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Living with bacteria. Configurations of antimicrobial resistance
in Austrian hospitals

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During my PhD, I descended into darkness, thankfully only genre-wise; the darkness in literature, music and movies felt strangely uplifting and comforting – not a coincidence, I believe. Dystopian, apocalyptic visions are never far when thinking and reading about AMR, but strangely, raging doom metal sounds, dystopian sci-fi and horror writings kept me motivated and lifted my spirits. I learned so much in non-academic spaces that carried and shaped me, helped me to ask questions and to become – and, more importantly, remain – curious. Literature taught me to take seriously language, context, politics and the living arrangements of humans and nonhumans. Books and movies helped me, perhaps more than anything else, to conceive of complexity not only as overwhelming, but also as engaging and invigorating: Marlen Haushofer, Toni Morrison, Octavia Butler, Mariana Enriquez, Lauren Berlant, just to name a few ...

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Introduction

The emergence of the first COVID-19 cases and the subsequent onset of a global pandemic of unprecedented scale shifted public awareness about pathogenic threats. Public health officials and scientists not only analysed microbial presences, their pathogenic potential and their mobility throughout the pandemic, but also scrutinized one of COVID's most dramatic sites: hospitals. While this is not a work about COVID-19, it started in 2021 in the time of COVID-19, and shines a spotlight on another microbial threat, often called a *silent pandemic*: antimicrobial resistance (AMR). The intensifying and increasing resistance of bacteria to antibiotics – one of the key substances of modernity – asks us to reconsider what life might look like for humans without effective antibiotics, how this situation came about and how we might re-configure a future in the face of this dreadful prospect.

At most times of the day and during our lives, bacteria remain non-explicit biological material, invisible to the naked eye, often unnoticed. But from lay person to patient, health care professional, politician or scientist, everyone is affected in some way by the condition of AMR, and scholars from various fields are scrutinizing and making explicit bacteria and their relations to humans. The modern contract of bacterial control and containment through antibiotics, valid during the past century, has lapsed. It is the very nature of the issue of AMR that in contrast to other microbes known for their pathogenic potential, the presence of resistant bacteria is ambiguous. Resistant bacteria are not inherently pathogenic. Yet their presence indicates a deeper problem: should their pathogenic potential be realized, the therapeutic means of controlling the infection may be compromised. A bacterial presence can turn into an infection, and the means of treatment – antibiotics – may not work in controlling, eradicating or minimizing the infection-causing bacteria, which can ultimately end fatally for the infected human.

It is the tension between bacterial presence and pathogenic potential in the nature of AMR that lies at the heart of this thesis. I examine the ways that professionals in hospitals are dealing with this bacterial uncertainty – the potential to turn pathogenic – that denies the clarity so eagerly longed for in biomedicine. I explore the ambiguity of living with bacteria, which is negotiated in the high-stakes environment of hospitals, where bacteria easily pose a great threat not only to patients, but also the hospital as a whole. I consider how the necessity of bacterial life is weighed against the danger of bacterial life, and how antibiotics can be safeguarded while also providing the best care. This doctoral thesis takes these rather existential considerations about humans living alongside bacteria and actualizes them by following one of the most pressing global health issues in one particularly affected institution: the hospital. In hospitals around the world, professionals navigate between the abstract global threat of AMR, the therapeutic failures to treat resistant infections at

the bedside, and the conflicting demands of individual care and system-wide reliance on antibiotics. This tension is simultaneously one of concrete practical necessity, because resistant bacteria can cause the death of humans, while also being an abstract conceptual one, since AMR could also cause the collapse of systems as we know them. It is exacerbated because the living arrangements, the functioning of biomedicine and the logics of production and reproduction rely on “antibiotics as infrastructure”, an infrastructure increasingly in distress due to bacterial resistance.

The problem of AMR makes visible and significant certain grey areas and ambivalences in living with bacteria as humans, where simple dichotomisations of “good” and “bad” bacteria fall short if we want to take the issue seriously. Sariola and Gilbert (2020) powerfully summarize these ambivalences that we encounter in the Anthropocene:

We thus arrive at the powerful ambivalence of microbes in the Anthropocene. On the one hand, microbes are defined as the foremost enemy of humans. In our failed attempts to eliminate microbes from our lives, the Anthropocene has created the conditions for recombinant viruses and antibiotic-resistant bacteria. On the other hand, we have recognized that microbes are part of our very being. Our health depends on the symbiotic bacteria that helps build and maintain our healthy bodies. (Sariola, Gilbert 2020: 2)

It is important to look at how this paradox of abundance and absence plays out in hospitals, precisely because they are very modern institutions which render microbes as enemies. It is also in this sense that classical models of contamination, contagion, disease and pathogenicity – where bacteria *x* is causing disease *y* – are insufficient. AMR urges us to rethink concepts and models and call attention to pathogenicity and infections as socio-ecological phenomena, not happening solely to the body, but always in relation to the body’s embeddedness in specific configurations (Foucault 1973, Hinchliffe et al. 2013, Lorimer 2020). A growing body of literature takes note of shifting roles for antibiotics, bacteria as well as humans within a broader ecology (i.e. Landecker 2016, Chandler 2019, Kirchhelle 2023, Hinchliffe 2021). I engage with these scholarly discussions and anchor them in the complicated context of hospitals, where antibiotic governance, manifested in dichotomised approaches to “good” and “bad” bacteria and preventive, all-encompassing use of antibiotics to create a safe, seemingly microbe-less environment, have ruled institutions for so long. The research questions guiding this thesis concern the configurations of living with and against bacteria in the face of AMR, in particular, how notions of hygiene, pathogenicity, infectivity and bacterial risk are shaped by the governance of AMR in Austrian hospitals. Inevitably, my focus on hospitals joins the ranks of studies that discuss AMR as a problem of and for hospitals, a problematization rightfully critiqued by social science scholars (Landecker 2019). But this thesis takes up the critique of the knowledge production surrounding AMR as being too narrowly focused on hospitals. Through ethnographic research in hospital environments, my material empirically buttresses our understanding of how professionals, through their practices inside the hospital, are

wilfully trying to de-centre the hospital and engage with AMR as a more-than-human, more-than-biomedical issue that extends beyond the hospital walls.

I argue that AMR governance in hospitals is best understood as a situated, relational ensemble of practices that aim to specify bacterial risk amid the uncertainty of AMR, organized by two interlinked epistemic formations: (1) bacterial profiling: the way that bacterial risk is made legible and actionable; and (2) scarcity holism: the way that ecological framings are mobilized to conserve antibiotics as scarce, infrastructural goods. I developed these concepts as a result of my research and data analysis.

Bacterial profiling, a technical term used in microbiology, is employed here to represent the epistemic culture encompassing an ensemble of practices in the hospital – monitoring, sampling, swabbing, analysing, interpreting and mediating – through which hygiene and infection teams approach bacterial presence and negotiate its risk. Rather than treating bacteria as simply “good” or “bad”, bacterial profiling foregrounds the situated, ecological evaluations that are made about bacterial colonization and pathogenic potential. It sheds light on the mundane, often overlooked hygiene practices that are as much a part of AMR governance as the more visible and glamorous stewardship programmes promoted by hospitals. With this, I argue for the importance of mundane hygiene work, and the need for hygiene to be seen as *infrastructural* in hospital work. Thus, while hygiene often plays a subordinate role, primarily as a measure of compliance with AMR regulations, hygiene practices should be seen as an infrastructural component of hospital work in its entirety.

Scarcity holism, on the other hand, is a term employed here when zooming out to scrutinize the socio-political constellation within which AMR governance, including bacterial profiling, takes place. The term indicates the coupling of a normatively charged sense of scarcity – not only of antibiotics but also of bacterial communities and diversity – with relational, situated approaches that problematize human–bacteria–environment relations. I demonstrate this empirically by showing, across studies of hygiene, pathogenicity and bacterial risk, how professionals enact AMR holistically under conditions of antibiotic scarcity. They treat categories and boundaries as permeable, whether across hospital walls, the skin or national borders. In each case, antibiotic scarcity does not just constrain action, it reconfigures what counts as hygienic practice, pathogenic threat and risk-worthy bacteria. AMR challenges the contours of biomedical hospital work by breaking up borders and boundaries, bringing in the environment, thinking through entanglements, and positioning AMR as a human-bacteria-environmental issue.

The result is not a problem solved or a rosy and happy cohabitation of humans and bacteria in a probiotic hospital. Instead, I show the messy, fraught and complex negotiations that hospital professionals – hygienists, infectiologists, hygiene physicians – are facing daily. A more abstract crisis – AMR – is looming over the concrete practices supporting patients to get better or to not

die. It is not a straightforward process of top-down policy implementation with a clear sense of how best to encounter bacteria, but an ongoing process involving the negotiation of varying logics, temporalities and scales: in short, the negotiation of bacterial ambivalence writ large.

The three papers in this thesis explore these negotiations through different fields of practice. The main concerns and issues are common across all three papers and relate to the tension of how to configure an urgently needed recalibration of bacterial encounters while operating within structures and institutions that cling to long-established modes of doing biomedicine and managing hospitals. The sub-questions that emerged from my data analysis relate to three empirical categories that are key to the governance of AMR in Austrian hospitals and form the basis of the case studies explored in the papers. The first of these is hygiene management, driven by a targeted unit in hospitals with the responsibility to create safe and clean hospital environments, attending specifically to bacterial presence. The second is infection management, driven by a separate hospital unit and focusing on managerial medical attendance to bacterial presence, but more directly involved in biomedical treatment and work on the wards. Both these cases come together in the third empirical category of the construction of bacterial risk profiles through screening schemes, which also plays an integral part in the management of bacterial presence, antibiotics and hospitals per se in the wider European and global landscape. An overview of the papers and their publication status is given below.

Article	Title	Journal	Status (27.2.2026)
I	Hygiene as infrastructure: antimicrobial resistance and the ambivalence of bacterial life in Austrian hospitals	Anthropology and Medicine	major revisions submitted, pending acceptance (27.2.2026)
II	From innocent bystanders to pathogenic bacteria: Navigating bacterial presence and pathogenic potential in hospital infection management amidst antimicrobial resistance	Social Science and Medicine	Submitted (27.2.2026)
III	Pathogens, borders, and ‘Ausland’: Bacterial risk profiling and the governance of antimicrobial resistance in Austrian hospitals	Global Public Health	submitted, 19.2.2026

Table 1: Overview of the three publications

AMR in context

What is AMR?

In 2025, the World Health Organization (WHO)'s landmark *Global Action Plan on Antimicrobial Resistance* (2015) marked its 10-year anniversary. As early as 1958, Hannah Arendt had already identified antibiotic resistance as part of the human condition (Arendt 1958, as cited in Landecker 2016: 27f.). The publication of the WHO document more than half a century later finally positioned AMR on the global health stage, accompanied by fearful anticipation of a silent pandemic, and dystopic renderings of a grim future without antibiotics (Brown, Nettleton 2017, Brown 2023). There is some vagueness to the term “antimicrobial resistance”, but broadly speaking it describes the process in which microorganisms such as bacteria, viruses, fungi or parasites lose the susceptibility to antimicrobial substances that aim to minimize, eliminate or control these microorganisms, e.g., in the case of infection (WHO 2015). AMR, then, is the consequence of microorganisms developing mechanisms of resistance to antimicrobials. In my research, I focus on specific antimicrobial substances that target bacteria, called antibiotics. If bacteria become resistant to antibiotics, they become drug-resistant bacteria or multi-drug-resistant bacteria. For the thesis, I use the broad term AMR, which is commonly used to refer to antibiotic resistance.

Situating AMR in Austria: a short note on the policy situation in Austria

Austria with its little more than nine million inhabitants, geographically located in the middle of Europe, considers itself to be mid-table in terms of antimicrobial resistance rates. Looking south, east, or north of the Austrian borders is a common practice when talking about AMR in Austria. Experts often refer to the Nordic countries or the Netherlands as role models, while countries to the south and east of Austria are often seen as a threat and danger to the Austrian system and resistance rates, since these countries are seen as having weak policies and poor performance in AMR governance, resulting in high resistance rates. Austria's practice of relating itself to other countries and positioning itself as a country within a wider European landscape of resistance is thoroughly analysed in one of my papers (III). At this point, I want to provide some background information on how AMR governance in Austria is regulated, to convey a sense of the context and frameworks within which hospital professionals act on AMR.

Organised like the federal state, the Austrian healthcare system is characterised by decentralised governance and high degrees of federal decision-making. While Austria was an early adopter of actions such as developing a national action plan and antibiotic stewardship programmes, the decentralised nature of Austrians health care governance hugely complicates AMR governance, as Jeleff et al. (2023) note in their analysis of the AMR implementation gap in Austria. This point is substantiated in my data and is evident for example in the fragmented landscape of data gathering

and surveillance tools. Several tools are in use in different states, for example Vienna and Lower Austria use ANISS (the Austrian Nosocomial Infection Surveillance System), whereas Tyrol, Vorarlberg and Salzburg feed in data to the German-based surveillance system called KISS (*Krankenhaus-Infektions-Surveillance-System* or Hospital Infections Surveillance System). But then again in Vienna, hospitals putting in data to ANISS complain that the largest hospital in Vienna, the General Hospital, is not part of ANISS, thus impeding local Viennese efforts to collaborate e.g., via warning signals.

No less fragmented are the Austrian regulations on hygiene and mandatory hygiene teams in hospitals. There is no Austria-wide legally binding regulation: at the federal level, there are only recommendations and minimum requirements. Published as early as 2002 and last updated in 2024, PROHYG is the Austrian policy document on hospital hygiene, but it is considered only as a strong recommendation (Kuppelwieser et al. 2018). PROHYG provides guidance such as how to calculate optimal numbers of hygiene-team members in relation to the type of hospital or number of beds (ibid). While this guided approach allows for flexibility and strategies that are targeted to localized situations and contexts, the system has been criticized for relying heavily on individual motivation, while it “lacks incentive structures” (Jeleff et al. 2023). This is a tension I encountered in my fieldwork as well, and it manifests at various levels. For example, while it is apparent that hospital hygiene is fundamental for the functioning of hospitals, its image and economic role are quite fraught. Hygiene professionals are well aware that they operate in a difficult space, not only in terms of their tasks, but also in their hierarchical relations within the hospital and among colleagues, the lack of external (inside and outside the hospital) acknowledgement of hygiene as an issue, and the shortage of dedicated hygiene staff. Because of the lack of incentive structures, Jeleff et al. (2023: 16) conclude that the situation in Austria is characterised by the high priority given to “agenda conformity”, with less actual long-term AMR measures. This is discussed by Broom et al. (2021) as a problem of values that is apparent in AMR governance more broadly, where quantified results, short-term measures and intervention in individual behaviour are prioritized over systemic and cultural analysis with a focus on long-term outcomes. While the authors don’t refer to Austria, they discuss an approach that is similarly observable in Austria.

In the next section, I lay out which methodological approaches guided me in answering my research questions.

Methodology: situating AMR in a policies–practices–materialities complex

Research questions

AMR crystallizes the stakes, tensions and inevitable entanglements that humans share with bacteria. In this doctoral thesis, I set out to explore how professionals negotiate relations with potentially

resistant, potentially pathogenic bacteria in a high-stakes environment such as a hospital, where the vulnerability of patients quickly turns bacterial encounters into threats. In this context, the ways in which Austrian public health officials choose to act politically on AMR tells us a lot about how this human-bacteria relationship is understood. I specifically wanted to convey a moment in time, where modes of antibiotic governance – i.e., efforts to eradicate bacteria – are put into question. Along with other enormous challenges due to environmental degradation and the climate crisis, and multiple other microbial crises, such as COVID-19, bird flu, Ebola or polio, this necessitates a recalibration of how humans live alongside and with bacteria. Against the backdrop of the policy situation in Austria, this thesis aims to ethnographically detail the enactment of AMR along vague policies and add to a discourse of AMR beyond behavioural change framings but as socio-political, planetary issue.

With this in mind, I formulated the following two research questions at the beginning of the project:

- How are the tensions between living with and against bacteria lived and decided within a hospital qua: (1) policies and discourses; (2) materialities and technologies; and (3) actors and practices?
- How is the management of antimicrobial resistance (AMR) in Austrian hospitals organised in terms of materiality, policy, practices, epistemic and ontological aspects?

This thesis aims to ground questions of AMR governance in the everyday practices of professionals in Austrian hospitals, thus centring the co-constitutiveness of practices, policies and materialities in the configuration of AMR governance. To achieve this, I combined the analysis of relevant policies with a hospital ethnography. The combination of the two was crucial in order to substantiate what Shore et al. describe as anthropology's contribution to policy studies which

(...) lies above all in its sensitivity towards the way in which policies work as instruments of governance, and its concern to explore how policies are understood by differently situated actors (...) The challenge is to study policies as they develop and as they are enacted in everyday practice. That, in turn, requires a concept of policy very different from that of conventional policy science; to use the terminology of Science and Technology Studies, it calls for an idea of policies as 'assemblages' rather than as discrete 'things'. (Shore et al. 2011: 20).

Against the backdrop of qualitative methods education during my studies in anthropology, I sought to understand the everydayness of practices that are considered as policymaking (Shore et al. 2011, Wagenaar 2011), and the relationship between policies as something abstract and the practices surrounding the policy issue of AMR.

Thus, methodologically, I build on a repertoire of approaches from critical policy studies and medical anthropology that, in a poststructuralist manner, emphasize: (1) the multi-sidedness, entanglements and relationalities in negotiating a subject of concern; and (2) put forth a specific

understanding of policies that deviates from conventional policy research (Bacchi 2009:1) aiming towards solving policy problems but setting aside the terms, meanings and values inscribed in the framing of problems as well as their envisioned “solutions”.

The policies-practices-materialities complex

To foreground the theoretical assumptions that underpin my methodological approach, I came to think about the policies-practices-materialities complex that configures the governance of AMR in Austrian hospitals. This is illustrated in Figure 1, which shows the overlapping dimensions of policies, practices and materialities.

The policies-practices-materialities complex is fed by the different disciplinary entanglements of comparative and critical policy analysis (policies), medical anthropology and ethnography (practices) and science and technology studies (materialities and nonhuman elements) that each accentuate different approaches and foci in their disciplinary tradition, but also each emphasize the relationality, entanglements and co-constitutiveness of practices, policies and materialities.

This thesis occupies a niche spot in bringing into conversation the three porous units of analysis of policies, practices and materialities.

This means substantiating a specific constructivist, practice-oriented understanding of policies as put forward by an interpretive strand in

policy analysis based on the works of Bacchi (1999, 2009) Shore et al. (2011) and Shore and Wright (2003). With Shore and Wright, I understand policies to be organizational principles that produce meanings but equally reflect them (2011: 1f.). Actors produce and enact policies, they make sense of them daily through practices, discourses and materialities, thus enacting and configuring them as much as following them.

Further, with my two guiding research questions in mind, I found it helpful to take up Bacchi’s (1999, 2009) approach to analysing policies as questions concerned with how an issue is problematized, i.e., who is articulating the problem, in what ways, through what means, and what kind of hegemonic knowledge is produced through these problematization practices. In that sense, the question of living with bacteria in the context of AMR is concretised in asking how professionals in the hospital problematize AMR as well as how they problematize the relation to antibiotics in their everyday doings of hospital work and patient care.

With this poststructuralist methodological substrate in mind, AMR as a problem presents itself not as an objective fact with clear contours, but as a process of societal interpretation, choices and specific configurations of problem representation (Bacchi 1999:1). This interpretative approach

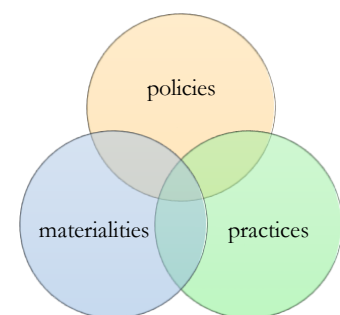


Figure 1: Policies-practices-materialities complex

rejects the idea of policies as neutral regulations and policy-making processes as linear, but rather stresses the messiness, tensions and ambiguity of such processes. In that sense, my approach to AMR complicates major institutional narratives, such as the WHO's One Health framing, precisely in fleshing out the messiness, tensions and negotiations that take place in hospital settings on a micro-level. I analysed the policy-documents issued by stakeholders on different scales like the WHO, the European Centre for Disease Control and Prevention as well as regulations from the federal government and federal states, their relation to each other and how they are brought into play in hospital practices.

Hospital ethnography

I initially designed this project as a one-site hospital ethnography. After an excruciating year of ethics processes at the hospital that I had identified for my fieldwork, I was able to establish connections with gatekeepers. I was finally granted ethical clearance and access only to be overruled by the legal department of the hospital. Ultimately, I was denied access to this specific hospital. Consequently, I adapted my research design and visited multiple hospitals in Austria to conduct qualitative interviews and in some hospitals, ethnographic observations.

Between 2021 and 2023 I conducted 21 semi-structured interviews and completed 8 days of observation in 4 different hospitals.

Interviews	#	Observations	Days	Speciality
Infectiologists	3	Hospital a	3	hygiene team/microbiology lab
Hygiene team members	9	Hospital b	1	hygiene team
Nurse or physician on ward	2	Hospital c	3	emergency room/intensive care unit
Patients	2	Hospital	1	infectiology
Lab analysts	1			
Professionals external to hospitals	4			

Table 2: Qualitative interviews and observations

The interviews and observations were the most integral part of data gathering and led me to the spaces where work on AMR takes place: hospitals, labs, research institutes and government offices. I designed an interview guide for semi-structured interviews (Prainsack, Pot 2021, Lareau 2021) around the thematic blocks of practices, materialities and technologies, policies, human-bacteria relations, hygiene and actors. Some of the interviews were followed up by visits for a day or more in the interviewees' places of work. During these observations, I followed the teams through their daily work routines on different wards, paid close attention in an ethnographic sense to the interactions the professionals had with colleagues and patients, as well as with materialities and technologies. This included what they did with their hands in an environment where the hand is a

crucial medium of touch, care or washing. This allowed me to get a sense of how practices such as handwashing or cleaning surfaces with a sponge are always embedded in material and social relations.

I conducted the interviews in German, recording them with a device and subsequently transcribing them. During and after interviews and especially following the observations, I took detailed fieldnotes (Emerson et al. 2011, Lareau 2021), which served me together with the transcripts and written policy-documents as the material that I analysed using the software MAXQDA. The coding process was guided by both Situational Analysis (SitA) and Constructivist Grounded Theory, which I explain below.

Using SitA I carried out an ongoing process of drawing different types of maps, and these visualization techniques formed an integral part of my data analysis (Clarke et al. 2022). Crucially, the mapping practices accompanied the whole research process and encouraged constant engagement with the data right from the beginning. SitA is an interpretative qualitative inquiry focusing on situations as units of analysis, where a given social phenomenon occurs. In my case, the situation under study was the management of bacterial encounters in hospitals. A situation, according to Clarke, is constituted through the entanglement of various human and non-human actors, discourses, policies, symbols, materialities and practices. Relations and networks between actors are of analytical importance and are displayed through different types of mapping, thus also allowing for the inclusion of heterogenous forms of human and nonhuman actors and elements. This important postmodern, feminist methodological intervention opened up ways for me to approach human-bacteria relations in a policies-practices-materialities complex.

Constructivist Grounded Theory (Charmaz 2014) was used as a guiding principle to explore themes, relations, tensions, categories that evolved out of mapping in more depth and structure. Through these processes my core categories and ultimately, the paper structure for this thesis emerged.

Research questions	- How are the tensions between living with and against bacteria lived and decided within a hospital qua: (1) policies and discourses; (2) materialities and technologies; and (3) actors and practices? - How is the management of antimicrobial resistance (AMR) in Austrian hospitals organised in terms of materiality, policy, practices, epistemic and ontological aspects?		
	Paper	Argument	Contributions
What does hygiene mean, what is the role of hygiene in light of AMR?	Paper I Hygiene as infrastructure: antimicrobial resistance and the ambivalence of bacterial life in Austrian hospitals	- Hygiene work has to deal with bacterial ambivalence in times of AMR, the fine line between bacterial presence and pathogenic potential - Expands on Chandlers (2019) notion of antibiotics as infrastructure and argues for hygiene as infrastructure and infrastructural care	Bacterial profiling: A practice-based lens for how hospitals make bacterial life legible and actionable: the ensemble of surveillance, interpretation, and mediation through which bacterial presence is configured as risk and acted upon
What does bacterial pathogenicity mean in light of AMR?	Paper II From innocent bystanders to pathogenic bacteria: Navigating bacterial presence and pathogenic potential in hospital infection management amidst antimicrobial resistance	- Pathogenicity is an agentic socio-environmental dance - From preventive use of antibiotics to targeted use and specification of bacterial presence	Scarcity holism: A socio-political lens for how ecological and holistic approaches are mobilized under a normatively charged sense of scarcity – of antibiotics and bacterial diversity – to conserve antibiotic efficacy while reconfiguring human-bacteria-environment relations.
What does bacterial risk mean in hospitals? How is it conceived of, conceptualised, put into practice?	Paper III Pathogens, borders, and 'Ausland': Bacterial risk profiling and the governance of antimicrobial resistance in Austrian hospitals	- Shifting bacterial risk profiles: dangerous foreignness becomes an ungovernable category amidst massive bacterial mobility - Definitions of bacterial risks are situated and localized	
Argument	AMR governance in hospitals is best understood as relational, situated practices dealing with bacterial ambivalence, organized by two interlinked configurations: bacterial profiling – how bacterial risk is made legible and actionable – and scarcity holism – how ecological framings are mobilized to conserve antibiotics as infrastructural, scarce goods.		

Table 3: Summary of contributions

Living with bacteria: mapping the literature on bacterial encounters in policies, practices and materialities

Since the scientific explication of bacteria made possible by Antoni van Leeuwenhoek's invention of microscopic lenses and followed by Louis Pasteur's demonstration of microbes as agents of disease (Raffaeta 2022), humans have conceptualised their existence alongside bacteria and other microbes. AMR both necessitates and reflects a broad, interdisciplinary endeavour to theorize bacteria, because it points to crisis. While antibiotics were once hailed as the magic bullet of modernity, the loss of antibiotic efficacy and the threat of increasing antibiotic failure have sparked a broad scientific, scholarly and public debate. Social science literature reflects this growing interest in microbes in diagnosing a "microbial turn" (Paxson, Helmreich 2014) and contesting the turn (Brives, Zimmer 2021), and with the emergence of a plethora of analytical concepts, such as "microbiopolitics" (Paxson 2008, 2014), "probiotic politics" (Lorimer 2020), or the "Antibiocene" (Kirchhelle 2023). The current living arrangement with microbes has been put under scrutiny, and each concept accentuates different aspects and highlights the diversity of areas and issues relating to microbes. While the popularization of the term "microbiopolitics" (Paxson 2008) for example emerged out of studying artisanal cheese-making and the regulation of food, the term "Antibiocene" reflects the large-scale environmental-microbial nexus that is exposed by AMR (Kirchhelle 2023).

There is no doubt that the regulation of food is different from the management of bacterial encounters in hospitals, but the broader concern in food regulation around the ubiquitousness of bacteria and how to deal with them across different fields of governance is instructive. In working across different fields, I aim to reveal the complexity, frictions and different stakes that deserve attention. While the microbiology of the bacteria at hand might be the same, the management of the bacteria might substantially differ in hospitals in comparison to chicken farms or our kitchens at home. This is the point I try to make in my thesis, namely the way that context comes to matter with (resistant) bacteria.

In moving through the scholarly debates about human-microbe relations in STS, medical anthropology, political science and human geography, I observed a shift towards greater attention being paid to microbes across a wide range of fields: environmental (degradation, climate crisis, pollution), political, bodily (the microbiome and the gut), in science methods (e.g., microbiome sequencing) and social science theory. Rather than asking whether a microbial turn has taken place or not, I am interested to map the literature that debates and puts forth this microbial consciousness or the social study of microbes. This, on the other hand, is clearly supported by an entanglement

consciousness, and the problematization of AMR as a One Health issue is the other side of the same coin.

What times are we living in? Engaging social theory on antibiotic environments and AMR as a tempo-spatial condition

AMR and antibiotic use are often too hastily framed as an individualistic problem in need of behavioural change by prescribers and users, a problematization critiqued extensively by social scientists (Broom et al. 2021, Brown 2023). I take up these critiques and build on discussions that take antibiotics seriously as material agents embedded in historically grown, socio-political configurations and economic systems (Chandler 2019, Kirchhelle 2023, Landecker 2016, D'Abramo, Neumeyer 2020). Bacterial materiality is conceptualised in social theory in relation to antibiotics and different environments, as well as broader socio-political issues. I then zoom out and discuss the importance of situating antibiotic use in large-scale environmental processes without shying away from acknowledging the planetary and environmental harm that anthropogenic knowledge production and practices are causing – in my case in the form of antibiotics.

Chandler (2019), with her discussion of “antibiotics as infrastructure”, gave me an important impetus to situate the materiality of antibiotics in a wider political-economy landscape. Her work points to the neoliberal modes of (re)production that antibiotics allow for by intensifying and condensing time and space. This may be as a promoter of growth in animal farming, as a measure for infection prevention in humans and animals in dense spaces such as hospitals and factory farms, or as a shortcut in recovery time, so that a patient can go back to work as quickly as possible. Referring to Bowker and Star's (2000) work on infrastructures, Chandler calls this a moment of inversion, where the use of antibiotics as infrastructure is rendered visible in a situation of infrastructural crumbling. Thinking through antibiotics as infrastructure is so instructive because it manages to steer the problematization of AMR away from individualistic approaches targeting behavioural change or the often-invoked notion of irrational use (Denyer Willis et al. 2023), and towards analysis of the entrenched nature of antibiotics, environments, histories and political-economic systems. In this way, the prescription of antibiotics points not to individual failure, but to the inherently exploitative nature of human-animal relations in animal farming or neoliberal healthcare. Seen through this lens, antibiotics compensate for other shortcomings, such as adequate recovery times for humans, and natural growth in animals that requires time and healthy environments.

This intervention to situate antibiotics in their embeddedness within social structures and their planetary footprint is also done by tracing antibiotic histories: changing microbial materialities are

embodied in resistant bacteria and wider environmental processes. In trying to grasp how biology and life-forms themselves have been altered through antibiotics, scholars look at the changed bacterial materialities expressed in resistance developments, so as to trace the intricate ways in which human history plays out in biological material (D'Abramo, Neumeyer 2020, D'Abramo 2022, Kirchhelle 2023, Landecker 2019). In 2016, Landecker introduced the term “biology of history”, a landmark conceptualization of how the production of knowledge surrounding antibiotics has forever altered the very nature of bacteria. Because of that, the bacteria of today are not the bacteria of yesterday: “human historical events and processes have materialized as biological events and processes and ecologies” (Landecker 2016: 21). Almost 10 years later, Landecker (2024) calls for “social theory for an age of anthropogenic biology”, and once more draws explicit lines between environmental degradation and human knowledge production. Reflecting on the current situation even stronger as a moment of late industrial dysbiosis, microscopic agents like bacteria figure prominently in the anthropogenic biology. Hygiene figures in Landecker’s analysis as a crucial example of where the modes of control established in the last century to prolong life now contribute to climate change (2024). As such, anthropogenic biology, she suggests, serves as an analytic tool to investigate how biology is historicized materiality (in the form of resistant bacteria, for example) and how this relates to modes of knowledge and practice. To put it more concretely, the forms of biological control established through antibiotics as infrastructure lead to “novel patterning of living matter and processes across space and time” that far exceed their “intended target” (2024: 4, 8).

This novel patterning of living matter is discussed by scholars in terms of what kind of microbial landscape historical processes have produced. There are fruitful approaches that characterise the current moment as one of “bacterial ambivalence” (Sariola, Gilbert 2020, Bradshaw 2024), characterised by microbial absence and abundance, or as the microbial paradox of the Anthropocene. Efforts to control and eradicate microbes have promoted resistances, reduced microbial diversity, and disrupted microbial balance. It is important to look at how this moment, this paradox, this abundance and ambivalence play out in hospitals, precisely because the modernist view that microbes are the enemy in hospitals still prevails.

Taken together, the approaches introduced in the paragraphs above help me to grasp the current moment: understanding antibiotics as infrastructure allows us to scrutinize the power of these substances as a basis for specific socio-political configurations, where density in space, the temporal constraints of recovery and healing, and the pressing logics of productivity for humans and animals alike, are inbuilt.

Further, these infrastructural dimensions of antibiotics materialize in resistant bacteria, as the history of biology so powerfully illustrates. The complex ways in which antibiotics *as* infrastructure

materialize in environmental changes, that is in processes that can nowadays be labelled anthropogenic biology, because these processes, these histories make up what bacteria are materially and how we know them today. This allows for an anthropogenic biology with ways of knowing that are characterised by acknowledging the paradoxical relations between human and microbes.

Bacterial politics from global health to the human gut

As a multi-scale issue, AMR relates to global health as much as public health, it points in all directions, up and down in scale and sideways in dimensions from ecology, health, water, air and soil to human and animal bodies. AMR is like a connective tissue, and policy-making grapples with the wicked nature of AMR.

AMR is a difficult-to-grasp issue in global health because it is not a single disease-causing pathogen, and indeed, resistant bacteria are not disease-causing per se. They can inhabit your skin, nose or gut and do no harm at all, going unnoticed as long as they exist. Kirchhelle and Podolsky call AMR an “awkward fit” (2022) for international health frameworks that traditionally focus on containment strategies of single pathogens such as cholera or smallpox. To acknowledge the complex nature of AMR and propose a holistic approach, the WHO introduced One Health as an intersectional framework spanning human, animal and environmental health. At the core of these efforts lies the question of how to govern and manage microbes’ mobile nature. Crucially, over recent years, scholars have analysed the normative stance inscribed in One Health policies, critiquing the reductionist ontological vision of “one world with one health” inscribed in it as well as the anthropogenic emphasis (Hinchliffe 2015, Law 2015, Wolf 2015). As such, social scientists flesh out the missing opportunity to take seriously the human-nonhuman entanglements beyond a mere normative understanding that animal or environmental health should ultimately serve humans’ wellbeing (Cañada et al. 2022, Kamenshchikova et al. 2021, Wernli et al. 2017). Cañada et al. (2022) point out the “problematic health hierarchies” from an ethical perspective on AMR. Non-human health may be taken seriously in everyday encounters on small-scale farms, as the authors observe, where a more ethical form of care for non-human subjects can take place. But the relational thinking often gets lost in the translation to governmental levels. The authors’ proposed ethical framework argues that we should take into account the situatedness of AMR ecologies where non-human health is a virtue in itself and not only prioritized when it is a question of safeguarding human health.

Despite the One Health framing, AMR remains an awkward issue. Steuernagel et al. (2024) argue that the labelling of AMR as a pandemic situates it within disease-control and eradication strategies and policies, where a focus on biomedical and technological solutions serves as a shortcut. As such,

microbial presence and mobility is still thought of in terms of containment and control, whereas the authors argue that AMR should be seen not as a failure of control but rather as “a continual adaptation of microorganisms to the relentless exploitation and overuse of microbial products for human advantage” (2024: 2).

In this vein, the analysis of cases where AMR has been framed as an issue of biosecurity (Wernli et al. 2017) is crucial to help us critically reflect on the medicalization of insecurity (Elbe, Voelkner 2014) in the construction of pathogenicity, contagion and contamination. Biosecurity is a key term in the political governance of bacterial mobility and fits well within the narrative of disease control through the containment of single pathogens (Hinchliffe 2021). Inscribed in biosecurity logics are rigid practices of managing microbial mobility or “pathogenic circulation” (Voelkner 2011) by creating various forms of borders. Microbial mobility framed as an issue of biosecurity functions in antagonistic ways, where human health is contrasted against microbes, according to Voelkner (2019). Hence, what Lie calls “infection barriers”, namely the “physical and mental barriers [that] aim to prevent the virus and other microbes from settling in the city” (Voelkner 2019: 376, citing Li 2014), are part of biosecurity strategies that hold on to narrow understandings of microbes, a point made by various scholars in critiques of such oppositional governance of infectious diseases (Fishel 2015, Du Plessis 2017). Such barriers, however, are never fully able to control microbial mobility. As Voelkner (2019) shows, post germ theory and new materialists’ thinking in international relations opens up the space to critique these narrow public- and global-health oppositional narratives that are inscribed in microbial politics.

Next to microbial politics related to urban governance, the study of food and its regulation offers crucial interventions that put forth the notion of microbiopolitics as a tool to analyse how health and bodies are governed through food. Almost two decades ago, Paxson (2008), in an ethnographic study of artisanal cheese-making in the US, introduced the notion of “microbiopolitics” to advance Foucault’s notion of biopolitics and to thus include microbes in questions of governance and power. Importantly, Paxson delineates different forms of microbiopolitics. “Pasteurian microbiopolitics” are concerned with elimination and control through strict hygiene and the sterility of microbial environments. But the modes of engaging with microbes that Paxson observed in cheese-making practices differed from this “antiseptic attitude” (2008: 18) and spoke more to what she terms “post-Pasteurian microbiopolitics”. Here, microbes are introduced as allies in crafting cheese. In a similar vein, Lorimer (2020) analyses the use and governance of microbes as allies for human health including practices of rewilding as examples of a “probiotic turn”. Still, both Lorimer and Paxson remark on the contingency at the centre of probiotic or post-Pasteurian microbiopolitics: human control remains a central microbiopolitical feature, but control is itself is

epitomized in developing cooperative alliances with microbes to discriminate against other microbes.

Another current surge of explicating human-bacterial relations through public health and biopolitics takes place in the inner “ruminations” (Wilson 2015) of the human body, in the gut. There is recurrent interest in substantiating and theorizing the ills of the world (e.g., environmental degradation, lack of microbial diversity, pollution, homogenized diet) through the digestive organs and diseases of the gut (Wolf-Meyer 2024, Maroney 2020, Benezra 2023, Lorimer 2020). In “Gut feminism”, Wilson famously investigates the gut as “ruminating”, breaking down body-mind dichotomies and feminists’ sceptical attitudes towards biological data (Wilson 2015). It is an important intervention in not only taking biology and the gut seriously, but also in questioning linear directionality and simplistic causality. Not only do gut microbes influence brain chemistry, as argued in recent studies on depression (Luqman et al. 2024, Valles-Colomer et al. 2019), but they are an organ of the mind.

The insights from cheese-making, infection barriers in urban biosecurity approaches, and references to the gut and digestion to signify the tension between individuals, environments and modernity in crisis all speak to the vexed nature of AMR. As Landecker aptly put it: “An antibiotic meant as an individual intervention is an environmental event” (Landecker 2016: 34), because a ruminating gut may stand in for the late industrial dysbiosis of missing microbes. Antibiotic consumption and large-scale introduction in the last century altered bacterial ecologies, leading to a paradox of abundance and absence of microbes (Sariola, Gilbert 2020, Bradshaw 2024). Sariola and Gilbert (2020) and Bradshaw (2024) discuss the ambivalence so potent in AMR that the microbial landscape is characterised simultaneously by this abundance and absence, a disbalance that materializes as much in widespread, modern diseases of the digestive system as in antibiotic resistance – too much of some and too few of other bacteria.

The literature on bacterial politics has helped me to see a hospital as a societal microcosm where politics is made with bacteria and microbes, while also being embedded in urban environments and wider ecologies. This literature has helped me to grasp the non-linearity of bacterial movement, vertically in scale but also horizontally. It has helped me to understand buildings as digestive systems (Wigley 2022), and offers helpful metaphors for hospitals, such as the multidirectional ruminations of the gut (Wilson). The dissolving of borders in discipline (biology versus social science) and the body (the brain and the gut), is as influential as understanding how bacterial politics are done through policies at the global scale (One Health) or urban governance (Voelkner). The hospital is embedded in these politics, and even more so the hospitals where I carried out my ethnographic research, as they were all in urban areas. This was relevant for analysing, as I did, the local practices of situating AMR and its management. The concept of microbiopolitics or the

probiotic turn as approaches to understanding the epistemic shifts that are committed to a processual understanding of microbial management, one that focuses on calibrating bacterial relations rather than eradication, helped me understand the practices of hygiene and infection management. Ultimately, my research contributes to this literature in speaking to questions of AMR governance and framings, to bacterial politics at large, enacted in microscale and microcosmoses within hospitals.

Epistemic cultures of living with bacteria in healthcare and hospitals

Hospitals are the flagship institutions of modern biomedicine (Chabrol, Kehr 2021) but also nowadays the main culprit in AMR. Practices of hygiene, infection prevention and antibiotic stewardship serve to flesh out the ways in which professionals perceive and approach bacteria and bacterial risk. The literature that discusses the hospital as an environment where epistemic battles are taking place, and the literature looking closely at the practices that constitute epistemic cultures are building up to what I refer to as bacterial profiling, the epistemic culture I describe as part of my findings.

Previous work points to the ambiguous history and presence of bacterial encounters in settings where one often hastily assumes practices to be a mere *fight against* bacteria, subsumed by terms like antibiotic era or Pasteurian politics. For historical contextualisation, the work of Condrau and Kirk (2011) is insightful. They discuss the hospital as a contested space between clinical practice and microbiology science with different approaches to antibiotic use. Importantly, the authors reflect on the history of hospital infections to show the intricate and complicated ways that antibiotics have always been negotiated in hospitals. In their historiography of hospital infections in the UK, Condrau and Kirk complicate the narrative that hospitals have become safe microbial havens because of the introduction of antibiotics in the middle of the last century. Rather, they portray the hospital “as an arena where professional battles between research, medical practice and public health interests were being contested” (2011: 403). An important tension lay in the “ecological orientation” (p. 398) of bacteria as dynamic organisms that microbiologists put forth, thus fending off utopian visions of eradicating infectious diseases through the magic bullet of antibiotics. This tension solidified in the hospital, where medical practitioners favoured a less holistic approach, mostly because they work to a timeline in which resistance is a future issue but the prevention or treatment of infection a present one (p.403). Relatedly, conceptual attention has shifted from the hospital environment, the walls, surfaces and floors as the hygienic focus of infection prevention to the people moving in the hospitals. In the figure of the healthy carrier, clinical attention and practice has shifted from keeping the walls clean to inspecting the patient and their bacterial composition in hygienic terms. The prototypical healthy carrier that has become central to

epistemic practices in epidemiology is a figure of biosecurity mobilization that urges microbial screening, monitoring, detection and containment, as Wald (2008) shows in her analysis of outbreak narratives. Kamenshchikova et al. (2018) write about the complex narratives that AMR screening in refugees compile, where the screening of healthy, but foreign person is rendered microbiological “interesting” by scientists, potentially beneficial but also stigmatizing by nurses and an important step towards health and knowledge about the body by refugees. This shows that such a mundane practice as bacterial screening is given various meanings. In AMR, mobile groups such as travellers and refugees take on particular importance, as, in parallel to the healthy carrier, they stand in for bacterial mobility. As Wald (2008) suggests, narratives of diseases and particular epidemics follow a formulaic plot. As we talk about making sense of diseases, conceptually and practically – for example through epidemiology and screening schemes – infectious diseases, bacterial risks and pathogenicity are part of an “outbreak narrative” that borrows its dramaturgy from detective fiction and investigative journalism. There is much social science analysis on the militaristic and war-like framing of contagion and AMR in the global health discourse (Walker 2020, Meek 2024). The analysis of Wald (2008) stands out for its level of understanding of the hospital context: it is not so much a war against bacteria fought in hospitals, but a detective story about finding the bad guys (pathogenic bacteria). To solve the mystery of pathogenicity requires careful profiling of bacterial presences, so as not to target innocent bystanders with antibiotics, which in turn would exacerbate AMR. These approaches demonstrate the complexity of medical practices, their interwovenness in cultural narratives of diseases and battles over the onto-epistemological status of bacteria. This underscores the argument that neat categorisations of antibiotic timelines in the antibiotic versus post-antibiotic era, or Pasteurian versus post-Pasteurian politics, are helpful and sometimes necessary, but also a simplified version of reality.

Similarly critiquing one-dimensional narratives of hospitals and AMR, Doron and Broom (2022) interrogate the image of the clinic as a stable unit of AMR policy-implementation. Their analysis explores the hospital practices that run alongside modes of antibiotic governance and concerns over care, ecologies and socio-spatial inequalities. The concept of porous borders has proved very instructive for me to understand hospitals and the frictions emerging within a biopolitics built on demarcations, borders, biosecurity and inside/outside differentiations. This has helped me to understand the practices and sense on the ground for the flowing and floating of bacteria, the permeability of borders and professionals’ efforts to navigate between these poles.

The theoretical framework for this doctoral thesis is less characterized by a specific conceptual lens or the application of theories such as biopolitics, multispecies ethnography or actor-network theory, all of which run high in the social studies of microbes. Rather, I have tried to draw out the approaches that helped me understand and interpret, on the one hand, the current moment of

bacterial consciousness, and on the other hand, the interplay of policies, practices and materialities that I was drawn to in my fieldwork. All this literature has helped me to contextualize AMR and to abstract how the ethnographic observations I made fit into the analyses and narratives about AMR and ultimately contribute to the way that AMR is problematized. By juxtaposing literature and data, gaps and blind spots emerged, something I have tried to fill with the concept of bacterial profiling. This term also points to the narrative and epistemic dimension, elegantly fitting disease narratives of medical detectives as bacteria hunters, reflecting epistemological transformations of more-than-human health, but equally reflecting the narrow dimension of AMR practice.

In the last part “Profiling our way out of the antibiotic crisis” I will summarise the publications that form the heart of the thesis and will flesh out how the practices that respond to the absence and abundance of bacteria in the context of AMR construct specific *problematizations* of AMR. These, I conclude, are characterised by holistic touches and a reliance on individual efforts that ultimately fall short in taking account of the large-scale planetary, environmental and climate crisis.

Publications

In the following, I give a brief overview of the three articles that form the heart of my thesis. All of the papers explore, from different perspectives, the ways in which hospital professionals manage the tension of bacterial ambivalence and uncertainty in their daily practices. To gather the ethnographic data for the papers, I followed hygiene teams on their rounds and visits around the hospital, as they interacted with co-workers, patients, cleaning stuff, technicians and lab analysts to create a safe, hygienic hospital that is far more than the mere absence of bacteria.

In the first paper, “Hygiene as infrastructure: antimicrobial resistance and the ambivalence of bacterial life in Austrian hospitals”, submitted to *Anthropology & Medicine*, I expand on Chandler’s (2019) conceptualization of antibiotics as infrastructure and introduce the concepts of “hygiene as infrastructure” and “infrastructural care”. Recognising that hygiene is often overlooked and has a difficult position within hospital hierarchies, I explore the ways in which hygiene professionals work around epistemological openness to bacteria’s harmful, harmless and healing potentialities. I do so by fleshing out three relational dimensions within which hygiene professionals navigate this openness: professional relations, environmental relations and bacterial relations.

First, hygiene professionals need to mediate bacterial presence and hygiene requirements in their professional and institutional setting, with colleagues and within difficult hospital hierarchies. Second, they mediate environmental relations to manage bacterial risk in hospitals through a process called social anamnesis (*Sozialanamnese*), where bacterial cultures are put into context through the provision of specific patient information that embeds the patient within their wider socio-ecological environments outside of the hospital. The results of the social anamnesis are put into practice in the third dimension – bacterial relations – where the specific bacterial composition of the patient samples is interpreted and acted upon in communication-intense processes on the ward, aimed at optimising antibiotic use.

In this paper, I demonstrate that hygiene professionals negotiate these intricate professional, environmental and bacterial relations. They do so against the backdrop of bacterial ambivalence that characterises late industrialism, where professionals, scholars and public health officials scrutinize the absence of some bacteria and abundance of other bacteria as markers of individual and planetary health. The concept of “hygiene as infrastructure” provides a useful analytical lens for understanding these mediating practices, highlighting the limits of modern technological optimism in the shape of antibiotics as infrastructure and the need to rethink hygiene as a relational and socio-ecological practice of infrastructure and infrastructural care.

In the second paper “From innocent bystanders to pathogenic bacteria: Navigating bacterial presence and pathogenic potential in hospital infection management under rising antimicrobial resistance”, submitted to the journal *Social Science and Medicine*, I move from hygiene management to infection management, while staying true to the baseline tension of how professionals deal with bacterial ambivalence and uncertainty. In this paper, the focus shifts away from the work of hygienists treading the fine line between bacterial presence and pathogenic potential, and more towards the ways that infectiologists specify and contextualize the presence of bacteria as a way to better target antibiotic use. It is in this paper that I first introduce bacterial profiling as my conceptual lens to interpret the epistemic culture, and a main contribution of my thesis.

The third paper “Pathogens, borders, and ‘Ausland’: Bacterial risk profiling and the governance of antimicrobial resistance in Austrian hospitals”, has been submitted to the journal *Global Public Health*. In this paper, I explore the tricky biosecurity category of “Ausland” in the management of bacterial risk in Austrian hospitals. I examine the links between the practice of setting up borders around bacterial risk, wider AMR governance practices, and the shifting epistemic cultures of engaging with bacteria in the context of AMR. I explore how hygiene professionals are dealing with bacterial mobility on a daily basis, making decisions based on bordered categorizations, while also deconstructing and reconfiguring bacterial risk in their practices. Whereas global and public AMR policies are characterised by mapping bacterial risk, thereby creating borders around bacterial threats to make AMR actionable. However, the inevitability of bacterial mobility puts into question these governance practices, as the experience of Viennese hospitals shows. I employ the analytical lens of bacterial profiling to make sense of the logics at work, demonstrating once more how hygiene plays a crucial role in bringing shifting epistemologies to the management of resistant bacteria. One of the key findings of this paper is the tension of leaning on old-school concepts of biosecurity, demarcations, containment and control, while also trying to accommodate a new normal, where resistant bacteria cannot be exceptionalized. Hygiene plays a crucial role in configuring and shaping this anticipated future, where approaches to AMR are less geographically and spatially focused and more holistic.

In sum, the three papers share an effort to understand how the issue of AMR shapes our ways living alongside (resistant) bacteria in the present and anticipated future. Each paper illuminates different streams of hospital work that all experience and shape the tension of living with bacteria. Hygiene management, infection management and the construction of bacterial risk profiles represent an ensemble of practices that help to interpret AMR and make it legible and actionable. All of these practices tread the fine line between bacterial presence and pathogenic potential and

the harmless and harmful potentialities of bacteria that are not a given, but a dynamic “agentic dance of socio-environmental processes (Hinchliffe 2021: 12).

I. Hygiene as infrastructure: antimicrobial resistance and the ambivalence of bacterial life in Austrian hospitals

Abstract

This paper examines hygiene practices in Austrian hospitals amidst antimicrobial resistance (AMR), a pressing global health threat of late industrialism. Starting from Chandler's (2019) discussion of antibiotics as infrastructure, it employs hygiene practices as infrastructural care for late industrial hospitals. Bacterial ambivalence, which describes the absence and abundance of bacteria as a condition of late industrialism and the healing and harming potentialities of bacteria, calls for careful consideration of bacterial presence and of what hygiene means. Drawing on ethnographic research in Austrian hospitals, I detail how hygiene professionals need to balance intricate institutional, bacterial and environmental relations embedded in a political economy that is built on antibiotics as infrastructure and modernist modes of bacterial control and eradication. The concept of hygiene as infrastructure provides the analytic framework for understanding these practices, highlighting the limits of modern technological optimism and the need to rethink hygiene as a relational and socio-ecological practice of infrastructural care.

Keywords

Antimicrobial resistance, hospitals, hygiene, infrastructure, microbes

Introduction

On one of my visits to a big urban hospital in Austria, I follow the hospital's hygiene team on their rounds, a centralised team dedicated to managing infection prevention measures across all hospital departments, from monitoring the water supply to advocating for rigorous hand washing. The hygienist, a nurse with an extra training in hygiene practices, shows me the dialyse room, the beds and machines, before we descend into the cellar. Here, hidden from sight and daily business, the underground infrastructure of waterflows and filters reveals the not-so-visible forms of hygiene. Everything that comes from outside the hospital walls is meticulously surveyed and filtered, since contaminated water could cost patients' lives, especially during dialysis. A few rooms away, the dentist office is temporarily closed, owing to a contaminated water supply. Here we meet the responsible hygiene physician and another hygienist, along with a hospital technician and an external specialist on water filters. I follow intense discussion on how much "purity" certain filters can guarantee. Imagining a patient taking place on the dentist chair, the hygienist explains the teams' presence in the room to me, they need to evaluate the situation: water coming from outside, as much as patients or air or everything "on the move" potentially poses a threat, as bacterial flow between environments introduce pathogens. Here, facilitated by water flow, potential pathogenic bacteria might enter the mouth of a patient, whose bacterial environment – as a patient in the hospital – is considered to be vulnerable.

The above vignette highlights the crucial evaluation role of hospital hygiene experts: since bacterial flow between environments introduces pathogens, the supply of water from outside – in the same way as patients, air and everything "on the move" – potentially poses a threat. Newspaper reports of healthcare-associated infections linked to contaminated hospital water—resulting in severe harm and sometimes death—are deeply unsettling. An institution charged with promoting wellbeing and recovery can have its trustworthiness compromised by seemingly simple infrastructural failures: contaminated water, air, and surfaces render routine environments subject to bacterial risk. Bacteria that might harm vulnerable patients move through the water, air, patients, hands, the hospital kitchen and its food. It requires hygiene teams to manage bacterial presence across walls, patients' bodies, pipes, or surfaces by containing, controlling, or halting bacterial movement to safeguard care and prevent contamination. The presence of bacteria is inevitable, as are porous materials or bodies, and – as the above vignette illustrates – a hospital is a delicate space within which to navigate this inevitability. To ensure a hygienic hospital environment the hygiene team follows a comprehensive approach with a focus on adverse microbial presence. This requires the coordination of workflows, the mediation of laboratory data between professional groups, and the careful management of professional relations. Even more so in times of antimicrobial resistance

(AMR), where one of the most powerful substances for biomedicine becomes increasingly ineffective owing to the ability of today's bacteria to resist them.

As a global crisis, the issue of AMR extends beyond hospitals and human biomedicine and can be seen as a result of late-industrial infrastructural ruination. In a world with “deteriorating industrial infrastructure, landscapes dotted with toxic waste ponds, climate instability, incredible imbrication of commercial interest in knowledge production, in legal decisions, in governance at all scales” (Fortun 2014: 310), Fortun calls for an ethnography attuned to these “conditions” of late industrialism, a present marked by environmental degradation and crumbling infrastructures, by flows of “incredible particularity, and incredible complexity” (Fortun 2012: 449). Following Fortun, I understand AMR – along with the crumbling infrastructure of antibiotics due to AMR – as a condition of late industrialism.

In this paper I conceive of hospitals as situated within late-industrial living arrangements markedly shaped by bacterial presence. In late industrialism, this bacterial presence is characterised by the absence of some and the abundance of other, that is resistant, bacteria (Giraud et al. 2019, Sariola, Gilbert 2020, Bradshaw 2024). The “ambivalence of microbes” as Sariola and Gilbert (2020) call it, deepens in a human-centric institution like hospitals, where historically the well-being of patients is contrasted against microbial presence. Hygiene teams need to manage this bacterial ambivalence by navigating the healing and harming potentialities of bacteria all the while trying to keep antibiotics as infrastructure.

Thus, in response to the late-industrial condition of antimicrobial resistance (AMR), infrastructural care must be reconfigured. Antibiotics as infrastructure require stronger buttressing by hygiene as infrastructure, and hygiene must also contend with industrial ruination by making room for bacterial ambivalence. This paper examines how hygiene professionals enact that accommodation in practice in order to deal with AMR. In the face of simplified and deterministic narratives of what hospital hygiene should look like, hygiene professionals must avoid establishing regimes based on the (simplistic) idea that fewer bacteria are always better. Professionals don't think that less bacteria are necessarily always better and they manage this bacterial ambivalence accordingly. Their mediation of professional, environmental and bacterial relations in managing AMR demonstrates their infrastructural care.

Using the analytical framework of antibiotics as infrastructure (Chandler 2019), this paper recasts hygiene as infrastructural work: the substrate that makes antibiotic infrastructures possible. To show this infrastructural care, I focus in 3 ways on hygiene professionals' relations with colleagues and the institution, with the environment “outside” of the hospital and relations with bacteria. I conclude by stating that hygiene is infrastructural care, a relational and socio-ecological practice of

dealing with late-industrial conditions of bacterial ambivalence, the tricky decision about the harmful, harmless presence or absence of bacteria.

Methods

The research for this paper is based on a hospital ethnography on AMR in Austria, involving 21 semi-structured interviews and eight days of observations in four different hospitals, and using Situation Analysis (Clarke et al. 2022) and Constructivist Grounded Theory (Charmaz 2014) for data management and analysis.

After securing ethics approval for the overall study for my thesis at the beginning of 2021, I approached experts and stakeholders concerned with AMR in human medicine in Austria. I received ethics approval to conduct a hospital ethnography in one large hospital but was denied entry at the last moment by the hospital's legal department for unclear reasons. Subsequently, I adapted my research design to include multiple hospitals in urban areas across different Austrian federal states (Bundesländer). Instead of an in-depth analysis of one hospital, I refocused on comparing four different institutions. While this arguably limited the depth of the material, visiting different locations helped to achieve a sense of the highly localized structure and embeddedness of AMR governance in Austria.

In the hospitals, actors take on more than one role. A hygiene physician, for example, may also be an infectiologist or a physician in microbiology. I conducted a total of 21 interviews inside the hospitals, with infectiologists (3), hygiene team members (9), a nurse (1), patients (2), a lab analyst (1) and an intensive care unit (ICU) physician responsible for antibiotic surveillance (1), as well as with researchers (4) outside the hospitals. I conducted observations in four different hospitals, spending three days following hygiene teams, one day with an infectiology team, one day at a microbiology lab, two days in an emergency room, and one day at an ICU. The aim of both interviews and observations was to explore the extent to which AMR is entrenched as an issue in daily hospital work and flows, and the ways that hygiene professionals manage AMR through hygiene practices and professional relations.

I analysed my material by applying Situational Analysis in conversation with Constructivist Grounded Theory (Charmaz 2014). Situational Analysis guided the way that I approached my data using mapping techniques, for instance by visualizing the positions that different respondents took on hygiene and various human-microbe encounters in hospital. Constructivist Grounded Theory guided the coding of my data in MAXQDA, where my core categories of human-bacteria encounters and hygiene management emerged along the practice-oriented category of the biographical and hygienic gaze.

Hygiene in Austrian hospitals

In Austrian hospitals, hygiene (Krankenhaushygiene) is an inherent part of the functioning of hospitals built around dedicated hygiene teams. Along with Germany and Switzerland, Austria is one of the countries in Europe with the longest tradition of dedicated hygiene teams in hospitals. The Austrian policy paper “Organization and Strategy for Hospital Hygiene” – known as PROHYG – was first published in 2002 (Bundesministerium für soziale Sicherheit und Generationen 2002) and is now the standard document on hygiene management and strategy in Austria hospitals; it was last updated in 2024 (BMSGPK 2024). Austria’s healthcare system is decisively shaped by a high number of federal structures (Jeleff et al. 2023). Thus, while the federal government (Bund) publishes PROHYG – which “is not considered a law but a strong recommendation” (Kuppelwieser et al. 2018: 674) – as a policy framework to guide hospital hygiene governance, responsibilities for implementation lie with the federal states (*Bundesländer*).

Following PROHYG and the Austrian Law on Hospitals and Sanatoria (Bundesgesetz über Krankenanstalten und Kuranstalten [KAKuG], BGBl. Nr. 1/1957 idF BGBl. I Nr. 108/1997) in Austrian hospitals, hygiene teams have a clear advisory capacity in managing microbial life to counter hospital infections. As stated in the Austrian law KAKuG BGBl. I Nr. 108/1997) hospital hygiene encompasses measures for “preventing, detecting and combating hospital infections and maintaining health”. In the broadest sense, hospital hygiene centers around the prevention of infections. In the space that opens up between microbial colonization and infections, hygiene teams work on infection prevention and interpretation of diagnostics to target the use of antibiotics.

The teams are designed as staff unit with an advisory and recommendatory role in all matters of diverse microbial encounters, where the issue of AMR is just one – albeit a rather prominent one – besides fungi, parasites, and viruses. Every hygiene team consists of at least one physician, preferably specialized in microbiology and hygiene, and one nurse additionally trained in hygiene, called hygiene specialists. Because of a shortage of physicians specialised in hygiene and microbiology, not all positions might be filled with hygiene physicians. Where there is a shortage of physicians specialised in hygiene and microbiology, related disciplines might jump in. Depending on the resources that the hospital management allocates to hygiene, the teams might be supplemented by biomedical analysts. The minimal size of the teams formally depends on the number of hospital beds, but team size might also vary depending on resources and the priority given to hygiene by the hospital management. While in public discourse hygiene is imagined as a rather straightforward formalized and standardized practice of managing infection prevention, cleanliness, and sterility, the Austrian case illustrates how the interplay of federal policies and locally ingrained hygiene politics works in practice (Modelhart 2026 forthcoming).

Antibiotics as infrastructure, hygiene as infrastructure: managing bacterial ambivalence in late industrialism

Without antibiotics, contemporary hospitals could not provide the care that biomedicine enables that is crucially based on antibiotics. Antibiotics, as Chandler has argued, have thus not only become an infrastructure of a modern way of living, but also of hospital medicine itself. She discusses the role of antibiotics as societal fundament, coining the analytics of “antibiotics as infrastructure”: antibiotics are a taken-for-granted basis for modern ways of living and caring, not only in the sphere of biomedicine but also our modes of production. But this industrial infrastructure of antibiotics is crumbling. Scholarly analysis of antibiotics as infrastructure (Chandler 2019) and as “industrialized biological” (Landecker 1999: 20, 2016) detail the processes throughout the last century through which these substances became characteristic for modernity per se, relating to specific large-scale modes of production (such as factory farming) and dense hospital spaces. However, the upscaling of antibiotic production and massive interventions in environmental landscapes and processes have produced an ambivalent microbial situation. Altered bacterial materialities resulting from large-scale use of antibiotics, growing variants of resistant genes, and the proliferation of new bacterial strains, have been accompanied by the absence of other microbes, challenging assumptions about a supposedly healthy, microbially balanced environment. Antibiotics as infrastructure are tied to a balanced microbial environment, something that late industrial ruination starkly puts into question.

The characteristic tension of late industrialism is thus the diagnosis of an abundance and absence of microbes as Bradshaw (2024: 28) writes: “As microbes come into contact with anthropogenic pollutants in complex combinations, they are evolving in all manner of unforeseen and unknowable ways, producing a diversity – an abundance – of genetic structures and phenotypes”. At the same time, while substances like antibiotics are causing microbial evolution, provoking certain abundances, their very use – coupled with environmental changes – simultaneously bring to the fore a specific late industrial condition of “microbial ambivalence” (Sariola, Gilbert 2020). This is caused by presence of certain microbes vis-à-vis the absence of other microbes, as current debates around gut health, inflammatory, allergies and chronic diseases exemplify (Lorimer 2017, 2020). In their analysis of “abundance” in the Anthropocene, Giraud et al. (2019) focus on the abundance of hookworms, bedbugs and antibiotic-resistant bacteria, arguing that microbial abundance – alongside species loss, extinction, and environmental degradation – is closely linked to “failed technological fixes, colonial legacies and contemporary inequalities” (Giraud et al. 2019:1).

The practices of infection management and prevention, and antibiotic use in hospitals, have been studied, for example recently for the US healthcare system by Rynkiewicz through the lens of moral ranking systems (2022) or cultures of prescribing (2023). The ways in which hygiene professionals

manage bacterial ambivalence through the care infrastructure is rarely discussed, but it allows to highlight different stakes: the professional negotiations taking place in hospital environments are not only between balancing the responsibilities for individual patients versus the wider population in prescribing and safeguarding antibiotics but require looking at the many ways in which antibiotics are “infrastructural” outside of the hospital.

Following the analysis of bacterial ambivalence as a diagnosis of late industrialism, I engage the notion of antibiotics as infrastructure to see what infrastructures enable antibiotics themselves to function as infrastructure, especially in times of infrastructural cracks and crumbling. Therefore, I contend that a lot of infrastructural work and care is done by hygiene practices that brings in an onto-epistemologically complexity far beyond dyadic understandings of antibiotic use and misuse.

Hygienic infrastructure between ecological approaches and risk-factor analysis

Antibiotics crucially shaped the history of hospitals, and thus also the role of hygiene. During the last century and intimately linked to hygiene practices and the availability of antibiotics, hospitals environments have changed – architecturally, microbially, logistically and in terms of care and therapy. Thus, the hospital itself can be understood as a “microbial environment” with its distinctive microbial ecology shaped by hygiene practices. In his 2017 article, Gradmann traces the relation between hospital as microbial environments and the profession of hygiene, showing how “temporality” as a category of disease evolution came to matter in understanding infection control and hygiene management. Gradman shows how former holistic, ecological hygiene approaches were replaced through the concept of statistical risk-analysis models for infection control, which proved more cost-effective, but also much narrower and more focused on static bacteria and statistical objects (2017: 8). Gradmann’s overview of last-century processes “from ecology to emergency” mirrors other important social science observations about the shift towards a focus on risk management and epidemic preparedness in hospital hygiene management (Caduff 2015). Gradmann’s work, alongside that of Condrau and Kirk (2011), highlights a nowadays often overlooked part of history, in arguing for the relevance of ecological approaches even within hospital walls.

While the argument of antibiotics as infrastructure is a well-established, hygiene practices as infrastructure always paralleling processes in antibiotic development, bacteriology and laboratory science is lesser elaborated on. As such, the work by Gradmann and others like Condrau and Kirk (2011) help to establish the close connection of antibiotics, AMR nowadays and hospital hygiene. Condrau and Kirk also show how the hospital was always a contested space of medical disciplines that work around different timelines: microbiologists stood in for an “ecological orientation” (2011: 398) of bacteria as dynamic organisms put and clearly countered the narrative of the golden status

of antibiotics in a vision of eradicating infectious diseases, medical practitioners worked along different timelines in which resistance is a future issue but the prevention or treatment of infection a present one (2011: 403).

As the empirical section will show, the one isn't necessarily only replaced with the other. Instead, a recent approach to manage hygiene builds on bridging different bacterial ecologies and trying to grasp bacterial flows vis-à-vis its inevitability.

Hence, for my argument, two observations are decisive: first, the infrastructural aspect of hygiene practices, and second, that the hygiene infrastructure is built around practices of mediation. These observation parallel ongoing scholarly debates about biocultural beings (Frost 2018), biosociality, local biologies (Lock 1994, 2001, Koch 2011, Yates-Doerr 2017), permeable bodies (Lock 2018) or anthropogenic biology (Landecker 2024). Whereas water, as introduced in the opening vignette, is a known and well-researched microbial mediator, other flows are put into focus to understand the intimate, micro-scale of persons carrying certain resistant bacteria and large-scale environmental events. Blanchette (2019), for example, follows the not yet well elaborated connections of factory farming, waste and resistant bacteria travelling through the air. Murphy (2017) deploys the term "alterlife" to explore altered lives, but also life open to be altered: "It indexes collectivities of life recomposed by the molecular productions of capitalism in our own pasts and the pasts of our ancestors, as well as into the future" (2017: 497). Murphy's research shows the entanglements of water as a moving vehicle of toxicity that alters biological materialities. Landecker ask similar questions deploying "anthropogenic biology" as an analytic for the "aftermath" (also with a hint to Murphys "alterlife"), a heuristic for social theory in face of late industrialism. Anthropogenic biology here points to the biological processes marked by "globalized and industrial modes of control of the life" (2024: 3) and asks how social theory can grasp this aftermath, these altered biologies we are facing not least because of the knowledge and technologies we produced throughout industrialism that brought us to the recent moment.

These are the material realities of bacterial ambivalence hygiene professionals navigate: the literature shares an effort to grasp new life forms and altered biological materialities in the context of human-environmental relations that are clearly marked by toxicity, environmental degradation, climate crisis and anthropogenic biologies (Landecker 2024). AMR is just one, yet a very powerful, densification of these troubling relations. Thinking through the notions of bacterial ambivalence, a condition of altered biologies and alterlife in late industrialism, allows me to situate hygiene as a mediation between scales of AMR as a global health problem pointing to planetary crisis at large and everyday struggles of hospital work and providing biomedical care.

Negotiating professional, bacterial and environmental relations in hygiene practice

For most people in the audience of the auditorium, it is their first day of work in the hospital. New hospital staff get an introduction to the hospital, the buildings, logistics, and workplace safety. I accompany the hygiene team, who for their part present their daily work and advocate for the importance of hygiene practices as part of everyday hospital work. To impress this on the newcomers, they use a visually striking procedure. People are first asked to disinfect their hands. Then the hands are lit with a fluorescent light to highlight the areas that have been missed. My wrists shine in blue light. ‘The wrist, always the wrists,’ I am told by hygienist Carol. Slightly embarrassed, I share my sense of feeling caught. She seems very used to such a reaction and gently explains to me that that’s not the point, but that one ‘just sees what’s been missed’.

Hygiene work occupies a complicated place in hospital hierarchies. The little exercise described above, which took place in one of the hospitals where I carried out my ethnographic observations, reveals that hygiene work – the scanning of rooms, practices, people, and surfaces – is a practice of controlling and monitoring. It imposes a set of rules about what to wear and what not to wear, and how and when to wash hands. Hospital staff tend to see it as something that accompanies “real” medical work, i.e., necessary, but still often a nuisance. I also learn through my encounters with hygiene teams that a lot of affective work is put into hygiene, an aspect easily overlooked when thinking about sterility and cleanliness. Hygienists have to cultivate a safe bacterial environment but also nurture professional relationships that foster an understanding of hygiene as an essential part of biomedicine.

They need to advocate for hygiene as something that is not just a constraint on other people’s important work but is integral to that work.

My experience in the hospitals helped me to delineate three relational dimensions of what I term hygiene as infrastructure and infrastructural care as it unfolds in hygiene practice: the first dimension is the professional, the second is the bacterial, and the third dimension is the environmental. Hygiene inspections (Hygienevisite) to wards and departments represent the professional relations, as hygienists navigate the frictions between protocol and care in their encounters with patients and co-workers. In these moments, protective standards can come to feel obstructive: windows must stay shut, flowers and plants are discarded, and colleagues’ work is evaluated. The bacterial and environmental relations are part of the diagnostic infrastructure, and surface in the team’s mediation of bacterial data –bacterial cultures, counts, susceptibilities – and in their stewardship of antibiotics on ward visits (to optimize antibiotic use), where they render bacteria legible and act on the results. Whereas environmental relations focus on patients as bodies

outside the hospital and embedded into socio-ecological contexts, bacterial relations zoom in on patients as bacterial bodies within the hospital and on how it can be managed on site, for instance, which antibiotics are appropriate.

Professional relations: compliance, compromise, care

The two hygienists Darius and Emma put on their white coats, and we head to the ward for a hygiene visit. On the way, they tell me about the importance of cultivating good and respectful relationships with the staff on the wards. As a hygienist you are often scrutinizing daily routines, equipment, clothes, and ways of putting on bandages or washing hands. We are greeted in a friendly manner and make our rounds to patient rooms, toilets, the kitchen and hallway. The trained eyes of Darius and Emma wander along the wall to the ceiling, the windows, the soap dispensers, the wet rooms. Every corner, every scratch gets attention under their hygienic gaze. As they enter one wet room, they write down notes about the condition of the portable toilet, whose surface is showing cracks. Porous material attracts the hygienists' attention; they take notes, ask questions or point the staff to the "problem zone". Back in the bright patient room, they ask the patients to remove their personal belongings from the windowsill. They tell me that the beds are too close to the heater, and add that unfortunately, plants are not allowed for reasons of hygiene. We move on the storage room, then to the toilet on the corridor, where the soap dispenser is marked with a date. Every few months, the dispenser must be refilled, because harmful bacteria might grow within it. The washbasins are attentively examined everywhere; several times, sinks have been identified as the cause of outbreaks of infections in various hospitals. While we are visiting patients, someone is cleaning the room. Emma gently takes the person doing the cleaning to the side and explains that they can't use the same cleaning rag for different surfaces.

Hygiene practices are all-encompassing, as the above vignette illustrates. Hygienists scrutinize surfaces, materialities, human hands, and bodily movements alike, the air, liquids, the building and the things and people moving within it. Through the hygienists' eyes, cracks, holes, or worn materials are niches for unwanted bacterial presence, difficult to clean and control. The vignette above also illustrates how hygiene requirements may conflict with elements aimed at enhancing wellness, such as plants, or open windows and fresh air. Darius and Emma also pointed out a particularly difficult aspect of their work to me, namely the balancing act of communicating observations that aim to correct behavior without appearing patronizing and without causing the other person to lose face. At the same time, they acknowledged the structural constraints that limit and define the work of cleaning staff. They wait for a moment that will not expose the other person in front of the others. They also highlighted a politicized aspect of cleaning work in their remarks

on how the cleaning staff are outsourced nowadays, and they must buy and bring their own equipment, which is sometimes not compatible with the requirements of hospital cleaning.

In these interactions between the hygienists and the cleaning staff and the discussion with me afterwards an important aspect of hygiene work becomes apparent: it entails social maneuvering, because hygienists are aware that they are seen as the hospital police who control and monitor other people's work and behavior. A lot of effort thus goes into avoiding an atmosphere of surveillance and instead emphasizing their role as mediators. My interlocutors drew a connection between political and economic decisions that shape hospital management and cleaning options, and they explicitly identified the problem of outsourcing. Thus, it becomes clear that hygiene is also a matter of weighing up realistic relationships, practical causes, and infrastructural conditions embedded in political-economic matrixes. As one hygienist stated in an interview:

But I think it's important to convey that it's something positive, yes, that it's about improvement, and it's not about pointing fingers, always saying 'you haven't done this correctly'. Because everyone knows that when things have to be done quickly, hygiene is the first to suffer, and you will certainly judge that depending on the situation. But it's about the routine processes and looking at these; are there improvements or are there really major deficiencies and where can training be helpful or what would make sense. (Interview hygienist MP)

This hygienist expressed a sense of re-shaping the image of hygiene by conveying a feeling of common responsibility and improvement against a merely corrective and judging intervention. At the same time, context matters, and the prioritization of hygiene is always shifting, being at the forefront in some moments, but also fading into the background in other moments. This is not only and exclusively a matter of bacterial threat but also a question of intrapersonal professional relations.

While the hygienic gaze is encompassing and rigorous, the hygiene inspections demonstrate that it is much more than checking the boxes of hygiene issues on the documenting sheet. For hygienists, different things are regarded as being key bacterial mediators. The hands are the most prominent mediator, and hand hygiene regimes are the epitome of infection prevention measures, but cleaning equipment and water or air flows are also mediators connecting different environments. Different stakes are negotiated within the encounters between hygienists and hospital staff, stakes that highlight the sociopolitical dimension of hygiene. This includes the low priority and standing of cleaning in resource allocation, the difficult position of hygiene work within hospitals and medicine, the policing role that hygienists often represent, as well as the situatedness of hygiene standards and ways to work through their implementation.

But the need for hygiene is also mobilized by other professionals to argue for required resources. Not only do hygiene teams provide an open ear in situations where others don't know whom else

to ask, but they can also use their role to advance other matters under the guise of hygienic necessity. One hygienist explained this in an interview:

Hygiene inspections, we have structured them in such a way that the wards now see them more as a form of support. For example, let's say there's some furniture that's damaged, and then you wait years to eventually get approval to replace it. In such cases, the hygiene team is often utilized because if we report it and officially notify the management, they now know that they will get it resolved very quickly. This way, we've somehow managed to make them see it as positive support. (Interview hygienist TK)

While the allocation of resources and prioritization of hygiene in the hospital are tricky, concerns over hygiene measures brought to the management are taken seriously, a fact that is used by hospital staff to maintain good infrastructure and by hygienists to create a positive image and atmosphere of working together. The hygienic threat of broken material is resolved quicker than brokenness alone. Only in the context of hygiene does the porosity of a damaged couch become an urgent priority to act upon for a safe hospital environment. Only in the context of hygiene a damaged couch becomes urgent to act upon in, a priority for a safe hospital environment. During these negotiations and the balancing of relations, an expanding understanding of what hygiene is for becomes clear.

Environmental relations: providing context for bacterial cultures

When I spent time in the lab, I learned about what experts call "social anamnesis" (Sozialanamnese). This is a process whereby laboratory staff, who are somewhat isolated from the rest of the hospital and without patient contact, receive relevant 'social' patient information about the bacterial samples they receive for analysis, in order to determine, for example, whether the patient is just colonized by resistant bacteria or has an infection. This means figuring out if the bacterial presence on a patient is disease-causing and thus needs antibiotic intervention or if antibiotics could be avoided because bacteria are present but not causing any harm. A hygiene physician explained this in an interview:

And we deal with septic patients, particularly blood culture results, tracheal secretion results, wound swabs, and such things. You have to separate the wheat from the chaff, often there are so-called innocent bystanders, non-pathogenic germs that don't need to be treated. These, of course, also show up as positive signals in the various microbiological findings, but they are not worth treating. And in this way, a lot of antibiotics can simply be saved. (Interview hygiene physician JR)

In this and other instances, the concept of the "innocent bystander" is employed to distinguish between bacterial colonization (mere presence) and bacterial infection (pathogenic presence) – a distinction that is crucial to antibiotic stewardship programs aimed at optimizing antibiotic use in hospitals. A central responsibility of the hygiene team is to disseminate this knowledge, acting as intermediaries who bridge the gap between various stakeholders in the process, including staff in

the hospital wards and the laboratory. Their guiding principle is clear and is succinctly captured in the mantra: "Accept colonization, avoid infection."

The hygiene team not only communicates the laboratory's requirements to the wards but also advocates for a more nuanced approach to anamnesis – one that goes beyond the mere act of collecting a swab and sending it to the lab. Instead, they emphasize the importance of providing detailed context, ensuring that diagnostic processes are informed. The lab analysts refer to this kind of sample as "serious material", which they contrast to less conclusive material because it lacks such context. Context in this regard can refer to such aspects as occupation, place of residency (inside or outside of Austria), pregnancy, location of accident, and potential contact with the earth. Knowing a person's circumstances, prior environmental contact, or living conditions helps the lab team to refine their evaluation of bacterial presence, and it helps the hygiene team to convey the importance of targeted antibiotic use. The mere biological existence of the sample without the socio-biographical information is not helpful for the case. This was explained by an infectiologist in an interview:

What is really important in infectious diseases is the anamnesis, the medical history of the patient, because it already allows for a lot of diagnostic insights. From it, you can work out a certain risk profile, which includes things like travel history, previous hospital stays, prior treatments, contact with animals, dietary habits, family environment, and pre-existing conditions. All these factors can make certain pathogens more or less likely. Of course, we also consider the patient's occupation, leisure activities, and specific hobbies, such as water sports or contact with soil. (Interview infectiologist LP)

This mediating process between taking samples, the lab analysis and diagnostic work show how a bacterial culture alone doesn't tell enough of a story. The sample needs to be considered in light of the patient's prior movements and whereabouts, as well as where exactly on the body the sample was taken. Hygiene physicians are well versed in knowing where to expect certain bacteria – on and in the body and beyond – and where some might be out of place, or how to evaluate a mix of bacteria and determine which of them might be pathogenic.

Bacterial relations: diagnostic work and antibiotic stewardship

We meet with the doctors on call from the cardiology ICU to discuss current patients, their antibiotic regime, their infections, and their bacterial compositions. In the meeting room, the doctors provide additional information to contextualize the patient data that is displayed on a big screen, showing their blood levels, temperature curves, and inflammatory factors. The experts all think together about the implications of these levels and factors, about the overall picture and about their feelings about the patients; they discuss where to possibly remove catheters, where to end or begin antibiotic treatment. A patient has aspirated during the night – should they be treated with antibiotics? They are indecisive about this and discuss back and forth the state of the patient,

their risk factors, and their lab levels. What does the patient's story – their condition over recent days, their weight, age, underlying conditions, antibiotic and infection biography – tell the experts in the room about the patient's ability to deal with this potential bacterial threat in the lungs? In the end, they decide it is best to give the patient antibiotics, since aspiration is always tricky. In a humorous way, they ironically close the patients' discussion with the words 'come on, lets grant them the antibiotics' ('das gönnen wir ihm').

A key aspect of the role of hygiene professionals is antibiotic stewardship – the support to hospital staff in ensuring that antibiotic use is optimised in light of AMR. This involves discussion with staff within hospital departments – as illustrated in the vignette above – and aspects of diagnostic support and interpretation. Antibigrams – the tests to determine the sensitivity of bacterial resistance to antibiotics – are discussed on the wards, where the hygiene team joins staff in reading the antibiograms. Here, they mediate between the results of the lab and the professionals on the ward who must act on these results. Hygienists here come in as experts in microbiology, balancing antibiotic prescriptions for individual patients and the bigger picture of tailoring antibiotic use in times of AMR. Often this means deciding if the resistant bacteria that have been found and tested positive for sensitivity are even worth treating with antibiotics. The more contextual information the lab professionals have, the more targeted the analysis and diagnostic value can be. It also helps to get a sense for how far-reaching certain resistances are already outside the hospital – which my interlocutors referred to as the “community”. A hygiene physician explained the situation in the following way:

That is the function of hospital hygiene (...) If it is possible, and this is where it becomes very difficult, to differentiate between pathogens that are acquired in-house and are therefore at home in the biotope of the hospital and those that come from outside. Are we suffering from a local problem and are we spreading it in-house or are we getting it from outside? As an indicator of whether resistance has already arrived in the community. (...) We know that special resistances have been increasing since the year 2000. We know that this has actually arrived in the community to a certain extent and is no more common inside the hospital than outside, so that more intensive measures in the hospital may no longer be of any use at all.
(Interview hygiene physician CK)

The hygiene physician quoted here refers to the “biotope of the hospital” and how the diverse routes, directions, and habitats of resistant bacteria break down the barrier represented by the hospital walls. If the resistant bacteria are already in the community as opposed to being a localized hospital occurrence, then certain hygiene measures such as isolation become useless in face of wide-spread ubiquity. To work this out, it is thus not only helpful to know what is going on inside the hospital at a specific time with a specific patient, but also to get a sense of the resistance situation outside of the hospital, within the community. In terms of the hospital's accountability and its reputation as a hotspot for acquiring resistant bacteria, it is important to know whether the

problematic bacteria are being brought *to* the hospital, whether the AMR is not only a problem in and for hospitals, but also exists outside of the hospital walls and *within* the community.

In this communication-intense process between various actors, the goal is a targeted antibiotic intervention. The social anamnesis helps the lab professionals to trace the sample, to put together information gathered through questions with the results from technical analysis. The social anamnesis – the biographizing of the patient's body as a bacterial body – then permeates the mere presence of a certain bacterium. In the best case, social anamnesis enables the embedding of the bacterial presence, linking the swabbed bacteria back to the body it is part of, in order to evaluate the need for antibiotic treatment. Depending on the hospital's resources, hygiene work also includes microbiological expertise. In such discussions about antibiotic treatment, hygiene establishes a diagnostic infrastructure that is distributed across the wards and mediates between the interpretation of laboratory results, the individual patient and the goal and necessity of targeted antibiotic use.

Discussion

The examples of infrastructural care I detailed show how hygiene practices are a negotiation and balancing act of different relations, a maneuvering of multiple social, institutional, material and bacterial environments. First, during their hygiene inspections, the hygienists scan the material and spatial environments of patients to determine which might potentially be welcoming to bacterial growth: sinks, drains, cracks and grooves, plants, certain air flows, water. There are clear protocols and standards for the construction of hygienic environments, and the hygiene inspections serve to check the boxes: fresh soaps, enough disinfectants and hygiene equipment, enough distance between beds and radiators, no flowers or plants near patients. Simultaneously, the relations between professionals are played out, between wards and discipline, as well as across hierarchies. Horizontally and vertically, institutional rules and logic permeate these human-human as well as human-bacteria relations. As such, abstract institutional power becomes apparent in these relations, drawing contours to the performance of hygiene but also vice versa. Second, environmental relations are hygienically scrutinized by weighing in on the process of social anamneses, contributing to a diagnostic infrastructure of bacterial presence. Third, this diagnostic infrastructure is further buttressed by the role of hygiene professionals in antibiotic stewardship – their support to staff to optimize antibiotic use – through visits on the ward, interpreting antibiograms, and negotiating antibiotic use with physicians at the bedside.

All these practices show how hygiene professionals navigate the hospitals microbial environment and balance the complex and often contradictory relations between humans as patients and colleagues, bacteria, and institutional structures. These balancing acts, I argue, reflect the broader

dynamics of late industrialism, in which AMR presents as a crisis of modern technological optimism and the persistent, yet partial, efficacy of control measures. This is reflected, for example, in an understanding of what professionals' call "flora", a patient's bacterial composition that might be disturbed (through infections or antibiotics), intervened in (through, for example, catheters), or affected by changing environments. The patient is at once an individual body but also one that merges with its environment, as one interlocutor states: "Because the longer you stay in one place, the more you absorb the flora of that place" (Interview infectiologist ID).

For antibiotics to be an infrastructure, other infrastructural work is in need, and in late industrialism shaped by bacterial ambivalence, I argue that hygiene practices anticipate and negotiate infrastructural care that is put to practice through three different relations: professional, environmental and bacterial. By seeing the patient as a bacterial environment shaped by multiple influences – such as prior antibiotic use, hospital stays, and environmental exposures – hygiene professionals navigate the complexities of bacterial abundance and absence in ways that challenge the narrow, technocratic logic of modern antibiotic regimes. But it is not only flexible because hygienists don't want to come off as controlling, but because bacterial presence must be situated. Hygiene practices engender specific relations to bacteria, keeping (flowing and floating) bacteria in place. As such, hygiene moves beyond its image of constraining the work of staff and aims to be a valuable and valued contribution to the prevention and management of infections, the re-defining of rules for human-bacteria encounters, and the negotiation of potential risks to a safe hospital environment. This shift is observable where AMR is a serious issue on the hospital agenda as it was in three of the four hospitals where I conducted my research. Amidst growing concern over the future of antibiotics, the hygiene teams that I worked with weighed in as experts with a comprehensive approach, as their work concerns every corner of the hospital under the lens of infection prevention and microbial encounters, something that everyone in the hospital, including newcomers on their first day, have to be made aware of.

The balancing acts reflect an acknowledgement for an "anthropogenic biology as an analytic for the aftermath" (Landecker 2024), a knowledge of life full of intricacies and metabolic, composing and decomposing complexities. The discussions around patients' flora reflect a crucial aspect of anthropogenic biology, what Landecker analyses as an overestimation of modes of control, because they tend not to fail in its entirety: "These control measures do not fail, indeed they are generally powerful for a time, and thus enhance the tendency to mistake some control of the living for complete knowledge of the living" (Landecker 2024: 4f.). This suggests, I argue, that bacterial ambivalence is not only materially significant in understanding human-bacteria relations but also conceptually important in rethinking hygiene practices.

These daily negotiations of ambivalence point to the limits of modern technological optimism and the enduring influence of control measures that, while not entirely failing, are insufficient to address the complexities of AMR as anthropogenic biology. As Landecker (2024) suggests, this moment offers an opportunity to move beyond the narratives of control and instead focus on the biological and conceptual legacies of these regimes and modes.

Conclusion

In this paper I have shown how hospital hygiene practices reveal the tensions between bacterial abundance and absence, institutional power, and the socio-ecological dynamics of late industrialism. Through my ethnographic material, I have shown how hygiene professionals engage with the material environment – scanning cracks, drains, and surfaces for bacterial threats – while simultaneously navigating institutional hierarchies, inter-personal and human-bacteria relations. Their work reflects an awareness of bacterial ambivalence and the limits of modern antibiotic regimes that prioritize bacterial control over coexistence.

While AMR policies, such as One Health, advocate for integrated approaches to human and nonhuman health, the everyday practices of hygiene reveal the challenges of balancing bacterial abundance and absence, sustaining antibiotics as infrastructure, and re-evaluating modes of bacterial eradication. But bacterial and microbial ambivalence is not a newly established ontological and epistemological fact. AMR reveals the limits of modern visions of containment and control through bacterial absence. It calls for a re-evaluation of approaches. Alongside antibiotics as infrastructure, which clearly adhere to modernist logics of bacterial containment through absence, ‘hygiene as infrastructure’ can reflect late industrial ambivalence, and my ethnography has revealed how this takes place in practice. Relational hygiene politics centring bacterial flows, diversity and ambivalence should be welcomed, but such complexities should not only be acknowledged but also embedded in matters of governance and policymaking.

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II. From innocent bystanders to pathogenic bacteria: Navigating bacterial presence and pathogenic potential in hospital infection management under rising antimicrobial resistance

Abstract

Antimicrobial resistance (AMR) is reshaping everyday hospital work around infection prevention in hospitals. Drawing on ethnographic research in Austrian hospitals this paper examines how clinicians negotiate bacterial presence and pathogenic potential to decide when antibiotics are necessary and when they are not. I introduce the concept of bacterial profiling to describe the situated practices through which clinicians assemble, interpret and specify bacterial presence to tailor antibiotic use. These practices include distinguishing “innocent bystanders” from harmful bacteria, recalibrating long-standing dogmas about finishing antibiotic courses, and combining quantified biomarkers with embodied judgments of “felt sickness.” I show a shift from a “safety-first” reliance on broad, preventive antibiotic use toward a “certainty-first” approach that seeks bacterial specification through surveillance, interrogation, and thresholds. While bacterial profiling pragmatically navigates microbial “grey zones,” it also concentrates AMR governance on optimizing targeted use, potentially sidelining infrastructural and environmental determinants of resistance. Conceptually, the paper situates these practices within debates on the flexible and bacterial body and proposes scarcity holism to name the convergence of ecological sensibilities with individualized, behavior-focused stewardship.

Keywords

antimicrobial resistance; infection management; antibiotic stewardship; bacterial profiling; pathogenicity

Introduction

Antimicrobial resistance (AMR) is one of the most pressing global health issues. AMR refers to the mechanisms that microbes develop to resist human intervention such as antibiotics for bacteria or antivirals for viruses and has been recognized by the World Health Organization (WHO) as a leading threat that could fuel future pandemics. This has prompted urgent calls to raise awareness and take action against the growing problem of resistant bacteria. The main strategies leveraged by transnational and national bodies to fight AMR include education about the problem and its consequences, research into and monitoring of antibiotic use in both human and animal medicine, and interventions to propel behaviour change in prescription practices and use of substances (da Silva-Brandão et al. 2025, Kenny et al. 2025). Due to AMR, antibiotics are becoming a scarce good; there is widespread uncertainty about how and when to use them the best way. Relatedly, in hospitals, this uncertainty intensifies along questions of patients' wellbeing, often between life and death, biomedical treatment and care. Since the publication of WHO's Global Action Plan on AMR in 2015, social science scholarship has been critically analysing these approaches and showing the limitations of behaviour-change focused strategies and policies. Scholars have argued for close examination of the complex entanglements of bacteria, humans, and the environment, adding nuance by situating AMR as a more-than-medical, more-than-human sociopolitical issue (Broom et al. 2021, Chandler 2019, Hinchliffe 2021, Kirchhelle 2023).

This paper contributes to social science research on AMR by examining infection management – a key part of antimicrobial stewardship programmes (ASP) – taking a closer look at antibiotic uncertainty in Austrian hospitals. In this context, I ask how clinicians' approach (resistant) bacteria in hospitals along questions of infections and pathogenicity amidst a broader endeavor to study how life and the human body are configured vis-a-vis resistant bacteria and in light of increasing antibiotic resistance in hospitals. With a focus on the management of infections, I consider how resistant bacteria are treated, both practically, by navigating the use and non-use of antibiotics, and conceptually, by navigating questions about pathogenicity.

Drawing on ethnographic fieldwork with infectiologists, microbiologists, and hygiene clinicians, including interviews and observations of infection management teams, I analyse how clinicians make sense of suspected infections and potential pathogenicity and how these judgments shape the use and non-use of antibiotics.

Conceptually, this study focuses on the biopolitical configurations constructed by infection management, how life and living with and against bacteria as well as how the human body is shaped and managed vis-à-vis potentially resistant, potentially pathogenic bacteria. Expanding on the notion of the antimicrobial gaze developed by Kenny et al. (2025), I introduce the notion of bacterial profiling to account for the epistemic culture enacted by infection management

characterised by policing and biosecurity logics as well as more-than-human, ecological approaches. It describes the situated practices through which clinicians assemble and interpret bacterial presence to make sense of pathogenic potential and tailor antibiotic use. Bacterial profiling draws on policing and biosecurity logics while also accommodating more-than-human considerations about microbial ecologies and the relational, porous nature of bodies and borders.

To this end, I examine antibiotic stewardship's call to avoid "unnecessary" use and how it is enacted through bacterial profiling, which mediates tensions between immediate patient needs and longer-term resistance concerns. I argue that the abstract and concrete danger and threat of AMR propel onto-epistemic shifts that exceed a dualistic understanding of anti-biotic versus pro-biotic governance. Rather than a simple opposition between good and bad bacteria, current infection management in hospitals navigates bacterial "grey zones" where the status of bacteria –and the right course of action – remains negotiable.

Negotiating pathogenicity: bacterial profiling as a conceptual framework

Amidst a growing wave of social science research on AMR, microbes and their social-environmental entanglements (i.e., the *microbiosocial* (Whitthaker, Do 2023)), scholars have begun actively to explore the governance of microbes and their relationship to humans through a biopolitical lens rooted in Foucauldian thought. I build on this literature by situating my analysis within current debates on biosecurity and the biopolitics of pathogenicity, immunity and infectivity. These approaches explore human-bacteria relations across multiple scales and practices: from global governance and questions of biosecurity (Hinchliffe et al. 2013), including bordering practices (du Plessis 2018, Green 2021) and the framing of the nation state as an immunity project (Martin 1994, Neocleous 2022) or microbial state (Fishel 2017), to intimate, micro-scale engagements with microbes in hospitals, cheese-making (Paxson 2008) or microbiome-related health practices (Kotliar, Groszlik 2023). Biopolitical approaches help illuminate how AMR is governed, particularly in relation to how humans live with and against bacteria under conditions of antimicrobial resistance. In what follows, I engage with scholarship that applies biopolitical frameworks to the study of microbes, focusing on how concepts such as immunity, pathogenicity and infectivity intersect with the broader governance challenges posed by AMR.

As recently argued by Kenny et al. (2025), "monitoring regimes" constitute a pivotal strategy in addressing AMR, shaping what they call an *(anti)microbial gaze*. Building on Foucault's biopolitical work which gave rise to the concept of 'the medical gaze', this mode of governance is rooted in practices of counting, quantifying and surveillance. Kenny et al. (2025) explore the consequences of problematising AMR in this way and critically reflect on what forms of knowledge are obscured through the dominance of the quantified (anti)microbial gaze. Building on this conceptualization,

I reflect on the shifting roles and meanings of antibiotics, bacteria, and pathogenicity that infection management navigates. In this study, I show that bacterial presence is managed through a transition from broad, generalised and preventive use of antibiotics – aimed at producing sterile, “safe” and hygienic environments – to more targeted use guided by behavioural framings and surveillance of prescription practices, especially under the imperative to avoid “unnecessary antibiotic use”.

This shift enacts a specific version of the body, the microbial body: one that requires an ecological, holistic understanding in order *to specify* the individual bacterial profile. Alongside this, the meaning of antibiotics changes. Antibiotics are increasingly seen as potentially toxic substances that can contribute to a state of microbial dysbiosis. In this framing, microbial integrity becomes something to be maintained or “warranted,” so to speak. In the context of AMR, what unfolds is a rather interesting “agentic dance” (Hinchliffe 2021) involving bacteria, antibiotics, pathogenicity and toxicity, where roles and meanings of both antibiotics and bacteria swiftly change. As Hinchliffe puts it, emphasizing the importance of geography and spatial assumptions in AMR analysis: “resistance is not simply a matter of microbial recalcitrance or social misconduct, but the agentic dance of socio-environmental processes” (2021: 12). In this sense, bacteria may cause harm, be innocent bystanders, or exist as potentially pathogenic just not yet in sufficient numbers. Antibiotics, in turn, might reduce pathogenic bacteria, but they may also generate resistance pressure, disrupt bacterial compositions, or prove too toxic for a vulnerable body. It is precisely this agentic dance across both the intimate (body-centred) and large-scale environmental dimensions that infection management must try to navigate.

Although immunity is not my primary conceptual lens, it nonetheless plays a significant role in how AMR is understood and addressed. Biopolitical literature on immunity opens important questions about the governance of humans as microbial beings, and highlights the porosity of bodies, walls, borders and nation-states – questions that surface prominently in practices and discourses surrounding infection management in hospitals. Discourses on immunity also map onto other concepts such as *immunocompetence*, or the body’s ability to deal with microbes on its “own”. Much has been written about the connection between the biological concept of immunity and the nation-state, particularly in relation to ideas of security, surveillance and governance. Martin (1994) famously analysed the emergence of a “flexible body” that goes hand in hand with sociopolitical transformations, wherein (neo)liberal ideals of productivity and labour organisation are both reflected and reinforced by a flexible-self mode of subjectivity:

Perhaps the seductiveness of (immune) systems thinking comes about because it seems to represent an escape from earlier forms of discipline that constrained bodies and groups in the mass production era, the strict immobilization of the body in rigid postures and limited movements in factories and prisons or the detailed rules that governed mind and body in schools and the military (see Foucault 1979, 1980). Fresh from these experiences, it is no

wonder that moving gracefully as an agile, dancing, flexible worker/person/body feels like a liberation, even if one is moving across a tightrope. But can we simultaneously realize that the new flexible bodies are also highly constrained? They cannot stop moving, they cannot grow stiff and rigid, or they will fall off the “tightrope” of life and die. We need to examine carefully the social consequences of these constraints. (Martin 1994: 247f)

The flexible, and now microbial body embedded in an “agentic dance of socio-environmental processes” (Hinchliffe 2021: 12) is enacted through bacterial profiling. Martin’s analytics prompt a critical examination of porous body contours and the neoliberal, political co-optation of such interventions. The flexible body halts us to analyse about the actors involved in the agentic dance and how the involvement is constructed and to ask about the normative, disciplining dimensions of a microbial body.

Bringing these strands together, bacterial profiling names the practical instantiation of Martin’s “flexible body” within Hinchliffe’s “agentic dance.” The flexible body foregrounds a neoliberal, responsabilized subject whose porous contours must be continually optimized; the agentic dance reframes infection as a process between humans, microbes, antibiotics, environments, and institutions. Bacterial profiling is not merely a technique of measurement; it is a biopolitical mode that materializes flexible bodies as microbial bodies. Within this assemblage of conceptual contributions to the study of human-microbial relations—focusing on power, governance and scale – from the bacterial to the individual to the planetary body – as well as the shifting contours of the body itself (e.g., where does the human body even end? (Wolf-Meyer 2024)), I propose the term *bacterial profiling* to describe these intricate practices I observed during my research for this study.

Infection management and antimicrobial resistance: A note on Austrian hospitals

Infection management is part of antimicrobial stewardship programmes (ASPs) (and vice versa) and serves as an umbrella term for practices that focus on infections and, consequently, (resistant) bacteria and antibiotic use. During my research I encountered different approaches to embedding infection management into hospital function. For example, one hospital had a dedicated infection management team, whereas in other hospitals, infection management was integrated into the hygiene department or treated as an extension of microbiology. Sometimes, these roles converged. In contrast to hygiene management, which is clearly embedded in formal hospital governance policies, infection management tends to remain a more internal and variable hospital matter. In some hospitals, ASPs are a one-person effort—if the hospital is lucky enough to have a physician with specialised training. However, many voice concern about the lack of professional, educational, and financial recognition for such work. When not structurally supported by hospital governance, ASPs often rely on individual motivation and personal interest in the subject. As one interviewee said when asked about the ASP structure in their hospital: “I am the team.” This participant

emerged as the hospital's antibiotic specialist after a period when the Austrian government promoted and funded ASP training for health care clinicians.

While Austria began promoting AMR-specific policies well before WHO's 2015 call for National Action Plans, the federal structure of Austria's political and healthcare systems has made it difficult to implement standardised, legally binding guidelines. In contrast, Germany, for example, has mandatory ASPs, formalised training programmes and diplomas (Jeleff et al. 2023). For clinicians working in infection management, the core challenges lie in navigating and legitimising the "bacterial grey zones"—adding nuance to an often overly binary interpretation of antibiotic use. While less specialised and sensitised practitioners might interpret antibiograms in clear-cut terms (seeing bacterial presence as a definitive sign of infection or pathogenicity), infection management tries to complicate clear readings and allow for ambiguity. Here, ambiguity means recognising that bacterial presence may not indicate health or disease, pathogenicity or infectivity, but rather reflects the patient's entanglement with more-than-human dynamics (Hinchliffe et al. 2013). Bacterial presence requires further qualification, a kind of profiling that draws on intimate knowledge of the body and its ecological relationships. In Austrian hospitals, a range of specialists are trying to establish ways of interpreting antibiograms, understanding patients and their bacterial compositions, managing infections, and tailoring both antibiotic use and patient care accordingly.

Methods

Interviewing and Observation

This article is based on material I gathered for my doctoral research project on antimicrobial resistance in Austrian hospitals. After securing ethical approval at the beginning of 2021, I conducted 21 in-depth qualitative interviews with clinicians, stakeholders and experts on AMR in Austria, with a focus on the healthcare setting. The interviews focused on the practices for dealing with AMR in hospitals. I also completed eight days of observation in hospitals, following hygiene teams and one infectious diseases team through their daily routines and movements. While only one team was exclusively dedicated to infectious diseases management (reflecting the rarity of such dedicated teams in Austrian hospitals), many other teams and interlocutors held multiple roles, such as serving as both hygiene physicians and microbiologists, or working as intensive care physicians while overseeing the antimicrobial stewardship programme.

Analysis

I analysed my material using interpretative methods, putting situational analysis (SitA) and constructivist grounded theory (CGT) in conversation with each other (Clarke et al. 2022, Charmaz 2014). The visualisation and mapping techniques of SitA require engagement with the data from

the very beginning of research, as different types of maps are completed at different stages in the research process. The outset of the process was characterised by mapping the issue of AMR in Austria through categories such as human and nonhuman actors, institutions, discourses, policies and materialities. Towards the end of the research, in conversation with coding strategies proposed by Charmaz (2014), categories such as pathogenicity, the microbial body, and human-microbe relations became part of a more complex mapping by identifying the positions taken by my interlocutors in certain discourses.

Through the repeated mapping of the material, I identified key themes early on, for example, that both hygiene and infection management focus on negotiating bacterial compositions, albeit with different emphases. By contrasting cases, comparing material and notes, and delving into the specific approaches to AMR from both hygienist and infectiology vantage points, I was able to nuance and complicate standard narratives around AMR policies in hospitals.

Results

I join an infectiologist in a small room in a quiet part of the hospital, where they take telephone calls for infectious diseases consultations. As one of the few teams offering this service, they receive calls from hospitals all over Austria. We talk about the difficulty of “seeing” the patient in question without physically getting to know them. The professional on the other side of the line is often unaware of what kind of information the infectiologist needs to make sense of the patient. Thus, my interview partner tells me, a process starts wherein they have to use the “right interrogation technique” to solve infection mysteries from afar. I am intrigued by this term and how, in my research more broadly, the infectious diseases clinicians frame what they are doing in a detective-like manner: their work is to discover, to profile, to ask the right questions, to apply the appropriate gaze, and to interpret the data points and blood levels that are provided. In short, they referred to a sense of pulling threads together from frequently isolated information sources: different wards, different problems, different specialists.

In Austrian hospitals, a variety of specialists work to establish ways of reading and acting on antibiograms¹, observing patients and their bacterial compositions, managing infections, and tailoring antibiotic use and patient care. Under the banner of infection management and a part of antimicrobial stewardship programmes (ASP), clinicians consider the state of rising resistance rates among patients and fewer effective antibiotics, enmeshed within economic concerns and wider hospital politics. Infection management is one of the pillars of AMR governance and corresponding ASP in Austrian hospitals. Fuelled by a logic of effective antibiotics as a scarce resource in need of

¹ An antibiogram shows laboratory susceptibility results to antibiotics, helping clinicians to choose the most effective treatment.

considerate use, infection management focuses on specifying bacterial compositions by gathering and combining knowledge about the body, understood as a microbial ecosystem. By closely examining what kind of bacteria are present, where (on and in the body) and in what quantities clinicians elaborate on pathogenic potential to decide what kind of antibiotics are needed or might be “unnecessary”. Through these practices, clinicians configure the patient’s body in a more holistic manner than in usual hospital settings, moving beyond highly specialised biomedical subfields to consider the patient’s microbial body in relation to overall health status and environmental embeddedness.

At the same time, the indicators for “unnecessary” antibiotic use reveal how the human microbial body is configured in the face of the antibiotic crisis. Antibiotics are no longer only viewed as the magic bullet of biomedicine but also as toxins, agents that aggravate bacterial resistance, and antagonists to microbial balance and ecological systems (including the body itself). Thus, clinicians often contrast antibiotics to the normal bacterial flora (Normalflora), configuring antibiotics as intruders. Meanwhile, as I further elaborate in the following section, bacteria may sometimes be constructed as “innocent bystanders”, which are part of normal flora that do no harm but might trigger unnecessary antibiotic use in lesser versed and trained healthcare clinicians.

“Innocent bystanders”: Bacteria in and out of place

One of the main tasks of infectiologists is to support colleagues in specifying which bacteria (in a sea of bacteria) cause harm, which require treatment, and which should be left alone. They thus need an intimate understanding of when and where bacteria are unwanted:

By knowing which pathogen is present in which part of the body and which isn’t, there are certain cases where I’d say: that germ – we can disregard it in this location. However, if it were somewhere else, I would certainly consider it worth treating. (Interview JR)

Another way clinicians refer to the location of bacteria is through the concept of the “innocent bystander”:

And we have to deal with septic patients, in particular blood culture results, tracheal secretion results, wound swabs, these things, and you also have to separate the wheat from the chaff. And often explicitly not treat the innocent bystanders, the non-pathogenic germs, because they naturally also come back as positive signals in the various microbiological findings but are not worth treating and a lot of antibiotic treatment can be saved here. (Interview JR)

As the name “innocent bystander” suggests, non-pathogenic bacteria may be present in some cases, but they do not necessarily need to concern physicians. To the less trained eye, their mere presence might be mistaken for pathogenicity, leading to unnecessary antibiotic use. This is where an infection management team steps in: to prevent antibiotics from being used on innocent bystanders:

A good example is tracheal secretion: if enterococci are found there, for example in our long-term ventilated patients, if the germ *Enterococcus* is detected, which can certainly play a role as a urinary tract infection pathogen and can also cause sepsis from there, we would not treat it in the tracheal secretion, even though it returns, because it simply does not cause pneumonia or anything else there. And if you know that, you can avoid quite a bit of antibiotic treatment here, because I simply don't care if it's detected there, and I just don't treat it. And if you don't know that, you would just start some antibiotic treatment because a positive result comes back, but it's completely unnecessary. (Interview JR)

This is important, because not only are these bystanders not considered disease-causing, treating them with antibiotics might also promote the development of further resistance.

In other cases, swabs from infected wounds indicate the presence of different bacteria, some resistant to multiple antibiotic groups, as well as the infamous *Staphylococcus aureus*: it is a common skin/nasal bacterium that can turn pathogenic, and MRSA is its drug-resistant form. I refer to these hospital bacterial presences as grey zones, where infection management clinicians work on clearing the fog by elaborating on the situatedness of bacterial presence. Bacteria can be innocent bystanders, hastily interpreted as pathogenic because they are made explicit through swabbing, testing and showing resistance mechanisms. Further, the argument for hygiene and infection measures hinges on clear boundary-making between the inside and the outside. Hospitals make bacterial colonisation explicit through screening, swabbing and testing; clinicians repeatedly reference these demarcation lines. One interlocutor explained that it is only by getting in contact with the health system that bacterial colonisation becomes important:

As long as you have nothing to do with the health system, this is not an issue at all, no matter how heavily you are colonised with anything. You have never asked the man at the box office if he is colonised with resistant bacteria. (Interview infectiologist ID)

By entering the hospital, patients' bacterial compositions (unnoticed outside hospital spaces) become relevant – not only regarding their pathogenic potential but also their resistance properties. This creates a paradox: hospitals are publicly seen as generators and hotspots of resistant bacteria, yet clinicians inside the hospital point out that they are simply the ones to name entanglements and relations produced outside of hospitals, where the bacterially rife body moves around in the first place.

Hospital spaces, permeated by the antimicrobial gaze, scrutinize not only the human body but also surfaces, materialities and equipment as bacterial. The hospital functions as a high-stakes environment where bacterial presence is made explicit, especially amid antibiotic scarcity. Clinicians, on the other hand, argue that antibiotics are used more generously and less specifically outside hospitals (following a better-safe-than-sorry mentality), while the current antibiotic crisis clearly calls for tailored, well-considered use. It is thus the mandate of clinicians versed in infectious diseases, microbiology and hygiene to raise awareness about the specificities of bacterial presence

so that antibiotic use becomes targeted and tailored and that unnecessary prescriptions for innocent bystanders is avoided.

“Feeling sick”: the “right” use of antibiotics and immunocompetence

A question that gets easily lost in the hospital, where the patient body is constantly measured by numerous indicators, is how infections are experienced bodily. The right use of antibiotics is also measured against a feeling of sickness; patients who are not severely sick or immunocompromised can contribute to a shared sensitivity about the topic. While infection in a surveilled place like the hospital is a matter of data points (e.g., CRP, blood levels, bacterial swabs), clinicians argue for an approach that supposedly returns some bodily autonomy to patients, where the need for antibiotics might be “felt”:

And you can't get that out of their heads either. And if someone has been saying for 40 or 50 years, “You definitely have to take the whole pack,” that takes time. And it's much more difficult, too. It's very easy to say, “You have to take it for ten days, then stop.” Yes, as if I were saying, “Do you have a deep-seated infection?” “No.” “Are you immunocompromised?” “No.” “That means you can decide for yourself when to stop the antibiotic. Are you able to do that?” “Yes. Okay.” “Then I'll say good. Here's your antibiotic. Take it as long as you think you need.” (Interview infectiologist ID)

This sentiment clearly challenges what antibiotic users, including me, have been told and the official guidelines of the last decades. The infectiologist acknowledged that although negotiating antibiotic use between physicians and patients in hospitals is difficult, it might be more feasible in less pressured environments such as primary care.

Interlocutors working with AMR who are concerned with infections in one way or another repeatedly brought up the deeply ingrained dogma that to avoid antibiotic resistances, patients must finish the entire antibiotic course. For a long time, stopping a course of treatment early was considered a patient's failure (or even a sin). Today, infectiologists explained that they struggle with the legacy of this popular understanding. Nowadays, antibiotic pioneer Paul Ehrlich's “frappe fort, frappe vite” (strike hard, strike fast) approach is favoured in Austria and is now gaining traction internationally. Antibiotics are also viewed as interfering and intervening, as toxic and potentially overwhelming for the body:

B: There are simply patients who die because we cannot treat them. Full stop.”

A: “Yes. Exactly. That makes treatment extremely difficult.”

B: “Yes – extremely, extremely – and extremely toxic. Because what's left? You are left with antibiotics with severe side effects which almost always knock out the kidneys; they are not pleasant antibiotics. And that's also why they're what's left: what isn't used, of course, doesn't generate resistance. And when you do use them, then the microbes become resistant to them.” (Interview ID)

The anti-biotic (anti-life) character of substances is generalised; because the overall human body is considered to be microbial, antibiotics' bacteria-killing properties are viewed as a potentially disruption to the body, with the potential to provoke a state of microbial dysbiosis. The need for antibiotics must be diagnostically specified, potentially felt by the patient, considered along its toxic potentialities and potential resistances:

It is a fallacy to say that I have to treat the infection so that no resistance develops. We used to always say, "You always have to take the pack of antibiotics so that you don't develop resistance." We have completely moved away from that. No, on the contrary: "Take it for as long as you need it. As soon as you feel so good that you no longer think about it, you probably just don't need it anymore (Interview ID)

What sounds like a rogue approach to antibiotics and infections and stands in stark contrast with what one actively needs to unlearn – to finish up a blister of antibiotics no matter what – speaks to a simple infectiology idea:

A: Yes, well that is still difficult to decide at the moment, when it is good and when it is not yet.

B: Actually, it's quite simple, because it's actually how I feel: "You feel badly ill because the interleukin six is high. When the interleukin six is gone, you are no longer ill. You then feel even less ill." (Interview infectiologist ID)

The infectious-diseases physician highlights interleukin-6 (IL-6), a biomarker of inflammation and infection. They characterize it as a "felt biomarker," one that registers both in laboratory results and as a somatic sense guiding decision about the use or non-use of antibiotics.

Though limited in hospitals, this approach speaks to a broader sense of how the body is understood as a microbial ecosystem of its own. It acknowledges antibiotics as potentially toxic and interfering, while acknowledging that some bacteria are innocent bystanders, and that patients have their own normal bacterial flora.

The making of normal flora: Negotiating pathogenic potential vis-à-vis "unnecessary" antibiotic use

Participants in my study often invoked the notion of "unnecessary" antibiotic use, positioning themselves as counteracting a culture of antibiotic prescription that is not only excessive or conducive to resistance, but also harmful—to the problem of AMR, to the environment and to the patient's microbiome. Antibiotics and their use are entangled in complex layers of managing pathogenic potential, restoring or stabilising health, and preventing infection and death. Patients colonised with bacteria, in this context, embody and actualise the threat of AMR writ large. In this sense, hospital clinicians often see themselves as spiders, with multiple and far-ranging limbs that extend into the hospital's corners and the patients' armpits.

Antibiotic stewardship programmes (ASPs), and thus the work of hygiene and infection management clinicians, illustrate how experts in microbiology and infections challenge an entrenched hospital infrastructure where antibiotics function as routine prevention and safety measures. In the face of AMR, the status of antibiotics is changing. Clinicians increasingly frame their use as unnecessary, as toxic and as driving the development of resistance.

Let's put it this way: avoiding unnecessary antibiotic use and avoiding unnecessarily broad antibiotics. It is very tempting to always use the broadest one, that's all we need, that's one of the strongest, the carbapenems and also the resistance to these antibiotics, of course, are the most feared because they are used as reserve antibiotics, and whenever it is possible to work with other means, I try to advise against it, always reaching for the strongest drug right away, so to speak. It is often enough to manage with simple means, that's one thing, and the duration of the administration also plays a role. It should also not be, and this is a general trend in antibiotic therapy today, it runs through all the specialist lectures on this subject: shorter is better. That's a new mantra. (Interview JR)

Here, the notion of unnecessary antibiotic use, on the one hand, and the unnecessary use of broad-spectrum antibiotics, on the other, are two sides of the same coin. This interlocutor's approach reflects what I observed and emphasise throughout this paper: AMR is problematised primarily as an issue of antibiotic use—too broad, too generous, too unspecific. Consequently, current practices centre around narrowing down and tailoring antibiotic use, aligning with one of the central pillars of AMR policies: antibiotic stewardship. As another interlocutor plainly stated: “We don't need any new substances at all. We just need targeted use.” (Interview OW).

Targeted use, then, represents an epistemological effort—an attempt to generate sufficient knowledge about bacterial bodies and their environments to be able to act precisely. With this I circle back to the opening vignette wherein the interlocutor mentioned the need for the “right interrogation technique”. In the face of AMR, clinicians must become detectives and approach bacterial presences as matters to be complicated – what appears obvious might not be what it seems. Bacteria can assume different roles and so can antibiotics. The scarcity of effective antibiotics is contrasted with practices of extensive use, prescription and intake. Profiling the human microbial body using the practices I have described – the right interrogation techniques, specifying bacterial compositions, singling out innocent bystanders, and competently evaluating patient immunocompetence – is part of bacterial profiling that frames and enacts AMR as a matter of epistemic recalibration. This recalibration is grounded in the belief that more precise knowledge about the bacterial specificities in human bodies will resolve the AMR crisis.

Discussion

Whereas a lot of public health literature and policy recommendations focus on “correct use” of antibiotics and envision a compliant patient, my data suggests infection management in practice

actually opens up the space for embodied approaches that consider patients' felt sickness and bodily awareness – especially in light of antibiotic scarcity. I found this to be an interesting if counterintuitive approach to the highly quantified, data-driven regimes that antibiotic stewardship programmes typically put forth. One key dimension is how the concept of “unnecessary antibiotic use” buttresses the work of infection management. Much has been written about “irrational” antibiotic use, both in policy strategies and critical analyses. For example, Denyer Willis et al. (2023) present the concept of “irrational use” as a humanitarian device that frames AMR governance as a problem of unruly behaviour by users (especially in global health initiatives, i.e., on the African continent). While irrational antibiotic use is usually a concept oriented towards countries outside of the European Union, the way that antimicrobial stewardship programmes focus on avoiding “unnecessary use” is based on similar assumptions. The emphasis shifts slightly, however, in the latter context: AMR becomes manageable within hospital micro-environments as an epistemic issue, where bacteria must be characterised and profiled to counteract resistance.

I conceptualize this as *bacterial profiling*, an extension of what Kenny et al. conceptualize as the *(anti)microbial gaze*. Building on their insights, I have suggested that infection management practices provide a concrete empirical case of how AMR is governed through data-gathering, microbial specification, and surveillance. These governance practices reflect a shift: antibiotics, once part of the hospital's safety infrastructure and deployed under a “safety first” dogma in hospitals, are now increasingly governed under a logic of “certainty first.” Current ASP strategies aim for clinicians to focus on being certain that the antibiotic given is *actually* necessary or is, for example, *actually* capable of reaching the pathogen in question. The term *bacterial profiling* helps bring together these interlinked practices of surveillance, interrogation, and specification—efforts aimed at determining when and where antibiotics should be “correctly” used. It helps to bring together an analysis of the underlying logic of AMR policy that frames its primary goal as intervening through knowledge production and the specification of bacterial presence. In the context of infection management, this means that antibiotic stewardship efforts focus on tailoring antibiotic use – an approach made possible through intimate knowledge of the human body as a microbial body. In addition, the term *bacterial profiling* aptly captures the inscribed framing of the hospital practices I observed, which consistently overlap with language and logics of policing and control.

While these profiling practices also reflect ecological thinking and bring the environment into view in various ways, they remain focused on the individual bacterial bodies being profiled. These bodies are constructed to reveal something about the body's ability and immunity to handle bacterial colonization, or what immunology calls *immunocompetence*. Following Martin's caution about celebrating the flexibility of bodies too uncritically, I consider what it means to perform the human body as bacterial especially in a clinical environment where this seems counterintuitive. Ecological

thinking becomes entangled with highly individualized, behaviourally focused approaches. I term the resulting configuration *scarcity holism*, a mode of AMR governance that simultaneously invokes holistic, ecological, and more-than-human health perspectives (as in One Health approaches), and yet also leans heavily on behaviourally oriented approaches. If resistant bacteria are primarily considered a problem for individual human patients, then the solution is oriented toward sustaining antibiotic efficacy for future individual treatments. This demands careful tailoring of antibiotic use—specifying who is really in need and who is not—in order to conserve a scarce resource. In this context, thinking of human bodies as bacterial or multispecies entities that must be taken care of *as* multispecies makes sense, especially if antibiotics are recognized not only as therapeutic but also anti-biotic: destructive to microbial life that might in fact be beneficial, natural, or healthy.

It is necessary to carefully consider the context in which micro-biopolitical approaches are applied as an analytical lens.² Research in domains like food, cheese-making, and rewilding might operate under substantially different stakes than those involved in microbial encounters in hospital settings. While a probiotic touch may be read as a healthcare utopia, it can equally signal the neoliberal appropriation of microbes – anthropomorphizing them for human benefit, without necessarily advancing more-than-human planetary wellbeing (Greenhough 2023). Much like Martin’s warning that flexible bodies are not inherently liberatory successors to rigidly defined, encapsulated ones, the enactment of microbial and more-than-human bodies in clinical practice should not be taken as a triumph of social scientific critiques of nature-culture dualisms.

Conclusion

In the context of managing infections in hospitals in light of AMR, I have shown how clinicians perform a concrete form of the (anti)microbial gaze – one in which surveillance, data gathering, and microbial governance intertwine with the body as a microbial ecology. The human microbiome is framed as a flexible entity, highly individual yet environmental and planetary in scope (Wolf-Meyer 2024). In this framing, antibiotics, bacteria and the bodies they inhabit share porous borders (Broom, Doron 2022) and unstable ontologies and epistemologies that infection management temporarily stabilises (Gröndal 2018, Wolf-Meyer 2024). Long-standing dogma surrounding antibiotic use and the evaluation of infections and bacteria are being renegotiated in light of AMR, revealing shifting epistemologies concerning infectivity, pathogenicity and the human as a microbial being. In the infection-management setting, the body emerges as a porous, albeit highly individual, more-than-human entanglement. This paper has traced a complex mixture that resists the simplistic, dualistic framings often found in policy and scholarly analysis.

² Thanks so much to the scholars at the CSSM in Helsinki for this important point!

As valuable as discursive efforts are to decentre the human – especially in a world where the Anthropocene and human exceptionalism have created such decay and destruction – it remains important, as Kenny et al. (2025) or Martin (1994) have suggested, to attend to the more obscured dimensions of AMR governance, which are often veiled by a standardised narrative. What is striking is that the flexibility and porosity of microbial life are not merely invoked by social scientists but are emerging from within clinical practice itself. This opens space for hope – for acknowledging more-than-human ways of knowing and relating to human-bacterial relations. At the same time, as Kenny et al. (2025) and Martin (1994) caution, standardized monitoring regimes and narratives about the flexible body can obscure infrastructural dimensions of AMR. Notably, the embrace of a holistic, data-driven microbial body made visible through profiling micro and macro environments onto patients, risks a solutionist approach and the narrowing of governance to optimizing “targeted” antibiotic use. This framing tends to sideline the infrastructural dilemmas AMR points to. In governing AMR as an issue of targeted antibiotic use (“We don’t need new substances, we need targeted use”), the focus shifts away from addressing societal and planetary conditions of life, and towards minimizing “unnecessary” antibiotic use. The concept of bacterial profiling emphasizes that clinical practice already recognizes microbial contingency. AMR policy must combine this relational care with an awareness for infrastructures beyond antibiotics and environmental health writ large, so that approaches not only optimize prescribing, but also addresses other causes and connections in the *agentic dance of socio-environmental* processes that configure bacterial resistance.

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III. Pathogens, borders, and ‘Ausland’: Bacterial risk profiling and the governance of antimicrobial resistance in Austrian hospitals

Abstract

Antimicrobial resistance (AMR) poses a significant threat to health care systems worldwide. Drawing on an ethnography of Austrian hospitals, this study analyzed how bacterial risk is constructed through screening schemes. I develop the concept of bacterial profiling – an ensemble of surveillance, interpretation, and mediation practices that render bacterial presence legible and actionable – and use it to examine how “Ausland” (abroad) functions as a shifting proxy of risk within Austrian AMR governance. This paper begins with a vignette of the Tyrol Air Ambulance to situate longstanding outbreak narratives that link bacteria to cross-border mobility. It then traces how hospitals operationalize country-based risk maps into screening categories and how these categories are stretched or collapsed, most notably in Vienna, where differentiated country lists were replaced by a single Ausland category. Ethnographic observations and 21 interviews show how hygiene teams negotiate the tension between externalizing risk and acknowledging the ubiquity of resistant bacteria in local ecologies. Hygiene distinguishes colonization from infection and prevents unnecessary antibiotic use. It shows the limits of externalization, the politics of proxy categories, and the centrality of mundane hygiene in configuring risk, ultimately arguing for relational approaches that move beyond fixed geographies of threat.

Keywords

Antimicrobial resistance (AMR), bacterial profiling, borders and biosecurity, Austria, hospitals

Introduction

Austria, the country I am writing from, is eagerly visited by winter sports enthusiasts from less mountainous European countries and is well known for its numerous ski slopes. A lesser known but equally part of winter tourism in Austria is the *Tyrol Air Ambulance*, colloquially referred to as the *Gipsbomber*. Since 1976, *Tyrol Air Ambulance* planes have flown winter tourists in casted body parts back to their respective home countries, earning the *Gipsbomber* moniker (roughly ‘plaster bombers’ in English) for their frequent missions to rescue skiers with broken bones. In the 1990s, when Austria was considered a high-risk country for Methicillin-resistant *Staphylococcus aureus* or MRSA (one of the most well-known drug-resistant bacteria), Swedish hospital isolated patients were brought back to Sweden from Austria immediately upon arrival. For Swedish hospitals, the *Gipsbomber* not only transported injured patients, but also served as a vehicle that brought MRSA to the country. Swedish authorities, as the story goes, were quick to act upon threats brought from foreign countries, such as by the imaginary of the *Gipsbomber*—an airplane medium for transporting pathogenic bacteria.

This is not an unfamiliar story, and scholars working on antimicrobial resistance (AMR) are familiar with what the *European North* (i.e., Finland, Sweden, Norway) represents in the field: an exemplary region for AMR policies and a haven for antibiotic management. While the risk profile for MRSA in Austria has shifted over the years, the urge to make sense of bacterial presence by mapping European countries and regions is still rife with policymaking. The reason that such narratives and maps of countries are linked to bacterial threat is the increasing resistance of bacteria to antibiotics, one of the key substances of modern biomedicine that poses a threat to the functioning of healthcare globally. In the now often-cited Global Action Plan of 2015, the WHO declared that without efforts on a global scale, “the world is heading towards a post-antibiotic era in which common infections could once again kill” (2015: n.p.). In an analysis of the global burden of bacterial AMR in the year 2019, authors in *The Lancet* estimated that bacterial AMR was directly responsible for 1.27 million global deaths and contributed to 4.95 million deaths (Murray et al. 2022).

The *Gipsbomber* from the opening vignette highlights how bacteria, back in the 90ties especially MRSA, were considered as traveling. However, it is not only bacteria that are on the move; the conceptualization of risk and its close relationship with *Ausland*, meaning ‘foreignness’—something outside and external—is shifting as well. In this study, I trace these shifts through one specific case, namely, the construction of bacterial risk profiles in Austrian hospitals. Three main questions guide this effort: first, how Austrian hospitals construct risk profiles, and second, how the category *Ausland* organizes the screening and containment strategies. Third, and more abstract, I ask what tensions arise among local efforts, global health policies, and AMR governance.

I worked with the notion of bacterial profiling to detail the practices involved in AMR governance. Professionals in Austrian hospitals construct epistemic bacterial cultures to manage the risks of resistant bacteria, using them as a means to address the problem of AMR, develop risk profiles to increase the ability to govern AMR in hospitals, and build on differentiation and demarcations between the inside (the body, hospital, city, state) and the outside. The term ‘profiling’ indicates how hygiene and infection management in Austrian hospitals are positioned as a kind of biomedical detective work, approaching the mysteries of human versus bacteria encounters within the context of effective antibiotics getting scarcer. The characteristics that such governance has in common are the aim of specifying bacterial compositions to tailor antibiotic use, the focus on ecological and environmental concerns, and to a certain degree, to socialize bacterial compositions, and that it reproduces hierarchies while also partially flattening differences. In this paper, I focus on this last characteristic: the parallel process of bordering and debordering, of configuring differences and hierarchies while deconstructing them as well along the case of constructing bacterial risk profiles. I argue for an approach that considers bacterial risk as relational and situated, not merely externalized.

Bacteria, borders, barriers and the (policy) architectures of bacterial risk

Background

While the truism that microbes do not respect borders (Elbe 2022) is swirling, a broad array of conceptual and theoretical approaches in social science deal with a conundrum: how do nation states, practitioners, policymakers, and public health initiatives grasp the mobility of microbes? How is AMR problematized as a global public health threat? A practical consequence of diagnosing the abundance and ubiquity of potentially harmful living organisms is that policies tend to focus on exercising control over movement and mobility by constructing borders for microbial containment on different scales. Crucial scholarly analysis alludes to the links between microbial containment strategies and national(istic) bordering projects (e.g. Bashford 2004, Fishel 2017, Wald 2008), critically examining the positioning of AMR as an issue of biosecurity, especially in discussions of animal health and One Health approaches (Hinchliffe et al. 2013) or the problematic nature of standard narratives of origin stories (Wald 2008).

In the context of AMR as an issue of biosecurity, different levels of governance are mobilized, and scholarship sheds light on the different tiers along which AMR and bacteria move. I begin by presenting literature that poses questions of bordering practices along microbes, each considering different entities on different scales as the units of analysis for thinking about borders: the body

(Martin, Esposito, Neocleous), the hospital (Broom & Boron), the city (Voelkner), and the nation-state (Du Plessis, Fisher). This aligns with the various tiers I observed at play in governing AMR in Austrian hospitals, and the back and forth between them. As such, the following approaches contextualize and accentuate how microbes and borders relate to each other.

Starting from the intimate scale of the body, bordering is put into practice in hegemonic approaches to the immune system and body politics, suggesting a clear-cut boundary between bodily integrity and “the outside” as potentially harmful and intrusive. The rhetoric of the immune body that propels microbes primarily as intruders, as something the body must deal with instead of as part of the bodily workings, has been reflected on at length and for many years by scholars, such as in biopolitical terms (Esposito 2011, Neocleous 2022) or as a history of ideas (Martin 1994). Abjection, a term from psychoanalytical thinking, blurs this biomedical narrative of the body versus the rest in how infection is experienced. For example, pus is an embodiment of permeable bodies, where the fantasies of bodily integrity or the body as a closed entity are questioned, evoking horror and disgust.

Zooming out of the body as the encapsulated entity being envisioned, Broom and Doron reflect on the relationship between the built structure and architectures of care for vulnerable patient bodies, fleshing out “porous” borders of hospital walls within wider ecologies of care:

“Porous borders in this context denotes tensions between imagined divisions (i.e. inside/outside; clean/dirty; clinic/street side) and the actual flows – of microbes, persons, goods and practices – that accelerate the evolution and spread of resistant bacteria. Such porous borders, as we shall see, are overlayed with a political economy that render them either mis-recognised or subsumed within a biopolitics.” (Broom, Doron 2022: 1)

They complicate the “imaginary of the clinic” as a concrete, isolated entity for top-down policy intervention, problematizing the tendency towards epistemic bordering in AMR policies. As they say, localizing sites as entities and/or in isolation may seem to render AMR governable, but it often brushes away the messiness of everyday practice (Broom, Doron 2022: 2).

From the perspective of urban space as a unit of analysis, Voelkner queries the relationship between a megacity such as Hong Kong and the virus, how the sharing of dense urban space with microbes is politically envisioned, and the utilization of material environments as infection barriers. She argues that the architecture of contagion built around the notion of infection barriers still conveys a sense for microbes, in contrast to human flourishing, and suggests a Daoist approach that centers on the dynamic, transformative, and historical relatedness of humans and microbes without constructing them as antagonists. This is because Voelkner shows how architecture – not for individual institutions such as hospitals, but for entire cities – is geared towards demarcation, erecting barriers against bacterial risks, and striving to control permeability and porosity.

In this vexing play of maintaining the illusion of bordering as an effective means of biosecurity, du Plessis (2018) works to change perspectives and look at microbes as bordering actors and political actors through the lens of international relations and new materialism. Her concept of microbial bordering alludes to how microbes territorialize and construct borders, in contrast to approaches that convey borders as only human-made. She concluded that acknowledging microbial-made borders also acknowledges the limits of governance regarding eradication and national sovereignty. She advocated for more-than-human ways of thinking by governing infectious threats in international relations.

In a similar vein of considering questions of policy frameworks for microbial threats, Hinchliffe (2021) offers a critique of Global Health policies and the shortcomings of One Health, advocating for a post-colony approach to microbes that is “alive to social and microbial difference” (2021:4) without geographical determinism. His work on biosecurity, albeit mainly focused on AMR within the farming sector, informs my critical approach to microbes and bordering practices, especially his remark on rethinking “the spatial assumptions that underpin the geometry of disease outbreaks, where pathogens are thought to cross over onto healthy lives” (Hinchliffe et al. 2013: 531). Steuernagel et al. (2024) argue that AMR might not exactly fit the category of “disease outbreak” because resistant bacteria are neither pathological per se nor trigger a single disease; it is still very much aligned with narratives of disease outbreaks and pandemics. This results in specific problematizations of AMR and consequent policy-framing, a framing of AMR as a pandemic that is positioned within global health strategies of disease eradication and control. Importantly, they argued that such labelling, which focuses on the containment of microbes and draws on the logic of disease elimination programs, obscures the overall picture of AMR as a bio-social problem. Similarly, Kirchhelle and Podolsky (2022) historically traced why AMR is relatively difficult to govern in international health policies. They contend an “awkward fit” (2022:40) for pathogen-focused policy frameworks because AMR does not revolve around single disease-causing pathogens such as cholera or smallpox.

To conclude, the creation of borders and barriers from intimate to large scales is an inherent part of epistemic cultures conceptualizing human-microbe relations, as are their practices to make AMR governable. Thus, this article traces these practices in their alignment with global health policies, as well as their cracks, frictions, and competing logics in everyday hospital work.

Literature shows how microbial presence is framed through borders and barriers across bodies, hospitals, cities, and nations, often under the logic of biosecurity and outbreak governance. What remains under-described is how such framing is enacted, mediated, and sometimes resisted in everyday hospital practice. Building on this, I developed a practice-based conceptual framework that examines how bacterial risk is made legible and actionable (bacterial profiling).

Conceptual framework

I employ the term *bacterial profiling*, a practice-based lens for how hospitals make bacterial life legible and actionable: the ensemble of surveillance, interpretation, and mediation through which bacterial presence is configured as a risk and acted upon. In this study, the concept guided the interpretation of the construction of bacterial risk profiles and the meaning of *Ausland*. To use bacterial profiling as an epistemic culture, I built on work by Hinchliffe and his post-colony approach and his older writings on biosecurity topologies, in which he urges to rethink the spatial assumptions of biosecurity measurements and disease pathologies. In an inventive move, he and his co-authors write about this reconfiguration of “topologies of infected live” as a move from *borderlines to borderlands* to argue against biosecurity approaches that “tend to conceptualise healthy life and disease as separate spaces, with biosecurity understood as a practice of demarcating and shoring up borderlines” (2013:532). Furthermore, bacterial profiling operationalizes insights from Wald’s (2008) analysis of outbreak narratives—how the cultural storytelling of disease emergency containment legitimizes specific practices. AMR is frequently narrated through pandemic logics of outbreak and containment, and hospitals enact them in routine ways through screening and categorization or isolating bodies. This is why “profiling” is apt: it captures how culturally salient story structures structures – detection, containment and blame –are and how these narrative logics are translated into everyday techniques that render bacterial presence legible and actionable.

Methods

This study draws on a multi-site hospital ethnography conducted in Austria between 2021 and 2023, in which I focused on professionals’ practices on antimicrobial resistance (AMR). Data management and analysis were based on situational analysis (Clarke et al. 2022) and constructivist grounded theory (Charmaz 2014). Following situational analysis, iterative maps were developed to trace human and nonhuman actors, arenas, and social worlds. These visualizations—of, for example, positions on hygiene, human–microbe encounters within clinical spaces, and debates over risk-adapted screening—were used throughout the research cycle to foreground relations and networks rather than isolated entities (Clarke et al. 2022).

A petition for ethical clearance was submitted to the Ethics Committee of the University of Vienna for conducting empirical research with human participants (interviews and participant observations) in 2021. The Ethics Committee issued clearance in 2021 (No. 00649). After obtaining ethical approval in July 2021, experts and stakeholders involved in AMR-related work in Austrian biomedicine were contacted. Recruitment proceeded through professional networks and snowballing within and beyond the hospital settings.

In total, I conducted 21 semi-structured interviews and eight days of observation. Given the organizational realities of Austrian hospitals, some participants held multiple roles (e.g., a hygiene physician who was also an infectiologist or microbiologist). I interviewed infectiologists (n = 3), hygiene team members (n = 9), nurses (n = 1), patients (n = 2), lab analysts (n = 1), and ICU physicians responsible for antibiotic surveillance (n = 1). I also interviewed researchers outside the hospital (4). For the observation, I was in four different hospitals in urban areas, where I spent three days following hygiene teams, one day with an infectiology team, one day at the microbiology lab, two days in an emergency room, and one day in an ICU. For the interviews, I used a semi-structured guide asking how AMR appears in the rhythms of daily work. While observing, I observed practices unfolded and where AMR became visible, such as during screening at admission, isolation procedures, antibiotic choices, or routine cleaning. I captured concrete practices in my field notes, especially when professionals weighed risks, responsibilities, and care. Constructivist grounded theory (Charmaz 2014) guides coding and memoing. Using MAXQDA, I conducted initial line-by-line coding, followed by focused coding, to synthesize recurrent processes and meanings. The iterative movement between codes, memos, and situational maps supported my category development and theoretical integration. The core categories structured in this paper include bacterial profiling, microbial mobility and containment, and the socio-spatialization of AMR. Throughout, I attended to how AMR “travels” across hospital spaces and scales, linking bedside practices to institutional policies and wider public and political attention.

“No hospital is an island”³

I approached my research questions by asking how professionals problematize, conceptualize, and act on bacterial mobility, and how these practices enact a socio-spatial cartography of AMR. Circling back to the example of the *Gipsbomber*, a telling tale about bacteria, tourists, and planes constructed as disease vectors, in the following I detail how notions of threat, risk, responsibilities, and blame of and towards individual bodies (humans) and collective bodies (e.g., nation states) are mapped onto the patient.

³ I borrow this phrase from Haraoui et al. (2024)

What is lingering outside? Negotiating bacterial presences between the inside and outside of hospitals

Through my visits to the hospitals, I learned that when a patient comes to the hospital in Austria, professionals decide whether a patient is tested for resistant bacteria under the guidance of the hospital's hygiene teams and screening schemes (in the form of questionnaires). Not all incoming patients were tested, and the ones tested might not have been tested for the entire range of possible drug-resistant bacteria. A basic pillar of AMR policies in hospital work is that the effort of screening patients goes into evaluating for a specific kind of *risk*: that is, which patients might be at risk for antibiotic-resistant infections, but also which patients might need to be isolated to protect others from obtaining resistant bacteria.

Figure 1 shows an example of a screening scheme for an Austrian hospital (in this case, a Styrian hospital). It shows where nurses need to swab for different bacteria and classifies which patients count as “at-risk.” In the latest version of the Austrian National Action Plan on AMR (BMSGPK 2021), every hospital and its respective hygiene team are responsible for decisions about who is considered an “at-risk” patient. Screening and testing for drug-resistant bacteria is a contested policy issue with much debate over the

usefulness and effectiveness (e.g. Nijsingh et al. 2020) of AMR governance or the “complex narratives of health, stigma and control” in screening specific refugee groups (Kamenshchikova et al. 2018). Since the Global Action Plan on AMR in 2015, countries have been urged to develop National Action Plans (NAPs). Austria developed a National Action Plan in 2013, with the latest update in 2021 (Jeleff et al. 2023). While Austria was early in developing AMR policies, Jeleff et al. noted that there are considerable “implementation deficits” (2023:17), largely because implementation was voluntary and no incentives were offered. For the screening of drug-resistant bacteria, the latest version of NAP-AMR (2021) states that it is the responsibility of hospitals and their respective hygiene teams to decide on risk profiles for drug-resistant bacteria and aligning measures. While this can be interpreted as laziness or bad policymaking, actors in the hospital champion the idea that bacterial composition, mobility, and containment must indeed be locally contextualized and situated:

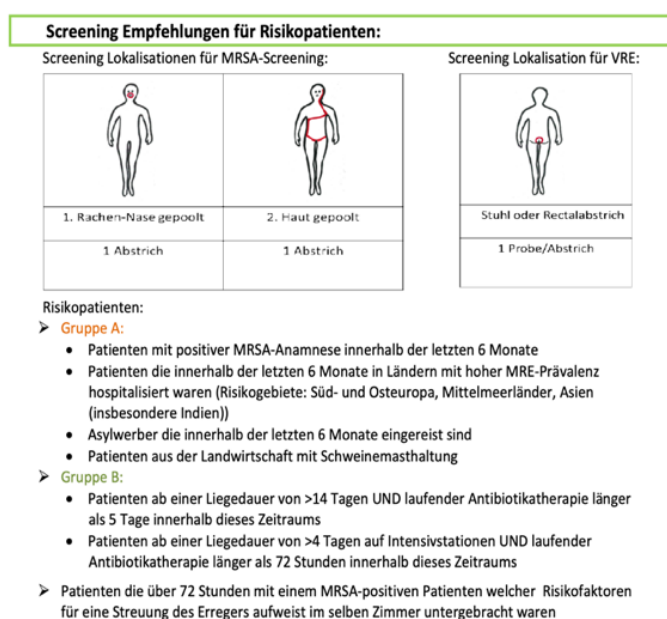


Figure 2: Screening scheme for Styrian hospitals

The resistance situation can vary greatly depending on which [bacteria] is resistant in each region. Each hospital faces its own challenges, depending on the wards that prescribe one drug or another and the antibiotics used. Hospitals closer to Germany might use German drugs, whereas those closer to the Czech Republic might opt for Czech drugs. You must act at the hospital level with antimicrobial stewardship teams. Therefore, implementing such measures on a nationwide scale in this area is challenging. A state-level approach would be somewhat more feasible, but the most effective method would be within each individual hospital. (Interview with public health officials PW and XR)

Interviewees discussed the difficulties of establishing one-size-fits-all measures for dealing with AMR because much depends on the hospital itself, specialized wards, and treatment and prescribing cultures. Interestingly, interviewees also mentioned the importance of geographical positioning, in that the use of certain antibiotic substances versus others shows itself in different resistance situations. In this case, border proximity to other countries speaks to the potentially varying use and preference of antibiotics, fracturing the antibiotic landscape, and therefore, resistance rates.

At the same time, it is important to note that those I spoke with also critically reflected on the missing incentives and legal regulatory support in their work on AMR. Vague policy guidelines thus create room to interpret necessary processes in light of local contexts and specific situations. However, as both professionals and the literature suggest, they rely too heavily on self-motivation and the personal initiative of individual professionals.

Cartography of Resistance: The Infamous North–South Gradient

How then do hospitals – and within them, hygiene teams – develop screening schemes and decide and reflect on their policies? A key issue that reveals the tension inherent in scaling such practices is the allocation of risk: what and who are considered at risk of carrying resistant bacteria? Hospital screening schemes, therefore, typically focus on what is known as risk-adapted screening—deciding which patients and which factors (such as countries of origin, occupations, or aspects of patients’ medical histories) are considered to pose a risk in terms of 1) introducing drug-resistant bacteria into the hospital and 2) developing difficult-to-treat infections due to the presence of such bacteria. In discussing how to define a person as “at-risk,” professionals inside the hospital invoked a specific European cartography of resistance rates and associated risks:

Unfortunately, all southern countries are at high risk. There is a pronounced North-South gradient, and I’d say that everything to the southeast is especially risky for people coming from those areas because certain infections are endemic there. The prevalence of MRGNs and MRSA was much higher than it was here. Greece is an absolute hotspot, along with Romania, Bulgaria, the southern Balkans, and parts of Italy, particularly in the southern regions. The further north you go, as clearly shown on the maps published each year by the European society responsible for this surveillance—an EU organization—you see lower prevalence rates. The prevalence in Nordic countries is consistently low because they have very strict protocols. (Interviews with ICU physician)

The North-South gradient, so prominently discussed in AMR throughout Europe, is also closely linked with narratives that frame the “South” as characterized by lacking or lazy policymaking and overtly generous and lawless prescriptions, in contrast to Nordic countries and their historically exemplary role in dealing with AMR.

Countries are ranked according to their risk-harboring characteristics, and in this way, entire nation states, along with their antibiotic cultures, are framed as posing a risk to the Austrian AMR situation, both in abstract and concrete terms.

For example, in Greece, you can easily obtain any antibiotic at a pharmacy, and no prescription is needed; this purchasing and prescription pattern is common in southern countries. Or, take India, where you can get everything without restrictions. By contrast, Nordic countries have stricter policies. Years ago, they implemented widespread isolation measures, meaning that everyone was truly isolated when needed, whereas we adopted a more relaxed approach. As a result, antibiotic prescriptions are stricter there, and other hygiene protocols have been tighter than those in southern countries. (Interview with hygiene physician FA)

This cartography, constructed by linking antibiotic use, restrictions, and policies to broader socio-spatial assumptions, is mirrored in hospital screening schemes, as illustrated by the example of Styrian hospitals shown in Figure 1. Beyond referencing specific countries and regions as risk areas, these schemes also explicitly include biographical patient information, such as occupation, living circumstances, and patterns of human mobility. For example, individuals who work on pig farms or asylum seekers who have visited Austria within the last six months are categorized as having a higher risk. Austria, situated geographically between the South and the North, positions itself accordingly in these risk maps. In the 1990s, Sweden (as a Nordic country) regarded Austria with caution and quickly isolated everyone arriving at the *Gipsbomber*, and today Austria focuses its demarcation towards Eastern and Southern Europe. Greece, in particular, was almost always problematized in interviews as a hotspot for AMR. However, as one interlocutor pointed out, this reasoning ultimately points to the fact that bacterial compositions are shaped relationally in interactions between humans and the places they inhabit.

And just to give the Greeks a break—if someone goes on a self-discovery trip to Kerala and spends three months there, they might come back with a urinary tract infection, and I would assume it is caused by 4MRGN *E. coli*. The longer you stay in one place, the more you essentially take on the local flora of that area." (Interview with infectiologist ID)

While there is constant reference to specific countries and locations, the interviews also highlight the wider problems and tensions surrounding mobility and containment, emphasizing how an individual's bacterial composition is shaped by their surroundings. Professionals configure the human microbiome as both a reflection of and materialization of spatial belonging and positioning, where time (to a limited extent) and most of the space configures bacterial profiles. As this interviewee made clear, although many AMR-related practices in the hospital are built around notions of risk zones, high-incidence countries, and categorizing patients accordingly, this linear

rationale for precautionary measures can also easily collapse when considering the relationality, global interconnectedness, and mobility of bacteria. However, hospitals are expected to function as controlled environments that, in contrast to the “outside world,” should manage this ecological uncertainty, particularly through screening, which seeks to establish who arrives carrying which bacterial composition. In the reasoning that emerged within the interview, risk-harboring environments were located “elsewhere”: in bacterial compositions acquired outside the hospital (or in another hospital) or outside Austria.

What is *Ausland* anyway, if “pathogens know no borders”?

While othering is a common practice in biomedicine, it is worth examining the versions of otherness that professionals reify in the governance of AMR in hospitals. What is the contrast between the inside and the outside, the other, or *Ausland*? How are the construction of *Ausland* and *risk* connected to each other? What happens with AMR as a policy issue if these categories become porous, permeable, and unclear?

A recent revision and adaptation of screening schemes and policies in the Viennese context that hints at the process deserve a close look. The Viennese working group decided to revise the construction of the risk profiles for drug-resistant bacteria. This working group, made up of hygiene experts, agreed that instead of organizing the screening schemes around different foreign countries, everything should be collapsed into one category: *Ausland* (foreign countries) as opposed to *Inland* (Austria). This change essentially indicates that further qualification is no longer needed as to *which* foreign country a patient is transferred from or spent time abroad, but only *if* the patient is coming from somewhere outside Austria. One interlocutor summarized the reasoning for this as follows:

There are geographical differences, but in Vienna, we decided not to focus specifically on these differences. Instead, we included everyone from abroad during the screening process. After all, someone could acquire a resistant infection, even in Geneva, and it is not feasible to continuously update recommendations to reflect the resistance statistics of all regions in real time. This is just manageable. Therefore, in this case, we prefer to cover everything using a broader approach. (Interview with hygiene physician CK)

The interlocutor refers to how the construction of screening schemes is oriented towards resistance statistics and country analysis reports (from the ECDC), but how within the inner workings of a hospital, continuous consideration of these changing resistance numbers is impractical. Hence, every patient coming from outside Austria is treated as at-risk for drug-resistant bacteria. While the dissolution of differentiation based on countries’ resistance statistics avoids reproducing and enforcing long-lasting hierarchies and potentially harmful practices of othering, it nevertheless constructs a clear demarcation of Austria versus the rest (*Ausland*) and a problematization of AMR as outside of and brought into Austria.

But interviewees also reflected on the shortcomings of externalizing problematic bacterial presences.

I have to be honest with you; again and again, I am surprised. With the last 4MRGN cases that we saw, the people had only been as far as Lake Neusiedl [a lake one hour from Vienna], and yet, well, they had it. I can no longer simply say ‘they come from somewhere else, and therefore I absolutely need to investigate that’ [...] Yes, there are guidelines, but defining what counts as *Ausland* is difficult. (Interview with hygiene physician SP).

This quote shows how the interlocutor struggles with the concept of *Ausland* to determine at-risk patients. They referred to the home-boundedness of the last detected 4MRGN (resistant to four classes of antibiotics) and argued that it no longer seems adequate to locate the risk of carrying drug-resistant bacteria solely outside Austria and in foreign hospitals.

In this case, *Ausland* is configured as an opaque and increasingly insufficient concept that does not fully address the problem of resistant bacteria. As the interlocutor explains, the previously established lines of demarcation are breaking. The widespread presence of resistant bacteria that are found in close proximity challenges the detailed hierarchies of *Ausland* as well as the containment strategies that were based on national borders, drawing into question the usefulness of such risk profiles.

The externalization of bacterial mobility is an integral part of AMR stewardship in Austrian hospitals and is firmly embedded within systems of surveillance and control to create a sense of biosecurity protected from within the hospital and the nation-state. However, this approach partially breaks down the ubiquity and inevitability of resistant bacteria. Therefore, externalization can only be achieved thus far. At the same time, the current abundance of resistant bacteria and AMR has not yet become the norm; should it become so, I imagine that externalization and risk-based decision-making will become obsolete as pillars of AMR stewardship.

Circling back to the *Gipsbomber* from the opening vignette, it becomes evident that the category of what is considered risky “*Ausland*” is not fixed but shifts over time. In the 1990s, Austria, regarded as an MRSA hotspot for Swedish policymakers, constructed its own system of demarcations, borders, and risky “*Ausland*” to underpin AMR surveillance and policies. However, in certain contexts, such as Viennese hospitals, professionals question the ongoing relevance of such categorizations for AMR interventions, arguing that profiling bacterial compositions along lines of foreignness is porous and unstable.

Thus, the practice of profiling calls for alternative reference points and new ways of framing risk. The debate oscillates between viewing everything as *Ausland* and viewing nothing bacterial as foreign anymore, rendering containment systems built upon such differentiations increasingly ineffective.

Discussion: How can AMR and bacterial risk be governable?

Actors are aware of the problematic nature of the *Ausland* category, even as they simultaneously reinforce clear boundaries positioning Austria against the rest of the world or the inside of the hospital against the outside. Thus, drug-resistant bacteria and the broader issue of AMR have become socio-spatialized in specific ways. The consequences of responding to microbial mobility thus entail an ongoing negotiation over how to determine risk and draw borders, or, as one interlocutor put it, “Emergenzen kennen keine Grenzen”, which translates (though loses its rhyme) to “pathogens know no borders.”

While actors, especially hygiene teams within hospitals, do critically reflect on the limitations of such risk profiling, strong notions remain in the hospital as a controlled and controllable environment: a space where bacteria can be stabilized into temporarily static objects in need of containment. The logic of containment is further reinforced by policies that locate risk on the externally, though what is considered “outside” varies: it may refer to areas beyond political national borders, spaces beyond the hospital’s physical walls, regions outside a shared policy framework (such as Vienna versus the rest of Austria), or contexts defined by human-animal relations, as illustrated by screening questions for pig farmers.

This bacterial profiling, as I call it, opens socio-spatial framings of AMR that are constructed through demarcations operating on multiple scales. These demarcations extend beyond mere geography, forming a landscape of antimicrobial resistance that links bacterial compositions and microbial mobility to political, cultural, social, and economic domains; to assessments and comparisons of parallel health systems; to resistance rates and historical trajectories; and, more broadly, to processes of globalization and mobility. On the one hand, global policies suggest the need for unified strategies and fields of intervention, but on the other hand, local management and practices for dealing with AMR contend with the complex situation of bacterial compositions daily, making rules and decisions at the micro level.

A growing awareness of the porous borders of AMR as a socio-ecological issue and of human-bacterial relations as dynamic processes (whereby an individual’s bacterial flora is continuously in negotiation with the flora in their environments) render current AMR policies increasingly ill-fitted to the problems they aim to contend with (Kirchhelle, Podolsky 2022). Much effort has been made to contain specific bacteria; however, this approach often fails to match the scale and complexity of the problem. Established categories such as *Ausland* coincide with the vision of hospitals as secluded and controllable spaces, all of which are challenged by the widespread presence of resistant bacteria in the community.

My data suggest that the practices of AMR policies operate within this tension: they align with what scholars such as Kirchhelle and Podolsky (2022) describe as an awkward fit within Global Health

frameworks, drawing on long-standing traditions of antibiotic-driven eradication and containment, as well as on narrative elements associated with the origins of disease outbreaks (Wald 2008). At the same time, certain standard formulas have also been unsettled. Bordering remains a key epistemic practice, but it expands into ecological orientations or at times collapses altogether.

AMR is an issue of scale (Landecker 2016), one that moves between microscopic bacterial communities from intimate body parts to cities, regions, environments, nations, and continents.

Conclusion

In this paper, I aimed to demonstrate how ethnographic material can add nuance and complexity to the oversimplified inside/outside dichotomization of bodies, hospitals, cities, or nation-states that are often hastily invoked in representing the problem of AMR. Moreover, ethnography can help produce knowledge that does justice to the everyday practices and commitments of professionals, such as those whom I met during my research, who put a lot of energy, effort, and work to sustain the effectiveness of antibiotics so that patients can continue to receive appropriate treatment.

Austria is an interesting case study that examines scaling as a practice in AMR governance, conveying the complexity of making AMR governable in a wealthy, centrally located European country that shares borders with eight other nations. Thus, demarcations to and from different countries (and in different directions) come into play, each shaped by complex socio-ecological and political history and configuration. Using the Austrian case, I have tried to convey how hospital practices approach AMR as an issue of biosecurity, where an “us versus the rest” of the logic emerges. This logic follows patterns of protection, othering, and blaming but also deflects the burden of responsibility that accompanies the image of the hospital as a discrete, easily governable institutional entity. AMR governance in Austrian hospitals navigates the tension between, on the one hand, explicating resistant bacteria and deciding where to look and locate risks and, on the other, acknowledging the local environment as already permeated by resistant bacteria, as seen, for instance, in the collapsing relevance of the category of *Ausland* in Viennese policymaking. Between these poles, the presence and conceptualization of resistant bacteria oscillate between constructing risk profiles to target, control, and survey locatable risks to an emerging approach of resistant bacteria as part of a new normality. This is why I would argue that risk is to a large extent still handled as something originating in an imagined and constructed “outside” (body, hospital, city, nation, Europe etc.) yet, at the same time, risk as a clear, containable policy category is increasingly negotiated as “porous” (Broom, Doron 2022) or “permeable” (Lock 2018). The inevitability of bacterial mobility dissolves rigid contours and propels new practices in AMR governance. In line

with more ecological approaches, professionals on the ground enact risk as a situational context-dependent category.

While AMR as a governance issue is awkwardly (Kirchhelle, Podolsky 2022) aligned with logics of containment, disease eradication, and the standard narratives of disease origins and “othered” carriers of risk and contagion (Wald 2008), my material shows how on the ground negotiations align with what du Plessis calls microbial borders:

Microbial borders indicate not only that something dangerous that was supposed to be kept external to the state has made it in, which is, in itself, a failure of sovereignty, but also that the geography of the state is fractalized without the state being able to control this. (du Plessis 2018: 10)

I think what emerges is a pervasive sense of bacterial resistance as something inherently—be it as part of bodies or environments—not located entirely in a constructed “outside,” and thus, exceptionalized. Instead, it is seen as part of a broader surrounding ecology. This view also prompts epistemological processes: What if we think about risk, contagion, and containment not as phenomena that can and must be externalized and territorialized to be governable, but as the status quo—as a new normal? Such a shift, I would argue, might enrich current discussions on AMR, which to date strongly prioritize socio-spatial assumptions and anchor AMR primarily as an issue *in* and *of* space.

Declaration

Ethical approval was obtained from the University of Vienna Research Ethics Committee protocol (00649), approved July 2021. All interviewees provided informed consent prior to participation; participants were informed about study aims, voluntary participation, the right to withdraw, and measures to protect confidentiality. The study was conducted in accordance with the principles of the Declaration of Helsinki. Identifiable information was removed; pseudonyms were used; audio recordings and notes were stored on encrypted, access-restricted drives.

Data availability statement

Due to the sensitive nature of the ethnographic data and the privacy of participants, the full interview transcripts and fieldnotes cannot be shared. Anonymized supporting materials (e.g., selected excerpts and the coding framework) are available from the corresponding author upon reasonable request, contingent on an agreement consistent with the study’s ethical approval.

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Profiling our way out of the antibiotic crisis: bacterial profiling and scarcity holism as configurations of living with bacteria

The aim of my doctoral thesis is to answer questions concerned with the specific hospital-based practices of living with bacteria under the condition of AMR. By way of synthesizing the findings from my three papers, in this section I lay out how hygiene work, infection management and the constructing of bacterial risk profiles speak to my ideas of bacterial profiling and scarcity holism as conceptual contributions. I also aim to situate hygiene and infection management work in general as “infrastructural” and as cornerstones of AMR governance that deserve close attention and scientific as well as political acknowledgement. I end this dissertation with an outlook that is less a final statement, but more a possible starting point for further analysis.

I approached the topic of living with bacteria in the presence of AMR through various social science disciplines within which theory-building has made space for microbes, including anthropology, STS, political science, international relations, human geography and history (of science). The shared quest to make sense of human and nonhuman living vis-à-vis history and multiple political, environmental and planetary crises has guided this dissertation, especially the relational approaches to pathogenicity (Hinchliffe 2021), infection control (Voelkner 2011, 2019), bacteria (Lock 1993, Koch 2011), hospitals (Chabrol, Kehr 2020) and policymaking (Shore, Wright 2003).

The resistance of bacteria to antibiotics is one of the defining present and future threats to global health. It is, in Austrian hospitals, not just an abstract, far-away problem for others to take care of or a mere biomedical issue, but a concrete, everyday issue that cuts across policies, practices and materialities in configurations of how to live with bacteria in times of AMR.

Bacterial Profiling

Throughout my material, there is a tension between resistant bacteria as a biomedical, technical problem that ought to be governed through the “AMR gaze” (Kenny et al. 2025) – data gathering, surveillance and monitoring of microbes and antibiotics – and approaches to AMR as a more-than-medical, more-than-human issue in need of holistic, ecological understanding. Bacterial profiling is a term that I employ here to describe the epistemic culture of living with (resistant) bacteria in hospital spaces. The notion of profiling bacteria and especially the microbiome is common in microbiological research and refers to the sequencing of microbial communities. However, I use it here in an encompassing sense, not as a mere technical term. I use it as an analytical concept that names an ensemble of practices in the hospital – monitoring, sampling, swabbing, analysing, interpreting, and mediating – through which hygiene and infection teams approach bacterial presence and negotiate its risk. Rather than treating bacteria as simply “good” or “bad,” bacterial

profiling foregrounds situated, ecological judgments about pathogenic potential and colonization, and the mundane, often overlooked hygiene practices that are as much part of AMR governance as the more visible and glamorous stewardship programs. With this, I argue for the importance of mundane hygiene work as infrastructural in hospital work: while hygiene is often framed as mere compliance in AMR governance, I argue that hygiene is a crucial part of AMR governance.

Bacterial profiling also reflects broader narratives of AMR governance, which frame resistance as a global health threat to be addressed through surveillance, data collection and behaviour change. Through the specification of bacteria, narratives of patients, their lives, and the state of the world emerge which are closely linked to how we tell AMR as a global health threat: one that can be overcome through thoroughness, surveillance and control, data gathering, and behaviour change. It corresponds with what Neocleous, in a recent book on “The politics of Immunity” (2022), fleshes out in discussing the close relations between the concept of biological immunity and politics of policing and securing nation state through body politics.

My ethnography has revealed that, in Austrian hospitals, professionals enacting bacterial profiling often embody a policing role, navigating their ambivalent position within hospital hierarchies as both enforcers of hygiene and protectors of patient safety. For example, hygiene teams liken their work to that of detectives, requiring “interrogation techniques” to construct bacterial profiles that distinguish between infection and colonization, while adhering to the mantra of avoiding unnecessary antibiotic use. Their work is also like detective work in that they take a magnifying glass to every corner of the hospital, to every fold of the patient’s body that is scrutinized. The epistemic culture of bacterial profiling follows the problematization of AMR as one of insufficient knowledge, of not enough specification of bacterial risk. It is in this sense that bacterial profiling intervenes in constructing knowledge through surveillance, data gathering, specification of bacterial risk to tailor antibiotic use, but also to pay attention to the fragile nature of bacterial balance. Antibiotics take on the role of scarce substances in need of careful, tailored use but also as toxic, invasive substances that might cause harm for bacterial ecologies in bodies and the wider environment. Importantly, my analysis extends beyond bacteria to consider antibiotics as dynamic agents that, like bacteria, take on different roles. While social science literature has extensively critiqued understandings of bacteria as static objects, antibiotics have rarely been examined in this relational, ecological way. My use of bacterial profiling as an analytical lens, therefore, sheds light on the reconfigurations of both bacteria and antibiotics, offering a way to better understand the governance of AMR in hospital settings. While these profiling practices reflect ecological thinking and bring the environment into view in various ways, they remain focused on the individual bacterial bodies being profiled. Following Emily Martin’s (1994) caution about celebrating the

flexibility of bodies uncritically, I consider what it means to perform the human body as bacterial, as a holobiont, especially in a clinical environment where this seems counterintuitive.

In short, this dissertation has introduced and demonstrated the use of bacterial profiling as a practice-oriented lens for viewing the ways in which hospitals make bacterial life legible and actionable; it is the ensemble of surveillance, interpretation, and mediation through which bacterial presence is configured along notions of risk, pathogenicity, bacterial diversity or innocence and acted upon.

Scarcity holism

The antibiotic crisis and antibiotic scarcity that have arisen out of stalled development, rising drug resistance and environmental externalities have crucially reshaped the governance of AMR. The concept of bacterial profiling – understood as the epistemic culture of managing AMR in hospitals – can also be scrutinized within the socio-political constellation that requires AMR to be cast as a more-than-medical issue, and human health to be decentred in favour of One Health and planetary health perspectives. I call this socio-political constellation “scarcity holism”. I use this term to refer to the coupling of a normatively charged sense of scarcity of not only of antibiotics but also of bacterial communities and diversity with relational, situated approaches that problematize human–bacteria–environment relations. Whereas “bacterial profiling” refers to the ensemble of practices that specify and mediate bacterial risk in hospitals, “scarcity holism” situates those practices conceptually within a sociopolitical context that mobilizes holism to manage scarcity. With this, I want to critically reflect on the way that ecological approaches get folded into modernist solutionism—preserving antibiotic efficacy—while simultaneously reconfiguring relations among bodies, microbes, and environments.

My findings reveal three key areas where scarcity holism affects policy implementation and practices in Austrian hospitals:

- One, the notion of antibiotic scarcity drives holistic understandings and relational approaches and has become a pragmatic factor in AMR governance in Austrian hospitals, for instance in tailoring antibiotic use, specifying bacterial compositions, differentiating between innocent bystanders and pathogenic potential, accepting colonization, and considering the importance of a diverse bacterial flora.
- Two, scarcity holism is political, certainly in the Austrian context. And, as my ethnography has revealed, it is also easily obscured within clinical practice and datafied approaches. If resistant bacteria are primarily considered a problem for individual human patients, then the solution is oriented toward sustaining antibiotic efficacy for future individual treatments. This demands careful tailoring of antibiotic use—specifying who is really in

need and who is not—to conserve a scarce resource. In this context, thinking of human bodies as microbial bodies – as the study of infection management shows – that must be taken care of makes sense, especially if antibiotics are recognized not only as therapeutic but also anti-biotic, i.e., destructive to microbial life that might in fact be beneficial, natural or healthy. Preserving antibiotic efficacy for future individual treatments can align with neoliberal logics of responsabilization (e.g., “optimize your microbiome”), even as it broadens the field to environments and nonhumans. While a probiotic touch may be read as a healthcare utopia, it can equally signal the neoliberal appropriation of bacteria—anthropomorphizing them for human benefit, without necessarily advancing more-than-human planetary wellbeing.

- Three, my ethnography has revealed that scarcity itself is relational and situated. Antibiotics themselves are scarce, but they can also make scarce certain (non-resistant) bacteria, while resistant bacteria are on the rise. This is in line with the concerns of scholars who link environmental degradation with a loss of bacterial diversity (Bradshaw 2024). At the micro level, hospital professionals consider patients’ bacterial flora to be part of overall health when evaluating antibiotic use. At the institutional level, the hospital’s microbiome and material ecologies (sinks, surfaces, plumbing) come to matter. Here, long-standing visions of cleanliness and safety in terms of the absence of bacteria clash with a renewed acknowledgement of bacterial presence and diversity for a balanced – i.e., healthy – bodily or institutional environment or ecology at large.

Epistemic cultures privileging ecological thinking over modern, individualised and universal approaches to antibiotics – from prevention to specification – take shape under the problem of scarcity. At its core, this observation parallels what Martin (1994) describes as the shift from “Fordist” – i.e., contained, disciplined – to “flexible” bodies at the end of the 20th century. Just as flexibility became a defining feature of late capitalist bodies, ecological thinking and relationality emerge as defining features of professional practices under the conditions of scarcity (as well as social theory?). My use of the term “scarcity holism”, then, highlights how the problem of AMR reshapes not only biomedical practices but also the epistemic and ontological frameworks through which professionals, scholars as well as politicians, stakeholders and policymakers engage with bacteria, antibiotics and the environment.

In summary, how is the living with bacteria vis-à-vis AMR as a global health threat configured, negotiated and enacted within a policies-practices-materialities complex? Both bacterial profiling and scarcity holism are analytical lenses I developed from my interpretative work. Bacterial profiling captures the practice-oriented observations and conclusions that I have drawn, in that it describes the epistemic cultures of living alongside bacteria that actors in the hospital configure along

bacterial cultures. This is a biopolitical approach that prioritizes knowledge as control, technological fixes and data-drivenness, but also allows for vagueness, ambivalence, uncertainty. Bacterial profiling conveys a sense of urgency precisely because it takes place in a wider sense of antibiotic scarcity. The holism – the ecological thinking that is brought into bacterial profiling – follows well-known logics of incorporating flexibility, diversity and relationality for a narrow, anthropocentric, modernist purpose of sustaining life and anti-life (antibiotics) as it is and as it is known. The trickiness of AMR and human-bacteria encounters is indicated not only in the way of approaching antibiotics as scarce, but also in the way that antibiotics make scarce certain bacteria, and how they shape bacterial ecologies and discourses around bacterial loss and diversity as signs of healthy ecologies and bodies. This way, there is no easy equation out of AMR in, say, producing ever more antibiotics. Scarcity here also signals how perspectives on threats and flourishing are always intricate, dynamic and impossible to pin down exactly. This is why a scarcity holism that solely focuses on antibiotics as a scarce good ultimately must fail in finding sustainable ways to deal with AMR. The notion of scarcity holism therefore captures the frictions and ambivalences of AMR management: it is not a seamless One Health ideal, but a set of practices that combine ecological thinking with biopolitical aims to preserve both human and (some) bacterial life and the biomedical infrastructure that sustains it.

Epilogue: affect, temporality, and the non-exceptional in AMR?

This prompts three conceptual considerations and open questions I am keen to follow further. First, there is an affective dimension worth analysing that is lingering through the analysis. At some point, I started to sense a cruel optimism in Berlant's terms: this is based on the observation that we as a society relate to antibiotics in a cruel way, insofar as the politics at work in relating to antibiotics (e.g. as infrastructural for capitalist modes of production and healthcare) maintain a certain political-economic system. In Berlant's (2011) emphasis, it is not the object we desire that is inherently cruel, but our relation to it: "These kinds of optimistic relation are not inherently cruel. They become cruel only when the object that draws your attachment actively impedes the aim that brought you to it initially." (2011: 1). From a large-scale, macro perspective, the promise of antibiotics aligned with specific visions of modernity, mastering nature and controlling microbes and of a future without infections, came to impede the aim. What materializes in bacterial resistance to antibiotics is, to a large extent, what the promise of modernity and knowledge-production construed, as Landecker's concept of the "biology of history" powerfully illustrates: "This biological matter, chewing away its own ontology, is historically and culturally – and materially – specific to late industrialism, produced in and by previous modes of knowledge." (Landecker 2016: 21). What substantiates this cruel relation, I speculate, is what Landecker analyses as an

overestimation of modes of control, because they tend not to fail in their entirety: “These control measures do not fail, indeed they are generally powerful for a time, and thus enhance the tendency to mistake some control of the living for complete knowledge of the living” (Landecker 2024: 4f.). Here, antibiotics fit the bill because they embody crucial understandings of how to control bacteria, yet this knowledge remains overestimated, since antibiotics do not fail outright but partially and with nuances. I would say hygiene and infection management are very much built around the notion of sustaining antibiotics in their powerful role of controlling environments, clinging to an overestimation of this kind of power over, say, adapting anthropogenic biologies or the late industrial dysbiosis as the starting point for discussion.

Second, I came to think of bacterial time that is simultaneously omnipresent and left out. On a lot of levels, time plays a crucial role in making sense of AMR, considering the ever-public temporal references to a descent into medieval times (that stand in for dark times) if antibiotics fail, and bleak futures where “simple infections” (if there is such a thing) will cause deaths. There is an absence and presence at the same time, which might be called a haunting. Why is it that AMR discourse is so prominently underwritten with spatial considerations, but bacterial time plays a minor role in strategies and policies to make sense of AMR?

This leads me to a third implication, namely the urge and function of exceptionalizing AMR. Alternatively, what kind of thinking would be possible if resistant bacteria or resistance were not thought of as resistance and not as exceptional? If this were the case, one might assume that ways of thinking about the environment, planetary crisis, therapy and alternatives to antibiotics would look different. I think what emerges is a pervasive sense of bacterial resistance as something inherently—be it as part of bodies or environments—not located entirely in a constructed “outside,” and thus exceptionalized. Instead, it is seen as part of a broader surrounding ecology. This view also prompts epistemological processes. What if we think about risk, contagion, and containment not as phenomena that can and must be externalized and territorialized in order to be governable, but as the status quo—as a new normal? Such a shift, I would argue, might enrich current discussions on AMR which to date strongly prioritize socio-spatial assumptions that anchor AMR primarily as an issue in and of space.

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Appendix

Abstract

Antimicrobial resistance (AMR) poses an immense threat to human health around the globe. The resistance of bacteria to one of the most crucial substances of biomedicine – antibiotics – puts into question effective means to treat infections in humans and animals, and by extension societal infrastructures themselves, from food production to biomedical care. A marker for modernity in crisis, AMR challenges human efforts to control bacterial environments, necessitating new ways of acting alongside bacteria in sustainable ways. Widely acknowledged as a global health priority, AMR is now a well-elaborated policy issue across different scales, sectors and disciplines.

My doctoral research explores the hospital as a central institution of AMR governance, where hygiene and infection-management professionals concretise the abstract global health threat of AMR in their daily routines. I explore how the ambivalence of living with and against bacteria is negotiated in the high-stakes environment of hospitals, where bacteria easily pose a great threat to patients and the hospital as a whole. I consider how professionals manage the risk of antibiotics losing efficacy and no longer being available as treatment for infections with the provision of the best care. As such, I consider how AMR as an issue of global scale for health and the environment alike comes to matter in the treatment of individual patients, and vice-versa.

I carried out in-depth qualitative research, including policy analysis, in-hospital ethnographic observations and qualitative interviews with professionals, to explore the ways in which they negotiate bacterial threats in the face of AMR and make sense of policies, patient care and the future of antibiotics. The research was substantiated by analysis of critical policy studies and medical anthropology theories and methods, allowing me to analyse the everyday practices and responses to the threat of AMR, in relation to – and in tension with – politics, policies and scales. I focus on the relationship between AMR and biomedicine, Austria's healthcare systems and European policies, and thereby scrutinise the existential aspect of bacterial encounters for bacteria, the environment and humans alike.

I argue that AMR governance through hygiene and infection management in hospitals is best understood in terms of relational, situated practices that manage bacterial uncertainty, organized around two interlinked configurations. The first of these – bacterial profiling – is an ensemble of practices whereby bacterial risk is made legible and actionable through monitoring, screening, data gathering, interpretation and mediation of bacterial risks, pathogenic potential, and pragmatic and careful professional relations. The second – scarcity holism – describes the wider socio-political

constellation in which ecological, holistic framings of AMR and bacteria are mobilized to conserve antibiotics as scarce infrastructural goods.

Each of the papers that form the core of my thesis elaborates on these epistemic formations through one of three empirical studies, focusing on: (1) hygiene management, which is aimed at maintaining a “clean” and safe hospital environment; (2) infection management and the strategies designed to optimize antibiotic use; and (3) the shared effort of implementing screening schemes to create bacterial risk profiles. By zooming in on hospitals as pivotal sites of modern biomedicine and zooming out to the broader societal implications of AMR, this thesis contributes to our understanding of the crumbling infrastructure of antibiotics and its threat to biomedicine and societies. It also highlights the need for comprehensive strategies that address AMR beyond hospital walls, encompassing wider societal and ecological contexts.

Zusammenfassung (in German)

Die vorliegende Dissertation befasst sich mit dem Krankenhaus als zentraler Institution der Governance von antimikrobieller Resistenz (AMR), in der Fachkräfte für Hygiene- und Infektionsmanagement mit der globalen Gesundheitsbedrohung durch AMR in ihrer täglichen Arbeit konfrontiert sind. Ich gehe der Frage nach, wie die Ambivalenz des Zusammenlebens mit und gegen Bakterien in Krankenhäusern ausgehandelt wird, wo Bakterien leicht eine große Gefahr für Patient*innen, aber auch für das Funktionieren des Krankenhauses als Ganzes darstellen: Wie gehen Fachleute mit dem Risiko um, dass Antibiotika ihre Wirksamkeit verlieren und nicht mehr zur Behandlung von Infektionen zur Verfügung stehen, während sie gleichzeitig die bestmögliche Versorgung gewährleisten müssen? Anders ausgedrückt: Wie wirkt sich AMR als globales Problem für Gesundheit und Umwelt auf die Behandlung einzelner Patient*innen aus und umgekehrt? Hygienemanagement, Infektionsmanagement und die Erstellung bakterieller Risikoprofile als wesentliche Strategien gegen AMR dienen mir als empirische Studien zur Entwicklung meiner Argumentation. Ich argumentiere, dass AMR-Governance in Form von Hygiene- und Infektionsmanagement in Krankenhäusern gekennzeichnet ist von relationalen, situativen Praktiken, die mit bakterieller Unsicherheit umgehen müssen. Aus der Untersuchung dieser Praktiken ergeben sich zwei analytische Begriffe, die ich einführe: Erstens bezeichnet mein Begriff des *bacterial profiling* ein Ensemble von Praktiken, mit denen Bakterien durch Überwachung, Screening, Datenerfassung, Interpretation und Vermittlung von bakteriellen Risiken, pathogenen Potenzialen sowie pragmatischen und sorgfältig geführten beruflichen Beziehungen lesbar und handhabbar gemacht werden. Zweitens beschreibt der Begriff *scarcity holism* die soziopolitische Konstellation, in der ökologische, ganzheitliche Konzepte von AMR und Mensch-Bakterien Beziehungen mobilisiert werden, um der Knappheit von Antibiotika als infrastrukturelle Substanzen zu begegnen.