CHAPTER 2

Antimicrobial Resistance as a Creeping Crisis

Alina Engström

Abstract Antimicrobial resistance (AMR) displays many of the characteristics of a creeping crisis. It lacks clearly definable temporal and spatial boundaries. It develops in the natural world when and where conditions are conducive. It traverses sectors and borders in the natural, human, and built environments. It causes individual and societal harm when it escalates toward outbreaks in a random fashion. Outbreaks can be minor or major, burn fast or slow, be simple or hard to contain. Experts insist we are heading toward a “post-antibiotic age” and even deadlier “superbugs” if we do not act. Yet warnings and crisis framings do not appear sufficient to prompt a response. Public attention and governmental action have lagged. Occasional outbreaks invite attention and concern, only for the issue to fade again from the public view. International organizations shine more sustained light on the problem, but national governments are slow to respond. This chapter argues that our dependency on antimicrobial drugs is a blessing and a curse: curing us in the short term but building the conditions for a massive, incurable outbreak in the future.

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2.1 INTRODUCTION

During a trip to India, a Norwegian woman named Karin suffered an accident and required hospitalization. She underwent surgery and received prophylactic antibiotic treatment. Upon arrival in Norway, it was discovered she had contracted the bacteria *Klebsiella pneumoniae*—a bacteria made more deadly by the fact that over the past decade it had become resistant to most antibiotics. After multiple tries, a last-ditch effort was made with one particular, rare antibiotic that killed the bacteria (European Centre for Disease Prevention and Control [ECDC], [n.d.](#)).

This is just one story, of one patient, who suffered the effects of antimicrobial resistance (AMR) to antibiotics. In India, 58,000 babies died within their first year from an infection with resistant bacteria normally passed on by their mothers (Laxminarayan et al., [2013](#)). Worldwide, AMR causes 700,000 deaths per year. The number is expected to rise to 10 million by 2050 if left unaddressed (O'Neill, [2016](#)). Economic costs are expected to be as high as the 2008–2009 economic crisis (World Health Organization [WHO], [2019a](#)). On the current trajectory, we are moving toward a future where minor infections can no longer be cured, and common medical procedures will become more dangerous. The coming AMR crisis will make the Covid-19 pandemic look tame by comparison (Chanel & Doherty, [2020](#)).

In the natural world, microbials and their antithesis, antimicrobials, have competed for dominance since the beginning of time, evolving and fighting within the bodies of living organisms. It was the human invention of antibiotics that caused this normal process to tip out of balance (Levy, [1997](#)). Extra powerful antibiotics were introduced, curing minor infections that previously killed us. We quickly became dependent on them. Antibiotics were cheap, therapies were short, and we soon began overusing them.

Bacteria did not give up the fight. Natural selection led to new strains capable of overcoming our anti-bacterial treatment. These new strains of bacteria are called superbugs—resistant to antibiotics and most attempts to wipe them out. These superbugs evolve and incubate in time and space, affecting countries differently at different times. Due to uneven responses

to root causes, resistance levels are higher in low- and middle-income countries than in high-income countries (Klein, Tseng, Pant, & Laxminarayan, 2019). The interconnectedness of systems and several modern practices such as international travel and migration allow for the problem to arrive anywhere at any time.

The threat potential of AMR was built up during a long incubation period. Its accumulation is facilitated through ongoing, interacting processes related to natural selection, globalization, environmental degradation, and scientific advancement. The problem is widely acknowledged as growing and getting worse. Experts have been warning about the slow and steady threat accumulating for years, yet the response has been insufficient. The World Health Organization (WHO) and the Interagency Coordination Group on Antimicrobial Resistance (IACG) have framed the rising resistance levels as a “global crisis” that threatens a century of progress in health (IACG, 2019, p. 1; WHO, 2019b). Some countries have put AMR on top of their national agenda and even addressed it. Most countries have not.

Occasional outbreaks of “superbugs” serve as precursor events, signaling the presence of the deeper problem while attention occasionally shifts to combatting it. Nevertheless, crisis responses are disparate and uneven. National politicians, policymakers, practitioners, and individuals appear unaware of the extent of the problem (WHO, 2015). Media reporting about AMR rarely attributes blame or points to solutions (Capurro, 2020; Collins, Jaspal, & Nerlich, 2018). Questions of responsibility and ownership are complex and difficult to pin down (Brown & Crawford, 2009). The threat keeps accumulating.

In short, AMR displays the characteristics of a creeping crisis outlined in the introduction to this volume. Perhaps more than any other chapter, this case casts a light on both the objective and subjective nature of the crisis: evolving in the natural world, and only occasionally constructed as a threat. It also highlights the non-linear aspects of crisis development, moving seemingly forward and backward in development, and randomly appearing in “flare-ups” or precursor events. Another key insight revealed here is the lack of ownership: the natural origins of this problem, its global character, and its multiple manifestations mean few authorities have the desire or competence to respond with full force. The world has become dependent on antibiotics; strictly regulating their use and managing this creeping crisis requires significant sacrifices that societies appear unwilling, as yet, to undertake.

This chapter is structured as follows. It first explains the origin and incubation of the problem across time and space. It then examines the precursor events that signal a deeper, underlying concern before outlining the periodic attention shown to AMR, especially by the international community. It concludes with a summary of the analysis and thoughts on why meaningful action has failed to materialize in response to this creeping crisis.

2.2 ORIGIN AND INCUBATION OVER TIME

The origin and incubation of the AMR problem highlights the complex interaction between the natural and human worlds. During the “golden age of antibiotic discovery” between 1940 and 1960, the discovery of new antibiotics kept pace with the emergence of resistant bacteria (Davies, 2006, p. 287). The problem of resistance was not a major concern. But pharmaceutical companies soon began developing other drugs with higher profit margins (Bush et al., 2011). In the late 1980s, the world encountered what scientists called a “discovery void.” Between 1987 and 2011, no new classes of antibacterials were successfully discovered (Silver, 2011, p. 72–73). Meanwhile, existing bacteria continued to develop multidrug-resistant (MDR), pan drug-resistant (PDR), and extensively drug-resistant (XDR) genes resistant to multiple or all available antimicrobials being prescribed and over-prescribed (Magiorakos et al., 2012). Resistance has accumulated, and most bacteria now show resistance toward one or multiple antibiotics. Several bacteria—superbugs—already show concerning resistance levels (Davies & Davies, 2010, p. 419–420; O’Neill, 2016).

Although the root cause of the problem is a natural phenomenon, it is the different, interacting conditions in various natural *and* societal systems, such as health systems, that provoke the incubation and threat accumulation caused by misuse. Misuse contributes to bacterial mutation, a complex process whereby new strains multiply and thrive. A lack of effective regulation propels the problem (Lomazzi, Moore, Johnson, Balasegaram, & Borisch, 2019). A lack of regulatory governance hinders responsible production, distribution, and usage of microbials across different sectors, including the health care system, food production, and pharmaceutical dispensing systems (World Bank, 2019).

Moreover, the threat builds in communities and sectors where there is a lack of knowledge or norms to guide correct use. Individuals as patients, health-care practitioners as prescribers, and farmers as suppliers all contribute to the problem. For example, in the health-care sector, various

conditions facilitate the stepwise build-up of resistance: imperfect information; inadequate diagnostics; weak laboratory capacity; inappropriate prescribing (Ventola, 2015); the use of antimicrobials as “just-in-case” treatment; the prescription of “broad-spectrum” antimicrobials (National Institute of Allergy and Infectious Disease [NIAID], 2011); inadequate programs for infection prevention and control; poor access to health services (Littmann & Simonsen, 2019); and, poor-quality medicines.

In the agricultural and livestock sector, market demands further contribute to misuse. As consumers demand cheap meat, farmers reduce production costs by implementing short-cut practices. Antibiotics are used as growth promoters (Spellberg, Bartlett, & Gilbert, 2013) and to prevent treatment of infections in livestock (Chattopadhyay, 2014). Citizens’ lack of knowledge and their unwillingness to change behavior contribute to the misuse of antimicrobials in the agricultural sector. The threat agent, in turn, continues incubating in the agricultural sector. The availability of few new antibiotics and regulatory barriers for new antibiotic approvals (Ventola, 2015) add to this complex and interactive cycle, which allows the crisis to grow and spread across economic sectors and, as we will see below, geographical locations.

After an initial accumulation of the problem, and the creation of resistant bacteria, several conditions can individually or collectively facilitate its onward transmission. Bacteria spread if conditions in society, hospitals, the agricultural sector, or in the environment are beneficial for transmission (Organization for Economic Co-operation and Development [OECD], 2018). Such conditions include poor sanitation, inadequate access to health services, dirty water, poor infection control, and lack of vaccination (World Bank, 2019). The uptake and spread can also develop through the food chain, wildlife, water distribution infrastructure, as well as through food imports, migration, and trade (Harbarth et al., 2015). Bacteria can travel to hospital settings through contact between healthcare staff and patients, and through contaminated surfaces and medical equipment (Anderson et al., 2019).

These conditions represent a fertile environment for the threat agent to first incubate and then unfold over space. External trends beyond the system of antimicrobials such as population growth, migration, travel, and urbanization (World Bank, 2019) offer several possibilities for transboundary movement and transmission to seemingly unrelated contexts and sectors. Resistant bacteria can therefore turn up anywhere, at any time. This speaks to the random flare-ups in time and space in creeping crisis, an issue toward which we now turn.

2.3 RANDOM OUTBREAKS AND PERIODIC ATTENTION

AMR is characterized by fairly random “precursor events” that, as a creeping crisis perspective suggests, signal the extent of the problem, and which are sometimes—but not always—followed by increased public attention. The prevalence of precursor events highlights the intertwined dynamics of actual events and attention, further demonstrating the combined objective and subjective notions of a creeping crisis. Objectively, the threat morphs in different systems, breaking out occasionally across time and space. Subjectively, a precursor event is identified as a crisis in some situations, sometimes framed as indications of a future crisis, and sometimes not treated as a crisis at all.

2.3.1 *Precursor Events*

A clear feature of the AMR problem is that we live with the threat. In 2017, nine of the world’s most dangerous superbugs were found in London’s transport network; 12.8 million people ride along with these invisible bacteria everyday (Keegan, 2018). The public hospitals in Hong Kong report one new superbug infection every 18 minutes (Keegan, 2018). These regular, ongoing events demonstrate that creeping crises do not always escalate toward tipping points. AMR occasionally (and increasingly often) causes individual and societal harm in a random fashion.

Many precursor events remain hidden from public view (Belluz, 2019). Outbreaks differ in scope and characteristics. They can be minor or major, burn fast or slow, and be moderately or hard to contain. All have in common that they have the potential to cause harm. The harm caused can occur in two ways: (1) when the infected microbial is resistant from the start; and (2) when resistance develops during treatment (MacIntyre & Bui, 2017, p. 3). This section will outline a few precursor events and illuminate how random outbreaks can be as they tip over in rapid escalation.

One way to define a tipping point in the development of AMR as a creeping crisis is the sudden community- or hospital-based outbreaks of resistant infectious diseases. It is difficult to distinguish between minor and major precursor events in this creeping crisis. Minor events may be outbreaks that are limited in space. Major outbreaks might be more epidemic-like, evolving across space.¹ It is, however, problematic to

¹A distinction can be made between an outbreak, an endemic, an epidemic, and a pandemic. Outbreaks can turn into epidemics, if not quickly controlled. AMR is an endemic condition (MacIntyre & Bui, 2017, p. 3).

distinguish the two since it is not always clear if a superbug has evolved over space and tipped over in an outbreak.

In 2007, a gene resistant to the “last-resort” antibiotic *carbapenems* was first detected in a patient in India. It turned up in surface waters in urban India in 2010. Less than three years later, it had migrated to other parts of the world. It even ended up in the High Arctic, an area where humans rarely reside (Graham, 2019). In 2019, the WHO was informed about several cases of infections caused by the antibiotic-resistant *Pseudomonas aeruginosa* in US hospitals. The majority of patients were hospitalized due to complications associated with infections that they had obtained following invasive procedures in Tijuana, Mexico (WHO, 2019c). These cases illuminate how easy resistant bacteria can migrate across sectoral and geographical boundaries, although not necessarily tipping over in a minor or major precursor event.

Major precursor events cause broader harm at societal and individual level. New York City suffered a widespread outbreak in the early 2000s. It was the resistant *Enterobacteriaceae Klebsiella pneumoniae* that initially appeared as sporadic outbreaks throughout the city. It soon spread throughout the US and eventually migrated beyond the US. In 2005, one case turned up in France (in a patient who had previously been hospitalized in NYC) (Bratu et al., 2005).

The first major outbreak of *Klebsiella* outside the US was in Israel 2006 (Bratu et al., 2005; Arnold et al., 2011), where it spread like wildfire through the health care system. Israel’s Ministry of Health had no mechanism in place to detect the threat and to intervene. However, a group of infection prevention and control experts launched regular meetings where they shared data and discussed responses. Experts were mobilized and participated in situation assessment and response measures. One of the specialists was Dr. Mitchell Schwaber who later lent his expertise to a WHO-funded committee appointed to suggest global guidelines on how to combat Carbapenem-resistant bacteria, such as *Klebsiella pneumoniae* (WHO, 2017).

In 2016, Pakistan experienced an outbreak of *Typhoid fever*. Between 2016 and 2018, 8188 typhoid fever cases were reported; 5274 of these were extensively drug resistant (XDR). In 2018, the *XDR typhoid fever* had transmitted internationally through persons that had traveled to Pakistan. Six cases turned up in other countries—one in the UK and five

in the US (WHO, 2018). Both the *XDR Typhoid fever* and *Klebsiella* outbreaks demonstrate that precursor events may be connected. It also shows that they do not necessarily result in further escalation. They may well turn up as individual random cases. This randomness allows for the continuing creeping of the crisis.

2.3.2 *Periodic Attention*

Precursor events such as those outlined above can generate periodic attention from politicians, media, and experts, albeit in unpredictable ways. It is attention that determines whether a threat remains creeping or is elevated to a crisis construction.

Politicians, Policymakers and the Public

The most regular attention given to AMR, irrespective of actual precursor events, comes from international organizations and experts (an intertwined relationship, as discussed further below). Regarding policymakers, for instance, the WHO and the United Nations (UN) frame AMR as a major threat to public health (WHO, 2020; UN, 2016b) and the World Bank frames it as a threat to our economic future (Jonas, Irwin, Berthe, Le Gall, & Marquez, 2017). The WHO describes the increasing resistance level as a “global crisis that threatens the future of our most precious drugs: antibiotics” (WHO, 2019b). The UN, international agencies, and experts recently called for an ambitious, urgent, and coordinated action to avert a full-blown crisis (IACG, 2019).

Scientists warn this is the greatest danger humanity has faced in recent times. England’s chief medical officer has warned about an “antibiotic apocalypse” (McKie, 2017). The British Society for Antibiotic Chemotherapy argues that AMR is the “other” pandemic lurking behind Covid-19 that needs to be addressed with similar urgency (British Society for Antimicrobial Chemotherapy [BSAC], 2020). Back in 2014, the former UK Prime Minister David Cameron warned, “If we fail to act, we are looking at an almost unthinkable scenario where antibiotics no longer work and we are cast back into the dark ages of medicine” (AMR Review, n.d.). Subsequently, he commissioned a Review on Antimicrobial Resistance. The economist Jim O’Neill was asked to analyze the global problem and to propose actions to tackle the issue internationally. The scholarly literature on AMR has doubled the last decade thanks to increased funding. Funders have specifically called for interdisciplinarity and

recognition of the value of joint perspectives since the problem of AMR spans across sectors and disciplines (Chandler, 2020).

The first response to AMR on the international level was in 1998 when the WHO published its resolution on antimicrobial resistance (WHO, 1998; Wernli et al., 2017). Ever since, attempts have been made to address the AMR problem on a global level. International attention culminated in 2015 when the 68th World Health Assembly agreed on a Global Action Plan on AMR. Since then, the highest political levels of the international community seemed to have accepted the gravity of the problem. It was put on the G7 agenda in 2015 and on the G20 agenda in 2017.² In 2016, the UN high-level meeting on AMR resulted in a political declaration on AMR (Resolution A/RES/71/3) (UN, 2016a). In 2017, the UN Secretary General established an Inter-Agency Coordination Group (IACG) on AMR (IACG, 2018). To date, five major documents from key UN organizations have been published, warning of the importance of acting on AMR.³

Not long after the WHO's initial attention, the EU began addressing AMR and healthcare-associated infections by recognizing them as public health crisis in need of management (Commission Decision 2000/96/EC, 1999; European Parliament and Council Decision 2119/98/EC, 1998). The European Commission established the European Antimicrobial Resistance Surveillance System (EARSS) in 1998.⁴ In 2001, it published the Community Strategy against AMR (European Commission, 2001). Ever since, the European Commission and its agencies have been working closely with member states to address the issue. One main activity has been surveillance. Awareness campaigns have been implemented, Action Plans have been compiled, and a "One Health Network and Action" plan was presented (European Commission, n.d.), to mention a few examples.

²In 2015, the G7 published a report where all countries committed to develop National Action Plans (NAPs) (Federal Ministry of Health, 2015). In 2017, AMR was put on the agenda of the G20 meeting. Members agreed to lead by example in developing and implementing NAPs by the end of 2018 (G20, 2017).

³The documents were produced by WHO; World Bank; Food and Agricultural Organization (FAO); IACG; World Organization for Animal Health (OIE). These documents are all non-academic papers articulating recommendations for interventions to be implemented.

⁴The network collects and reports data on resistance of several bacterial pathogens across European countries. The first decade after its establishment, this network was run by the Dutch Institute of Public Health and the Environment (*Rijksinstituut voor Volksgezondheid en Milieu* [RIVM]). Today, it is coordinated by the ECDC under the name EARS-Net.

Several member states have used their Presidency of the Council of the EU as a platform to bring attention to the problem. Some countries that focused attention on AMR during their chairmanship include Denmark, Sweden, Belgium, and the Czech Republic (Allerberger, Gareis, Jindrák, & Struelens, 2009).

The EU and WHO have launched various antibiotic awareness campaigns over the last two decades. With little success, however; the wider public is still unaware of the problem in most regions of the world (WHO, 2015). The belief that antibiotics are effective to treat viral infections is still widespread.

Sporadic Media Attention

Despite warnings from scientists and the international community, the media and national governments have given this creeping crisis only periodic attention. In the early 1990s, the media echoed concern from the medical literature when reporting about the methicillin resistant *Staphylococcus aureus* (MRSA). Media attention to AMR shifted notably in 1997, when new, dramatic language emerged in media narratives. Frequent reference was made to AMR and “killer superbugs” (Capurro, 2020, p. 3). Apocalyptic post-antibiotic scenarios were described (Brown & Crawford, 2009) with headlines like “Deadly germs, lost cures” (Richtel & Jacobs, 2019), “Attack of the Superbugs: July 2041” (*The Economist*, 2019), and “What Superbug Hunters Know That We Don’t” (McCarthy, 2019a).

This type of rhetoric has ever since been prevalent in the media coverage on AMR. The problem is typically presented as a conflict between nature and medical progress. Articles have increasingly focused on the ability of bacteria to develop human-like characteristics with the ability to outsmart the scientific community (Washer & Joffe, 2006). Superbugs have also been presented as impossible to control as they move across spatial and geographical boundaries (Brown & Crawford, 2009). Indeed, much media coverage treats AMR as a *force majeure*—emerging and evolving in nature, propelled through lifestyle choices, and on a trajectory that is difficult, if not impossible, to change.

A recent study found that North American newspapers do not present an explanation of the biological process leading to AMR (Capurro, 2020, p. 9). The underlying causes of the problem are not explained to the wider public, although individuals are partly responsible (DeSilva, Muskavitch, & Roche, 2004; Capurro, 2020; Collins et al., 2018). Equally absent is

coverage of the actors responsible for managing the threat. Governments and the pharmaceutical industry are identified as the main actors; other actors are mostly ignored in the reporting. AMR is often portrayed as caused by a few industries, despite the wider complexities involved, and blame placed on modern societal practices such as globalized economies, farming, environmental degradation, insufficient water management, and deficient health care systems. In the UK (Collins et al., 2018), media coverage is instilled with attributions of blame and conflict over responsibility (e.g., doctors, patients, or industry). In contrast to Capurro's (2020) findings, however, the responsibilities of the pharmaceutical industry and the agricultural sector were found to be rather marginalized in the UK media coverage of AMR in comparison to the North American newspapers.

Reporting clearly differs between countries. Bie, Tang and Treise (2016) found that reporting about the new superbug NDM-1 (discovered in India in 2008 and eventually emerging in the UK and other countries) differed considerably between the UK, the US and India. The UK and US media associated the issue with fear and dread, and used more emotionally loaded words, when compared to India.

In sum, AMR garners regular warnings of international organizations, experts, and the media, although these warnings only occasionally coincide with actual outbreaks—thus speaking to the lack of synchronicity between outbreaks and attention. Equally intriguing, events and attention lead to only uneven and insufficient responses to the crisis.

2.4 CONCLUSION

This chapter describes a vivid case of a creeping crisis evolving across built and natural environments. The threat potential is still accumulating over time and space. It sometimes “tips” into outbreaks that garner occasional attention but rarely elicit a full-scale crisis response. The impending crisis is well known to the international community. Repeated efforts have been made to stoke a response, including the adoption of multilateral agreements in the WHO promising action (WHO, 2015). Meaningful responses at national levels, however, are rare—and not only in less developed countries (Bonk, 2015). Richer nations in the world are also resistant to clamping down on the root causes of this deepening problem.

The chapter highlights the objective and subjective perspectives that together help to understand creeping crises. Objectively, AMR reminds us

that creeping crises may emerge across systems due to the complex relations between the human and natural worlds. We recognize that human, animal, food, and environmental features are interconnected and propel the creeping crises. Subjectively, the case confirms that, for a problem to become a crisis, political elites, media, and public need to share a common belief that is indeed a “crisis.” This has not been the case with AMR. Precursor events bring momentary attention by local leaders but as soon as an outbreak is contained, the attention fades away. Crisis framings do not seem sufficient to prompt a response.

This particular creeping crisis appears to resist early detection. Outbreaks, or in the language of this volume, precursor events, occur occasionally, seemingly spontaneously, in various forms (e.g. individual incidents or epidemic-like spreads). Due to the complex relations between the human and natural worlds, outbreaks can materialize anywhere at any time, regardless of its origins. The enabling conditions by which AMR thrives are still developing in places where the response has been insufficient. It may therefore snowball because of distant drivers, but we can hardly see when and where this snowball will begin its journey. Effective management of this crisis will require renewed thinking about how to detect tipping points in its development.

Finally, the case of AMR highlights the difficulties of attributing crisis ownership. The problem requires a wide array of actors, at micro- and macro-levels of society, to respond: individuals, industries, professions, and governments. A focus on precursor events, rather than stopping the march toward a massive crisis down the road, leads observers to point to specific “owners” in specific events. Efforts to attribute blame, though, ignore deeper questions about whom—and how—we must address root causes that appear quite far from the immediate problem. Few actors are willing to step up to act. Under such conditions, sweeping crisis responses are unlikely.

AMR thus bears the key characteristics of a creeping crisis, with all the challenges and paradoxes that our theoretical approach helps to uncover. The threat is diffuse and random. Responses are hampered by ownership complexities and societal dependencies, since everyone needs antibiotics even though they have the potential to kill us. As one author warns, “no magic bullets will make the problem vanish. It will be with us forever” (McCarthy, 2019b). This study raises the concerning question, then, of whether we may have to live with creeping crises.

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