online-sourced sildenafil (ie, Viagra) remains an instructional example of online pharmacy research (Armstrong, Schwartz, and Asch 1999; Eysenbach 1999) and is representative of some of the wider social changes associated with burgeoning connectivity and the rise of internet cultures (Fox and Ward 2006). The prospect of obtaining sildenafil online epitomises the promises, pitfalls and pastiche of unregulated pharmacy: stigmatisation yet discretion, recreational use, targeted online advertising, corporeal safety concerns (ie, fakes), cyber security risks (ie, phishing), and individual medical entrepreneurialism in a neoliberal public health context. By contrast, online-sourced antiretroviral treatment (ART) prophylaxes (ie, pre-exposure prophylaxis, or PrEP) demonstrate the roles of clinicians, community groups and online pharmacies in addressing shortfalls in healthcare systems (Davis and Flowers 2014; Paparini *et al*. 2018; Smith *et al*. 2021; Huang 2022).

While distinct, these examples demonstrate the complexity of consumer pathways, the ways in which social issues mediate consumption, and the cyborg-ian nature of modern engagements with pharmacy (Martin 2006; Pienaar *et al*. 2020; Race *et al*. 2017). Complicating any call for greater regulation is the potential for looser regulations to increase equity and ameliorate some of the risks associated with off-label use. In New Zealand, for

example, the reclassification of sildenafil (from prescription-only to pharmacy-only) resulted in a significant decrease in border-control seizures, as online consumers (re)turned to community pharmacy (Gauld 2018). Relatedly, the permissibility of PrEP importation into Australia—jointly supported by the Therapeutic Goods Administration (allowing personal importation and approval therapies), clinicians (handling prescriptions), and community-based organisations and grassroots collectives (providing health promotion)—ensures that essential medication costs are more financially equitable for both individuals with and without access to health insurance (Smith *et al*. 2021, 189 187). Deregulation that leads to more open health communication and consumer-clinician discussion can be a pathway to greater public safety (Brijnath 2012, 298).

Rather than attempting—and likely failing—to combat agile e-commercial practices, retailers (with regulators) could seek to create informative digital environments that reintroduce originality to the highly derivative presentation style of the marketplace. An initial measure would be the establishment of a certification standard, clearer than the current QCPP accreditation used by Australian pharmacies. This has already been recommended to aid Australian consumers and prevent mistakes in pharmacy practice, where systems intended for the sale of *unrestricted* medications also offer *restricted* drugs (Hope and King 2020; Hope, Mayne, and King 2015). There is also potential to harness features of telemedicine to enhance pharmacy regulation, allowing reviews of antibiotic treatments by experts (Santos *et al*. 2019). Alternatively, or additionally, certification could emphasise the real—not abstracted—role of human pharmacists, using staff biographies to build trust (Qin *et al*. 2021). Current certifications (even on legitimate sites) focus on the pharmacy and render the pharmacist invisible.

Researching consumers and digital pharmacy

Research is needed to document how consumers use online pharmacies to procure, stockpile and share antibiotics. Online pharmacy is presently untethered from AMR communications, policymaking or agenda-setting and there have been calls for social research on these matters (Lu, Sheldenkar, and Lwin 2020; Tompson, Manderson, and Chandler 2021). It is important to understand how consumer practices, both online and offline, relate to what is known about antibiotic consumption (Kamiński, Łoniewski, and Marlicz 2019), what is made known by public health channels (Hansson and Brenthel 2022), and rates of resistance. Venhuis *et al*. (2016) use of Interpol data, and the UK's interest in out-of-hours antibiotic prescribing during COVID-19 (Zhu *et al*. 2021) demonstrate the kind of data and intent required to understand the scale of under-regulated antibiotic circulation, and the various institutional and jurisdictional attitudes towards antibiotic importation.

It is also important to understand how individuals articulate their antibiotic use (Davis *et al*. 2020b). Unregulated antibiotic consumption might not be isolated but linked to practices of polypharmacy (Brijnath 2012). These concerns might relate to the willingness of e-pharmacies to group medicines as 'packs', and the ability of online communities to find and share workarounds for existing systems of medicine governance (Hope, Mayne, and King 2015; Howes-Mischel 2017). Polypharmacy is elevated by the diversity of information online, and the multitude of consumer pathways available. Importantly, this polypharmacy can occur across what are traditionally considered 'human' and 'animal' drug domains, with implications therefore for the value of 'One Health' (Kahn 2016; Ticktin 2014) approaches to AMR. Thus, there is a need to better understand who digital pharmacy retailers are (Fittler *et al*. 2013; Tompson, Manderson, and Chandler 2021). Such enquiries could build on the subcultural ideologies (Howes-Mischel 2017) and aesthetic motivations (Reddy *et al*. 2021) already identified while also reflecting on relationships between pharmaceuticals and identity (Fox and Ward 2006; Martin 2006; Pienaar *et al*. 2020). Researchers could also draw connections between the fragmented aspects of online pharmacy marketplaces, and anthropological arguments for pastiche within the fragmented self (Wolputte 2004).

Expanding on our own ethnographic approach, medical humanities research could conduct co-research with consumer, such as 'media go-along' (Jørgensen 2016) methods, to gain insight into how they interpret and interact with online pharmacy environments (including information, images and certifications) and to unpack the symbolic meanings associated with medicines in everyday life (van der Geest and Whyte 1989; Chandler, Hutchinson, and Hutchison 2016, 12–13; Jamie and Sharples 2020). These approaches could be supported by further digital-ethnographic reviews of websites and smartphone applications (Dieter *et al*. 2019), especially if these approaches extend beyond the language (English only) limitations of this paper. Such approaches would elucidate the logistical operations and semantic and semiotic intentions of unregulated pharmacy platforms, vis-a-vis legal and clinical guidelines (MacLean and Hatcher 2019). Engaging human participants in tandem with visual media and digital objects can help form an evidence base for interventions and information campaigns (Irwin 2022), and would be novel in an Australian context, where humanities approaches to medicines are promising but nascent (Werder and Holland 2019).

The 'pastiche medicine' frame is also an important contribution to AMR prevention and critical scholarship on digital pharmacy. Pastiche medicine captures the lived experience of digital pharmacy, as it borrows the imprimatur of biomedical knowledge and combines it with the expansion of consumer assembled healthcare. These developments might be challenges and opportunities for AMR prevention, especially given the importance of global patterns of inequity (Kirchhelle *et al*. 2020). Digital pharmacy access might increase the use of antimicrobials when they are not needed. However, consumers using digital pharmacy to source antibiotics might be more easily reached in these environments, and can therefore be assisted to reduce health risks. Given how COVID-19 accelerated and normalised digital health, increased public policy engagement is required regarding the ways in which digital pharmacies curate pastiche-like mixes of biomedicine and consumption. We also argue that critical scholarship on digital pharmacy can be advanced by incorporating analyses of antimicrobials. Similar to the 'mimetic' and 'parody' performances of some so-called 'traditional' medicines (Langford 1999) and metaphors in pharmaceutical advertising (Delbaere 2013), pastiche medicine borrows and dismembers biomedical expertise, but it also trades in the healing possibility of medicines to gain ontological weight. The antimicrobial example we explore here speaks to the wider digital pharmacy landscape by providing deeper and more nuanced understanding of the digitally engaged patient, and a cognisance of polypharmacy that includes how consumers might seek to manage infections or perceived health risks.

In antibiotic digital pharmacy we find a blending of information, genres and digital formats, befitting the term 'pastiche medicine'. For AMR prevention, pastiche is problematic, rendering antibiotics unremarkable, inexpensive and readily available. In a pastiche environment, antimicrobials take on a quotidian quality,

presented alongside unrestricted drugs, vitamins and other non-medical goods in ways that emphasise consumer self-assembly. The threat posed by AMR, alongside other health crises, will only accelerate digital health in the future. In these circumstances, the curation of information, the knowledge of experts, risk management advice and of course, direct access to pharmaceuticals, are ongoing issues. Public policy, on AMR prevention and beyond, will need to catch hold of these currents and establish methods for protecting the health of consumers.

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BIBLIOGRAPHY

Armstrong, K., J. S. Schwartz, and D. A. Asch. 1999. "Direct Sale of Sildenafil (Viagra) to Consumers over the Internet." *The New England Journal of Medicine* 341 (18): 1389–92.

Australian Commission on Quality and Safety in Health Care. 2021. *"AURA 2021: Fourth Australian Report on Antimicrobial Use and Resistance in Human Health.,"* 4. Sydney. https://www.safetyandquality.gov.au/publications-and-resources/resource-library/aura-2021-fourth-australian-report-antimicrobial-use-and-resistance-human-health.

Australian Commission on Safety and Quality in Health Care. 2019. *AURA 2019: Third Australian Report on Antimicrobial Use and Resistance in Human Health*, 3. Sydney. https://www.safetyandquality.gov.au/publications-and-resources/resource-library/aura-2019-third-australian-report-antimicrobial-use-and-resistance-human-health.

Australian Competition and Consumer Commission. 2018. "Health & Medical Products." Text Scamwatch. https://www.scamwatch.gov.au/types-of-scams/buying-or-selling/health-medical-products.

Australian Crime Intelligence Commission. 2019. "Illicit Drug Data Report 2017-18." Canberra . https://www.acic.gov.au/publications/illicit-drug-data-report/illicit-drug-data-report-2017-18.

Australian Government Department of Health and Aged Care. 2019. "Australia's National Antimicrobial Resistance Strategy – 2020 and Beyond." Canberra . https://www.amr.gov.au/resources/australias-national-antimicrobial-resistance-strategy-2020-and-beyond.

Australian Government Department of Health and Aged Care. 2020a. "Fast Track Electronic Prescribing." Test. Australian Government Department of Health and Aged Care." Test. Available from: https://www.health.gov.au/resources/publications/covid-19-national-health-plan-primary-care-fast-track-electronic-prescribing. Accessed 12 Mar 2020.

Australian Government Department of Health and Aged Care. 2020b. "COVID-19 National Health Plan – Home Medicines Services Information for Consumers." Text. Available from: https://www.health.gov.au/resources/publications/covid-19-national-health-plan-home-medicines-services-information-for-consumers. Accessed 22 May 2020.

Australian Government Department of Health and Aged Care. 2021. "About the PBS." Available from: https://www.pbs.gov.au/info/about-the-pbs. Accessed 01 Jan 2021.

Australian Medical Association. 2020. "Pop up Telehealth Services." Text. Available from: https://www.ama.com.au/gpnn/issue-20-number-25/articles/pop-telehealth-services. Accessed 25 Jun 2020.

Ayo, Nike. 2012. "Understanding Health Promotion in a Neoliberal Climate and the Making of Health Conscious Citizens." *Critical Public Health* 22 (1): 99–105.

Bernath, Paul. 2003. "Regulation of Online Pharmacy: An Australian Perspective." *Journal of Law and Medicine* 10 (3): 339–63.

Bing. 2021. "How Bing Delivers Search Results." Text, Bing Search, Microsoft. Available from: https://help.bing.microsoft.com/

Bowen, Christopher. 2012. "Pastiche." In *The Princeton Encyclopedia of Poetry and Poetics*, edited by Roland Greene, Stephen Cushman, Clare Cavanagh, Jahan Ramazani, Paul F. Rouzer, Harris Feinsod, David Marno, and Alexandra Slessarev, 4th ed. Vol. 1005. Princeton: Princeton University Press.

Boyd, S. E., L. S. P. Moore, M. Gilchrist, C. Costelloe, E. Castro-Sánchez, B. D. Franklin, and A. H. Holmes. 2017. "Obtaining Antibiotics Online from within the UK: A Cross-Sectional Study." *The Journal of Antimicrobial Chemotherapy* 72 (5): 1521–28.

Brijnath, B. 2012. "Pills, Pluralism, Risk and Citizenship: Theorising e-Pharmacies." *BioSocieties* 7 (3): 294–307.

Brown, N. 2018. *Immunitary Life: A Biopolitics of Immunity*. 1st edition. New York, NY: Springer Berlin Heidelberg.

Brown, N., and S. Nettleton. 2018. "Economic Imaginaries of the Anti-Biosis: Between 'Economies of Resistance' and the 'Resistance of Economies.'" *Palgrave Communications* 4 (1): 123.

Burgess, J., and N. K. Baym. 2020. "*Twitter*." In *Twitter: A Biography*. New York: New York University Press.

Center for Drug Evaluation and Research. 2022. *Internet Pharmacy Warning Letters*. Food and Drug Administration (FDA. https://www.fda.gov/drugs/drug-supply-chain-integrity/internet-pharmacy-warning-letters.

Chandler, C. I. R. 2019. "Current Accounts of Antimicrobial Resistance: Stabilisation, Individualisation and Antibiotics as Infrastructure." *Palgrave Communications* 5 (1): 53.

Chandler, C. I. R., E. Hutchinson, and C. Hutchison. 2016. "Addressing Antimicrobial Resistance Through Social Theory: An Anthropologically Oriented Report." Monograph. https://researchonline.lshtm.ac.uk/id/eprint/3400500/.

Coast, J., R. D. Smith, and M. R. Millar. 1998. "An Economic Perspective on Policy to Reduce Antimicrobial Resistance." *Social Science & Medicine (1982)* 46 (1): 29–38.

Comber, S. D. W., M. Upton, S. Lewin, N. Powell, and T. H. Hutchinson. 2020. "COVID-19, Antibiotics and One Health: A UK Environmental Risk Assessment." *The Journal of Antimicrobial Chemotherapy* 75 (11): 3411–12.

Crawford, P., B. Brown, C. Baker, V. Tischler, and B. Abrams. 2015. *Health Humanities*. London: Palgrave.

Crawford, S. Y. 2003. "Internet Pharmacy: Issues of Access, Quality, Costs, and Regulation." *Journal of Medical Systems* 27 (1): 57–65.

Dalzell, S., and J. Macmillan. 2020. "Fever Clinics, Bulk-Billed Video Consults Part of $2.4 Billion Plan to Fight Virus." ABC News. Available from: https://www.abc.net.au/news/2020-03-11/how-government-plans-to-spend-billions-protecting-coronavirus/12044192. Accessed 10 Mar 2020.

Davis, M. 2022. *Selling Immunity: Self, Culture and Economy in Healthcare and Medicine. Critical Approaches to Health*. Abingdon, Oxon; New York, NY: Routledge.

Davis, M. D. M., D. B. Lohm, A. Whittaker, and P. Flowers. 2020a. "'Willy Nilly' Doctors, Bad Patients, and Resistant Bodies in General Public Explanations of Antimicrobial Resistance." *Sociology of Health & Illness* 42 (6): 1394–1408.

Davis, M., and P. Flowers. 2014. "HIV/STI Prevention Technologies and 'strategic (in) Visibilities." In *Disclosure in Health and Illness*, edited by Mark Davis and Lenore Manderson, 72–88. London; New York: Routledge Studies in the Sociology of Health and Illness,Routledge, Taylor & Francis Group.

Davis, M., B. Lyall, A. Whittaker, M. Lindgren, M. Djerf-Pierre, and P. Flowers. 2020b. "A Year in the Public Life of Superbugs: News Media on Antimicrobial Resistance and Implications for Health Communications." *Social Science & Medicine (1982)* 256: 113032.

Delbaere, M. 2013. "Metaphors and Myths in Pharmaceutical Advertising." *Social Science & Medicine (1982)* 82 (April): 21–29.

Dew, K. 2019. *Public Health, Personal Health and Pills: Drug Entanglements and Pharmaceuticalised Governance*. London; New York: Routledge Studies in the Sociology of Health and Illness, Routledge, Taylor & Francis Group.

Dieter, M., C. Gerlitz, A. Helmond, N. Tkacz, F. N. van der Vlist, and E. Weltevrede. 2019. "Multi-Situated App Studies: Methods and Propositions." *Social Media + Society* 5 (2): 205630511984648.

Djerf-Pierre, M., and M. Lindgren. 2021. "Making Sense of 'Superbugs' on YouTube: A Storytelling Approach." *Public Understanding of Science (Bristol, England)* 30 (5): 535–51.

Eysenbach, G. 1999. "Online Prescribing of Sildanefil (Viagra) on the World Wide Web." *Journal of Medical Internet Research* 1 (2): E10.

Fittler, A., E. Lankó, B. Brachmann, and L. Botz. 2013. "Behaviour Analysis of Patients Who Purchase Medicines on the Internet: Can Hospital Pharmacists Facilitate Online Medication Safety?" *European Journal of Hospital Pharmacy* 20 (1): 8–12.

Fox, N., and K. Ward. 2006. "Health Identities: From Expert Patient to Resisting Consumer." *Health (London, England* 10 (4): 461–79.

Frid-Nielsen, S. S., O. Rubin, and E. Baekkeskov. 2019. "The State of Social Science Research on Antimicrobial Resistance." *Social Science & Medicine (1982)* 242: 112596.

Gauld, N. 2018. "Viagra from the Pharmacist: Insight from Reclassification in New Zealand." The Pharmaceutical Journal (blog). https://pharmaceutical-journal.com/article/opinion/viagra-from-the-pharmacist-insight-from-reclassification-in-new-zealand.

GlobalData Healthcare. 2018. "Illegal Online Pharmacies: How Endemic Are They?' Pharmaceutical Technology." Pharmaceutical Technology. Available from: https://www.pharmaceutical-technology.com/comment/illegal-online-pharmacies-endemic/

Google. 2021. "Medical Information on Google - Google Search Help." Text, Google Search Help, Google Search. Available from: https://support.google.com/websearch/answer/2364942?hl=en

Hansson, K., and A. Brenthel. 2022. "Imagining A Post-Antibiotic Era: A Cultural Analysis of Crisis and Antibiotic Resistance." *Medical Humanities* 48 (3): 381–88.

Hine, C. 2015. *Ethnography for the Internet: Embedded, Embodied and Everyday*. London; New York: Bloomsbury Academic, An imprint of Bloomsbury Publishing Plc.

Hope, D., and M. King. 2020. "Review: Internet Pharmacy: Online Medicines: A Growing Problem." *AJP: The Australian Journal of Pharmacy* 101: 24–29.

Hope, D., P. Mayne, and M. A. King. 2015. "Access to Pharmacist Only Medicines from Online Pharmacies in Australia." *Australian Journal of Pharmacy* 96: 24–27.

Howes-Mischel, R. 2017. "Stocking up on Fish Mox: A Systematic Analysis of Cultural Narratives about Self-Medicating in Online Forums." *AIMS Public Health* 4 (5): 430–45.

Huang, P. 2022. "Sexual Health as Surplus: The Marketization of PrEP in Taiwan." *BioSocieties* 18 (2): 410–28.

Hutchison, C. 2022. "Wars and Sweets: Microbes, Medicines and Other Moderns in and beyond the(Ir) Antibiotic Era." *Medical Humanities* 48 (3): 359–70.

Irwin, R. 2022. "Imagining the Postantibiotic Future: The Visual Culture of a Global Health Threat." *Medical Humanities* 48 (3): 371–80.

Jameson, F. 1991. *Postmodernism, or, The Cultural Logic of Late Capitalism. Post-Contemporary Interventions*. Durham, NC: Duke Univ. Press.

Jamie, K., and G. Sharples. 2020. "The Social and Material Life of Antimicrobial Clay: Exploring Antimicrobial Resistance, Medicines' Materiality, and Medicines Optimization." *Frontiers in Sociology* 5 (April): 26.

Jørgensen, K. M. 2016. "The Media Go-along: Researching Mobilities with Media at Hand." *MedieKultur* 32 (60).

Kahn, L. H. 2016. *One Health and the Politics of Antimicrobial Resistance*. Baltimore: Johns Hopkins University Press.

Kamiński, M., I. Łoniewski, and W. Marlicz. 2019. "Global Internet Data on the Interest in Antibiotics and Probiotics Generated by Google Trends." *Antibiotics* 8 (3): 147.

Kemp, S., D. Buil-Gil, A. Moneva, F. Miró-Llinares, and N. Díaz-Castaño. 2021. "Empty Streets, Busy Internet: A Time-Series Analysis of Cybercrime and Fraud Trends During COVID-19." *Journal of Contemporary Criminal Justice* 37 (4): 480–501.

Khalife, Y. 2020. "COVID-19: Online Safety Tips to Help Older Australians with Social Distancing." Text ESafety Commissioner (blog. Available from: https://www.esafety.gov.au/about-us/blog/covid-19-online-safety-tips-help-older-australians-social-distancing. Accessed 17 Mar 2020.

Kirchhelle, C., P. Atkinson, A. Broom, K. Chuengsatiansup, J. P. Ferreira, N. Fortané, I. Frost, *et al*. 2020. "Setting the Standard: Multidisciplinary Hallmarks for Structural, Equitable and Tracked Antibiotic Policy." *BMJ Global Health* 5 (9): e003091.

Knight, G. M., R. E. Glover, C. F. McQuaid, I. D. Olaru, K. Gallandat, Q. J. Leclerc, N. M. Fuller, *et al*. 2021. "Antimicrobial Resistance and COVID-19: Intersections and Implications." *ELife* 10: e64139.

Langford, J. M. 1999. "Medical Mimesis: Healing Signs of a Cosmopolitan 'Quack.'" *American Ethnologist* 26 (1): 24–46.

Law, J. 2004. *After Method: Mess in Social Science Research. International Library of Sociology*. London; New York: Routledge.

LegitScript. 2016. "The Internet Pharmacy Market in 2016: Trends, Challenges, and Opportunities." The Center for Safe Internet Pharmacies. Available from: https://safemedsonline.org/wp-content/uploads/2016/01/The-Internet-Pharmacy-Market-in-2016.pdf

Liang, B. A., and T. MacKey. 2009. "Searching for Safety: Addressing Search Engine, Website, and Provider Accountability for Illicit Online Drug Sales." *American Journal of Law & Medicine* 35 (1): 125–84.

Liang, B. A., and T. K. Mackey. 2012. "Vaccine Shortages and Suspect Online Pharmacy Sellers." *Vaccine* 30 (2): 105–8.

Lim, K., K. Overton, A. Broom, and H. Seale. 2021. "Exploring the Representation of Antimicrobial Resistance and Stewardship in Australian Pharmacy Media: A Content Analysis." *The International Journal of Pharmacy Practice* 29 (6): 611–15.

Liotta, M. 2020. "RACGP Cautions against Use of 'Pop-up' Telehealth Services." Text NewsGP Royal Australian College of General Practitioners. Available from: https://www1.racgp.org.au/newsgp/professional/racgp-cautions-against-use-of-pop-up-telehealth-se. Accessed 21 May 2020.

Lu, C., B. Liu, Y. Zhang, Z. Li, F. Zhang, H. Duan, Y. Liu, *et al*. 2021. "From WHOIS to WHOWAS: A Large-Scale Measurement Study of Domain Registration Privacy under the GDPR." Proceedings 2021 Network and Distributed System Security Symposium; Virtual: Internet Society.

Lu, J., A. Sheldenkar, and M. O. Lwin. 2020. "A Decade of Antimicrobial Resistance Research in Social Science Fields: A Scientometric Review." *Antimicrobial Resistance and Infection Control* 9 (1): 178.

Lupton, D. 2014. "The Commodification of Patient Opinion: The Digital Patient Experience Economy in the Age of Big Data." *Sociology of Health & Illness* 36 (6): 856–69.

Lupton, D. 2018. *Digital Health: Critical and Cross-Disciplinary Perspectives. Critical Approaches to Health*. London: Routledge, Taylor & Francis Group.

Mackenzie, D. G., D. S. Y. Ong, and D. Ashiru-Oredope. 2020. "World Antibiotic Awareness Week and European Antibiotic Awareness Day, November 2018: An Analysis of the Impact of Twitter Activity." *International Journal of Antimicrobial Agents* 56 (6): S0924-8579(20)30420-9.

Mackey, T. K., and G. Nayyar. 2016. "Digital Danger: A Review of the Global Public Health, Patient Safety and Cybersecurity Threats Posed by Illicit Online Pharmacies." *British Medical Bulletin* 118 (1): 110–26.

MacLean, S., and S. Hatcher. 2019. "Constructing the (Healthy) Neoliberal Citizen: Using the Walkthrough Method 'Do' Critical Health Communication Research." *Frontiers in Communication* 4.

Mainous, A. G., C. J. Everett, R. E. Post, V. A. Diaz, and W. J. Hueston. 2009. "Availability of Antibiotics for Purchase without a Prescription on the Internet." *Annals of Family Medicine* 7 (5): 431–35.

Martin, E. 2006. "The Pharmaceutical Person." *BioSocieties* 1 (3): 273–87.

Maskiell, L. 2021. "Smart50 Awards: How the 'Dream Partnership' behind InstantScripts Led to 15x Revenue Growth." SmartCompany. Available from: https://www.smartcompany.com.au/startupsmart/advice/startupsmart-growth/smart50-awards-dream-partnership-instantscripts-revenue-growth/. Accessed 08 Dec 2021.

Mavlanova, T., and R. Benbunan-Fich. 2010. "What Does Your Online Pharmacy Signal? A Comparative Analysis of Website Trust Features." In *2010 43rd Hawaii International Conference on System Sciences*, 1–10.

Mayer-Schönberger, V., and K. Cukier. 2017. *Big Data: The Essential Guide to Work, Life and Learning in the Age of Insight*. London: John Murray.

Miranda, C., V. Silva, R. Capita, C. Alonso-Calleja, G. Igrejas, and P. Poeta. 2020. "Implications of Antibiotics Use during the COVID-19 Pandemic: Present and Future." *The Journal of Antimicrobial Chemotherapy* 75 (12): 3413–16.

Murray, C. J. L., K. S. Ikuta, F. Sharara, L. Swetschinski, G. Robles Aguilar, A. Gray, C. Han, *et al*. 2022. "Global Burden of Bacterial Antimicrobial Resistance in 2019: A Systematic Analysis." *The Lancet* 399 (10325): 629–55.

NPS MedicineWise. 2018. In *Buying Medicines over the Internet*. Text NPS Medicinewise. Australian Government Department of Health and Aged Care. https://www.nps.org.au/consumers/buying-medicines-over-the-Internet.

NPS MedicineWise. 2019. "Can I Help Prevent Antibiotic Resistance?" About Antibiotic Resistance." Text Australian Government Department of Health and Aged Care. https://www.nps.org.au/consumers/antibiotics-explained#can-i-help-prevent-antibiotic-resistance?

Office of Drug Control. 2019. "Importers." Text Department of Health and Aged Care. Available from: https://www.odc.gov.au/importers

Orizio, G., A. Merla, P. J. Schulz, and U. Gelatti. 2011. "Quality of Online Pharmacies and Websites Selling Prescription Drugs: A Systematic Review." *Journal of Medical Internet Research* 13 (3): e74.

Orizio, G., S. Rubinelli, P. J. Schulz, S. Domenighini, M. Bressanelli, L. Caimi, and U. Gelatti. 2010. "'Save 30% If You Buy Today'. Online Pharmacies and the Enhancement of Peripheral Thinking in Consumers." *Pharmacoepidemiology and Drug Safety* 19 (9): 970–76.

Paparini, S., W. Nutland, T. Rhodes, V.-K. Nguyen, and J. Anderson. 2018. "DIY HIV Prevention: Formative Qualitative Research with Men Who Have Sex with Men Who Source PrEP Outside of Clinical Trials." *PloS One* 13 (8): e0202830.

Petersen, A. R. 2019. *Digital Health and Technological Promise: A Sociological Inquiry*. Milton Park, Abingdon, Oxon; New York, NY: Routledge, Taylor & Francis Group.

Petryna, A., and A. Kleinman. 2006. "The Pharmaceutical Nexus." In *Global Pharmaceuticals: Ethics, Markets, Practices*, edited by Adriana Petryna, Andrew Lakoff, and Arthur Kleinman, 1–32. Durham: Duke University Press.

Pienaar, K., D. A. Murphy, K. Race, and T. Lea. 2020. "Drugs as Technologies of the Self: Enhancement and Transformation in LGBTQ Cultures." *The International Journal on Drug Policy* 78 (April).

Potts, A. 2004. "Deleuze on Viagra (Or, What Can a 'Viagra-Body' Do?)." *Body & Society* 10 (1): 17–36.

Qin, Q., Q. Ke, J. T. Du, and Y. Xie. 2021. "How Users' Gaze Behavior Is Related to Their Quality Evaluation of a Health Website Based on HONcode Principles?" *Data and Information Management* 5 (1): 75–85.

Race, K., T. Lea, D. Murphy, and K. Pienaar. 2017. "The Future of Drugs: Recreational Drug Use and Sexual Health among Gay and Other Men Who Have Sex with Men." *Sexual Health* 14 (1): 42–50.

Reddy, P. S., L. C. DeBord, R. Gupta, P. Kapadia, A. Mohanty, and H. Dao. 2021. "Antibiotics for Acne Vulgaris: Using Instagram to Seek Insight into the Patient Perspective." *The Journal of Dermatological Treatment* 32 (2): 188–92.

Rogers, R. 2019. *Doing Digital Methods*. 1st edition. Thousand Oaks, CA: SAGE Publications.

Santos, R. P. D, C. H. Dalmora, S. A. Lukasewicz, O. Carvalho, C. Deutschendorf, R. Lima, T. Leitzke, N. C. Correa, and M. V. Gambetta. 2019. "Antimicrobial Stewardship through

Telemedicine and Its Impact on Multi-Drug Resistance." *Journal of Telemedicine and Telecare* 25 (5): 294–300.
Seear, K. 2014. *The Makings of a Modern Epidemic: Endometriosis, Gender and Politics*. Farnham, Surrey, England; Burlington, VT USA: Ashgate.
Smith, A. K. J., B. Haire, C. E. Newman, and M. Holt. 2021. "Challenges of Providing HIV Pre-Exposure Prophylaxis across Australian Clinics: Qualitative Insights of Clinicians." *Sexual Health* 18 (2): 187–94.
Smolarchuk, C., H. Mohammed, M. Furegato, K. Town, H. Fifer, J. Wilson, A. Nardone, A. Lee, and G. Hughes. 2019. "Just Google It! Impact of Media Coverage of an Outbreak of High-Level Azithromycin-Resistant *Neisseria Gonorrhoeae* on Online Searches, and Attendances, Testing and Diagnoses at Sexual Health Clinics in England between 2015 and 2016: An Interrupted Time Series Analysis Using Surveillance Data." *Sexually Transmitted Infections* 95 (8): 594–601.
Therapeutic Goods Administration. 2016. "Buying Medicines and Medical Devices Online." Text. Department of Health and Aged Care. Available from: https://www.tga.gov.au/buying-medicines-and-medical-devices-online. Accessed 27 Jun 2016.
Therapeutic Goods Administration. 2021. "CW IP Pty Ltd Fined $53,280 for Alleged Advertising Breaches on the Chemist Warehouse and My Chemist Websites." Media release. Department of Health and Aged Care. Available from: https://www.tga.gov.au/news/media-releases/cw-ip-pty-ltd-fined-53280-alleged-advertising-breaches-chemist-warehouse-and-my-chemist-websites. Accessed 24 Mar 2021.
Ticktin, M. 2014. "Cross-Species Craziness: Animals, Anthropomorphism and Mental Illness." *BioSocieties* 9 (4): 482–84.
Tompson, A. C., L. Manderson, and C. I. R. Chandler. 2021. "Understanding Antibiotic Use: Practices, Structures and Networks." *JAC-Antimicrobial Resistance* 3 (4): dlab150.
Underwood, M. 2015. "Updating Our Search Quality Rating Guidelines | Google Search Central Blog." Google Developers. Google. Available from: https://developers.google.com/search/blog/2015/11/updating-our-search-quality-rating
van der Geest, S, and S. R. Whyte. 1989. "The Charm of Medicines: Metaphors and Metonyms." *Medical Anthropology Quarterly* 3 (4): 345–67.
Venhuis, B. J., P. H. J. Keizers, R. Klausmann, and I. Hegger. 2016. "Operation Resistance: A Snapshot of Falsified Antibiotics and Biopharmaceutical Injectables in Europe." *Drug Testing and Analysis* 8 (3–4): 398–401.
Veronin, M. 2011. "Packaging and Labeling of Pharmaceutical Products Obtained from the Internet." *Journal of Medical Internet Research* 13 (1): e22.
Werder, O., and K. Holland. 2019. "Australia and New Zealand: A Circuitous Path to Health Humanities." In *The Routledge Companion to Health Humanities*, edited by Paul Crawford, Brian Brown, and Andrea Charise, 215–29. Milton: Taylor & Francis Group.
Whyte, S. R., S. van der Geest, and A. Hardon. 2002. *Social Lives of Medicines. Cambridge Studies in Medical Anthropology*. Vol. 10. Cambridge, UK; New York: Cambridge University Press.
Wolputte, S. Van. 2004. "Hang on to Your Self: Of Bodies, Embodiment, and Selves." *Annual Review of Anthropology* 33 (1): 251–69.
Zhu, N. J., M. McLeod, C. A. M. McNulty, D. M. Lecky, A. H. Holmes, and R. Ahmad. 2021. "Trends in Antibiotic Prescribing in Out-of-Hours Primary Care in England from January 2016 to June 2020 to Understand Behaviours during the First Wave of COVID-19." *Antibiotics (Basel, Switzerland)* 10 (1): 32.