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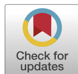

Tackling wicked problems through street-level diplomacy: the case of antimicrobial stewardship in Northern Europe

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ABSTRACT

Antimicrobial resistance (AMR) can be considered a wicked problem because the phenomenon is characterised by multiple, interdependent factors, functioning within ostensibly intractable dynamics. Collaborative or networked governance is often seen as the most appropriate approach to address wicked problems, and there is often scepticism regarding the scalability of micro-level local solutions contributing to neglect in the literature of the role that street-level actors play. Our study focuses on AMR stewardship practices in Northern Europe (Netherlands, Sweden and England), a region which has been relatively successful in controlling antibiotic use in healthcare. We conducted purposively sampled, theoretically-informed, qualitative interviews to explore stewards' practice as policy actors – how they carried out their tasks, worked with others, and dealt with tensions in their role. Using abductive analysis, we demonstrate that participants pursued sustained engagement with antibiotic prescribers and sought creative ways of working with, rather than against, embedded professional values. They deployed deliberative and diplomatic relational practices to build trust. Street-level diplomacy offers a theoretical framework for understanding how policy actors can work in the context of wicked problems. Street-level diplomats operate, with high levels of discretion, within complex, adaptive systems utilising their relational skills to build dynamic forms of influence amongst those implementing policies that have direct impact on citizens and services users. This provides a pragmatic analytical route through the extremes of romanticised calls for 'collaboration' to solve wicked problems or critical perspectives that suggest that wicked problems are intractable.

1. Introduction

Exploring wicked problems has been an enduring area of study since the concept was introduced in the 1970s (Rittel and Webber, 1973; Head, 2019). Wicked problems consist of multiple, interdependent, and sometimes contradictory factors meaning that they can seem highly intractable. Governance networks are often seen as the most appropriate means of addressing wicked problems (Weber and Khademian, 2008; Ferlie et al., 2011) as they foster collaboration (Jagers et al., 2020), encourage adaption through diversity (Koliba and Koppenjan, 2015) and an appreciation of complexity (Head and Alford, 2015). However, the role that 'street-level' actors, i.e. public-facing workers implementing policy through discretionary decision-making, play in governance for wicked problems has been neglected (Head, 2019; 184).

In this article, we contribute to an emerging practice-based approach to governance for wicked problems (Noordegraaf et al., 2019; La Grouw et al., 2024). We deploy a 'bottom-up' implementation lens to wicked problems (Lipsky, 1980); specifically, we use theories of street-level diplomacy, which conceptualises street-level work within networked systems rather than bureaucratic ones (Gale et al., 2017), to study the implementation of policies designed to manage wicked problems in practice. We examine the case of antimicrobial resistance (AMR) and conduct an abductive, qualitative analysis of data on healthcare professionals' experiences of implementing antimicrobial stewardship

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policy in Northern Europe, a region which has relatively low antimicrobial prescription rates by international standards. Our findings suggest that an irresolvable tension between the risk of infection and the risk of losing effective antimicrobials for future generations, is navigated through 'deliberative practice' (Laws and Hajer, 2006). By embracing uncertainty, synthesising knowledges and epistemological approaches, and creatively navigating professional hierarchies, stewards could foster trusting, deliberative spaces and challenge engrained prescribing habits.

We first outline the problem of AMR and the concept of antimicrobial stewardship, aligning these with the dimensions of wickedness. This is followed by a discussion of the governance for wicked problems literature, the need for a practice policy perspective, and how the street-level diplomacy approach can help fill this gap. We then outline our methodology and present our findings. We conclude with a discussion of our contribution, and present emerging questions for future research.

2. Antimicrobial resistance and stewardship

AMR refers to the mutation of micro-organisms with the consequence that antiseptics, antibiotics, antivirals, antifungals and antiparasitics used in human, animal, and plant health decrease in effectiveness. Microbial mutation is an ongoing biological process, but it is believed that significant use of antimicrobials in medicine and agriculture has increased rates of resistance, with significant socio-economic implications (Poudel et al., 2023). Antibiotic usage forms an integral part of contemporary biomedical care and supports a diverse range of clinical interventions, such as surgery and infection management, across preventative, curative and palliative care. With warnings of a post-antibiotic era and increasing mortality from common infections (Kwon and Powderly, 2021), there has been significant policy activity to manage the risks of AMR focusing on the need for multi-sector collaboration (Ciabuschi et al., 2020).

AMR demonstrates many of the characteristics of a wicked problem: scientific uncertainty (disparate and contradictory sources of knowledge), social pluralism (competing risk perceptions, priorities and interests among diverse stakeholders), institutional complexity (multiple and nested organisations), and transboundary (crossing species, organisational, and geo-political borders) (Head and Alford, 2015; Noordegraaf et al., 2017). While the lack of consensus among scientific communities over how to address AMR is itself worth studying, AMR furthermore 'presents a critical problem of what to think in and beyond biomedical science' (Landecker, 2016: 20). For instance, even those interventions which many agree would help with AMR, such as the development of new antimicrobials, would themselves drive resistance in the future. AMR cuts across biological, geographical, policy, and jurisdictional boundaries and heated debates have emerged between the medical profession, pharmaceutical, and agricultural sectors regarding who is (more) responsible and what regulatory mechanisms should be deployed (Jensen, 2024). With those attempting to address AMR also deeply entangled with its proliferation, and without an overarching governance mechanism to address the problem, AMR has been described by some as a 'super-wicked' problem (Littmann et al., 2020).

In the healthcare sector, much policy attention has been on influencing the behaviours of actors seen to contribute to increasing resistance, such as antibiotic prescribers (Chandler, 2019). Responsible antimicrobial usage is a policy objective found in the WHO's Global Action Plan for AMR (WHO, 2015) and stems from the notion that inappropriate or 'irrational' use of antibiotics (i.e. in the absence of clinical evidence of infection) amplifies resistance (Leung et al., 2011). To address inappropriate prescribing, antimicrobial stewardship has emerged as a key intervention. First coined in the 1990s by medical professionals looking to tackle what was perceived as the over-use of antibiotics, more recent conceptualisations of antimicrobial stewardship have stressed the idea of 'responsible' over rational use (Dyar et al., 2017). Whilst enhancing responsible prescribing through better stewardship may appear to offer a stable problem and solution pairing for AMR, wickedness prevails. For instance, there is no conclusive evidence that decreased consumption of antibiotics will, alone, lead to a decrease in rates of resistance (Bertollo et al., 2018) and what 'responsible' or 'rational' looks like is shaped by the context, goals, and resources available (Brisley et al., 2023) raising issues of social justice globally (Broom et al., 2023).

Beyond wickedness at the level of policymaking, for local AMR stewards, contestation, complexity and uncertainty characterises the nature of the work. Individual infection treatment requires deploying antimicrobials, yet such usage increases the risk of resistance developing in the population. No amount of ethical rumination, reflexive practice, or cautious antimicrobial usage can avoid this fundamental tension (Gilbert and Kerridge, 2020). Studies find that healthcare professionals have a difficult, confused relationship with stewardship, unable to fully make sense of it through the professional norms of evidence-based medicine (Rynkiewich, 2020) and risk-management (Davis et al., 2024). Much prescribing is driven by individual, clinical knowledge, and the prescriber's own experience rather than diagnostic technology (Tarrant et al., 2019). The attributes of the wicked problem of AMR discussed above in abstract terms, are also experienced in practice by those tasked with addressing wicked problems (Noordegraaf et al., 2019). Understanding how actors, for whom stewardship is a key part of their role, collaborate to address AMR is the central aim of this paper.

3. Governance for wicked problems

The question of how to govern wicked problems has been largely answered to date through the language of networks and collaboration (Ferlie et al., 2013; La Grouw et al., 2024). Despite the importance of relational dynamics for successful collaborative and network governance being acknowledged (Ansell and Gash, 2008; Dickinson et al., 2019; O'Leary et al., 2012), they are often seen to result from institutional arrangements and policy design choices (Johnston et al., 2011; see discussion of 'enabling conditions'; Termeer et al., 2015) or as a prerequisite for the design and function of networks within vertical and horizontal 'systems' (Weber and Khademian, 2008). The process of implementation and the role of the actors who undertake that implementation is neglected (Noordegraaf et al., 2019; Head, 2022). We see this neglect as limiting understanding of the forms of 'actionable knowledge and governance arrangements [which] can be used to navigate the challenges wicked problems pose' (Termeer and Dewulf, 2019; 169). We redress this neglect through building on the well-established field of street-level bureaucracy (Lipsky, 1980) and applying it to the context of implementing AMR stewardship in clinical settings.

Street-level bureaucrats are defined as public service workers or professionals who interpret and remake policy whilst coping with citizen demands, resource restraints, complex and sometimes ambiguous tasks, and competing organisational values and conflicts (Maynard-Moody and Musheno, 2003; Tummers et al., 2015). It has been widely used in the context of health to analyse discretionary decision-making and coping strategies of a range of actors including GPs (Checkland, 2004), health visitors (Hughes and Condon, 2016), nurses (Walker and Gilson, 2004), midwives (Finlay and Sandall, 2009), and receptionists (Litchfield et al., 2023), as well as related public service professions such as in adult social care (Ellis, 2011), or caseworkers in the welfare system (Jacobsson and Johansson, 2025). Together with the centrality of uncertainty in notions of discretion used in this literature (Zacka, 2017), the pressures of street-level work echo the attributes used to define wickedness and should be well suited for capturing the dynamics of working with wicked problems. However, this perspective also poses some challenges to the governance for wicked problems literature, where it focuses on policy design, governance arrangements and managerialism. Literature addressing the practice of the street-level-bureaucrat highlights tensions emerging between the need to work on the implementation of policies as directed from above, and the localised, embodied and tacit forms of

knowledge frontline workers develop when working within communities (Durose, 2009; Brown and Gale, 2018). Local knowledge as a key feature of street-level work contrasts with the universalising character of analytical and problem-solving capacities articulated in the collaborative governance literature (Weber and Khademian, 2008). Reflecting a broader tension between local and global perspectives on wicked problems such as AMR (Rubin, 2019), we argue that focusing on the local perspective can offer new insights into policymaking for wicked problems in general, and AMR policy specifically.

We are also interested in understanding whether street-level practices enhance or impede interventions designed to address wicked problems. Proponents of the street-level bureaucracy approach often emphasised the subversion of policy implementation (Exworthy et al., 2002), but the innovative and entrepreneurial character of street-level work is increasingly noted (Lave and Cohen, 2019; Barral and Ghosh, 2023). Nonetheless, how practices are related to outcomes and what potential mechanisms of change (best) apply has not often been the focus of this literature. Those exceptions that do (tacitly) examine change have highlighted the presence of productive and dysfunctional relational dynamics which enable and constrain collaboration between street-level actors, managers and citizens (Bartels, 2018). How such relational dynamics affect change in policy outcomes aimed to address wicked problems has yet to be studied.

A focus on street-level bureaucracy does help recognise the importance of frontline decision-making in policy implementation; however, the concept requires updating so it aligns with current understandings of governance. The increasing emphasis on service provision via the private sector and civil society has led to collaboration, flexibility and responsiveness to citizen demand to be increasingly seen as values which should shape governance (Dickinson, 2016). Critical interrogations of the street-level bureaucracy concept have revealed that it contains normative appeals to Weberian bureaucratic ideals of standardisation and professionalisation which sit in tension with contemporary forms of governance (Durose, 2007; Bartels, 2013). Recent investigation suggests that street-level actors operate within "hybrid" environments in which they encounter both traditional bureaucratic imperatives for top-down performance goals and contemporary imperatives for decentralised working, flexibility and bottom-up responsiveness (Larsen et al., 2025). While many continue to use the street-level bureaucracy term, we see the concept of street-level diplomacy as more appropriately reflecting this hybrid environment and the interactions which constitute it.

At the centre of the street-level diplomacy concept is an understanding that governance often occurs across networks where value pluralism is common (Needham et al., 2025), professional norms and practice can be entrenched and resistant to new roles or interventions (Currie et al., 2012) and there is an absence of shared formal structures (Løken and Vike, 2024). Therefore, 'soft' dynamics such as creativity, trust and collaboration are key to everyday policy work to navigate system politics (Waring et al., 2023) and difficult decisions (Lassa et al., 2025) or avoid punitive rule enforcement that could damage long-term working relationships (Hrynick et al., 2019). Rather than focusing on the interplay between frontline discretion and rule-following, street-level diplomacy 'focuses on the communicative, adaptive and cultural parts of (…) policy implementation in networks' (Gale et al., 2017: 14). Borrowing from the practices of multi-track diplomacy (MTD), this perspective highlights the diverse streams of action involved – entry to the system, involvement with partners, approaches to the work – within local conflict transformation and the relational dynamics which can lead to deep and sustained change at the system level (Notter and Diamond, 1996). Moreover, with its emphasis on distinct communities and actors coming together to create shared practices, the diplomacy framing helps illuminate the importance of interactions between street-level actors in the provision of public services (Phillimore et al., 2021; Ningrum and Lotta, 2024). Indeed, while the interaction with citizens has been a defining feature of the street-level bureaucracy concept (Hupe et al., 2015), recent accounts have emphasised how 'informal networks' and 'interorganisational teams' are also key components of 'frontline social constellations', as well as direct encounters with citizens (Raaphorst and Loyens, 2020; 36). Needham et al. (2025) argue that 'More than other approaches, the diplomacy metaphor gives proper attention to the need for collective change strategies of alliance building, bargaining and compromise'. We contribute to accounts which draw attention to the importance of 'street-level collaboration' between frontline actors and other public and managerial actors (Bartels, 2018), contending that street-level diplomacy is a helpful concept for capturing and disentangling the communicative and relational practices which are enacted in the context of wicked problems.

4. Methodology

Design: To explore antimicrobial stewardship as an example of how street-level work can help to address wicked problems, we adopted a case study design of antimicrobial stewardship practices within Northern Europe, which followed on from a survey study of antibiotic prescribers in England that had highlighted the role of AMR stewards (McKenna and Gale, 2022). AMR stewards in three countries - England, the Netherlands and Sweden - are treated as a singular case of stewardship, where there are relatively low rates of antibiotic prescribing (in the global context). With among the lowest global rates of antibiotic consumption, Sweden and the Netherlands are understood to have achieved significant improvements towards prudent prescribing practices despite the complexity of change in this area and are considered 'excellent' for 'optimising antimicrobial use in human health', with the UK considered 'very good' (ECDC, 2023). Although there are significant similarities between the three countries, such as a comprehensive primary care system, strict controls over access to antibiotics, and a minimal black market, there are some local differences in how these prescribing encounters are organised in England, the Netherlands and Sweden which are described below. Pragmatism, language, and issues of access also played a role in shaping how this research design unfolded (Schwartz-Shea and Yanow, 2013). Our research design was approved by the University of Birmingham's ethical review committee (ERN_20–18380).

Research Setting and Context: Antimicrobial stewardship is a broad system spanning government, healthcare institutions, the private sector and various professions. Across these different spaces, a diverse range of practices are considered as important areas for stewardship to take place, such as drug procurement and the design of performance management systems (Dyar et al., 2017). An example of the configuration of such practices is illustrated in Fig. 1. Concerned with street-level actors and how those they interact with influence their decision-making, we focus on healthcare professionals who have direct contact with those prescribing antibiotics or are themselves both prescribers and members of antimicrobial stewardship teams.

Swedish antimicrobial stewardship is concentrated within the Swedish Strategic Programme against Antibiotic Resistance (Strama, Strategigruppen för rationell antibiotikaanvändning och minskad antibiotikaresistens). Producing clinical guidelines and monitoring prescribing patterns at a national level, STRAMA also organises local networks of healthcare professionals across primary and secondary care. Comprised of medical microbiologists (a medical speciality), infectious disease specialists, pharmacists and general practitioners, these networks localise clinical guidelines, prescription monitoring, and provide targeted education to clinical settings and individual prescribers who are deemed to prescribe antibiotics in excess. While those in secondary care are staffed by individuals who also hold clinical responsibilities within hospitals, primary care networks are composed of individuals whose sole responsibility is to work within the Strama networks. In Sweden, physicians and certain qualified specialist nurses are authorized to prescribe antibiotics.

Dutch antimicrobial stewardship centres around the Dutch Working

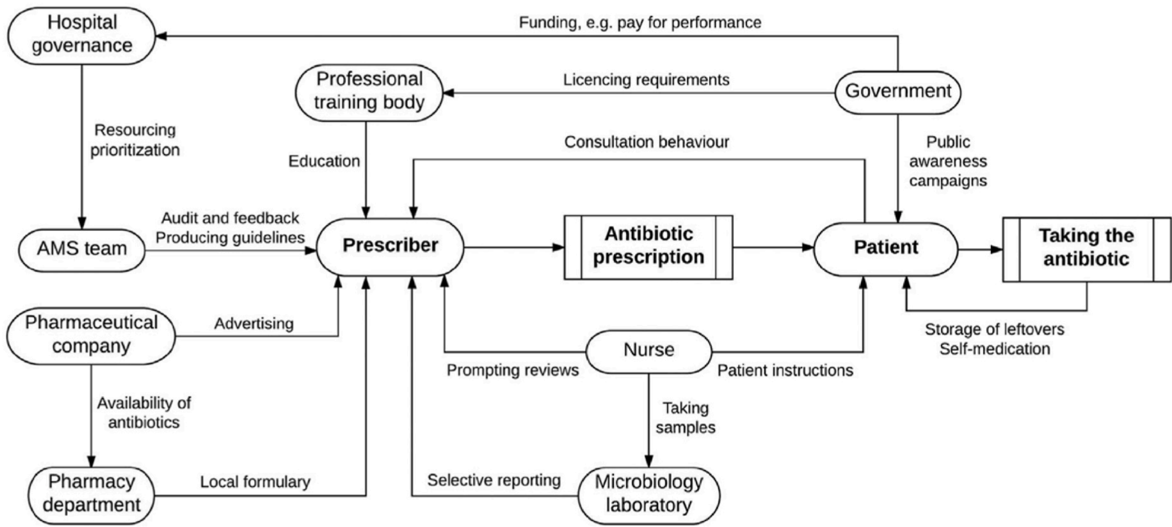

Fig. 1. Actors and practices of stewardship (Dyar et al., 2017).

Party on Antibiotic Policy (SWAB, Stichting Werkgroep Antibioticabeleid). SWAB carries out many of the same functions as Strama at the national level and the hospital level through their local 'A-Teams', and at primary care level they coordinate training and surveillance activities through regional AMR care networks, providing data via a periodic pharmacotherapeutic consultation (farmacotherapeutisch overleg, FTO) so that GPs can see how their prescribing compares to other GPs. In the Netherlands, only GPs and physician/surgical specialists can prescribe antibiotics.

In the English health system, there is no independent organisation dedicated solely to antimicrobial stewardship. Instead, stewardship is organised at primary care level around clinical commissioning groups who employ healthcare professionals as antibiotic stewardship leads, who localise guidelines and work directly with general practices where antibiotic prescribing is considered higher than it should be. At secondary and tertiary level, hospital trusts appoint stewardship teams usually composed of pharmacists and medical microbiologists. At the national level, at the time of the data collection, NHS England (the national body that led the English National Health Service until 2025) provided a leadership role supporting local stewardship efforts, through providing resources, such as education and guidance, and monitoring progress to reduce antimicrobial resistance and its impact on health inequalities. In England, doctors and some specially trained nurses and pharmacists can prescribe antibiotics.

Sampling and recruitment: We employed a purposive sampling strategy and interviewed those whose role focused on influencing frontline prescribing. All interviewees were clinicians by training, with experience also of prescribing at the 'street-level' through direct interactions with patients. Whilst some continued to work clinically, others had moved into roles 'one-step removed' where they spent all their time influencing other prescribers. This distinction was most notable between primary and secondary care. Those recruited from secondary care settings held hybrid roles where stewardship responsibilities, such as producing clinical guidelines, were intermingled with clinical responsibilities. In primary care, antimicrobial stewards were often no longer undertaking clinical work but had moved into full time managerial or coordinating roles. Despite this, we see these actors as comprising the immediate social context of frontline action which influences the micro-level interactions between prescribers and patients. In doing so, we follow other authors in focusing on the frontline space and those actors that are considered important in influencing the interactions with citizens (Bartels, 2018; Raaphorst and Loyens, 2020; Litchfield et al., 2023). We refer to our participants as 'stewards' and those they are trying to influence 'prescribers'. This is an etic, empirical categorisation for clarity of presenting findings as most of those we spoke with saw antimicrobial stewardship as a practice, rather than a professional identity. Table 1 summarises participant characteristic/s. In the findings, we do not identify the gender or profession of those whose words we cite, to avoid revealing their identities.

Data collection: Before semi-structured interviews were conducted online (via video-calling) or face-to-face, then transcribed and anonymised prior to analysis, informed consent was attained through signed participant consent forms. Our topic guide was informed by our previous research with 'street-level' antibiotic prescribers (McKenna and Gale, 2022). We asked stewards how they approached working with prescribers, the challenges of the work, their perspectives on clinical guidelines for infection treatment, and how this shapes their interactions with healthcare professionals. All interviews were conducted in English.

Analysis: We followed an abductive logic where we moved iteratively between theory and data (Tavory and Timmermans, 2014) conducting three rounds of coding. Our theoretical starting point was to explore how individuals resolved tensions between forms of (i) medical knowledge about AMR risks, (ii) antimicrobial stewardship interventions and (iii) social/clinical relationships (Brown and Gale, 2018), which builds on our previous work, and we coded then created an analytical memo for each theme (3) in each country (3) (i.e. 9 in total) to describe and familiarise ourselves with the data. Changing the prescribing habits of prescribers was a significant emerging theme and so our second round of coding focused on the relational practices of 'influencing' by applying the street-level diplomacy framework (Gale et al., 2017). Illustrative examples of how this was done are provided in Table 2. What emerged from this second round of coding was not only an analysis of relational practice, but also why stewards thought relational practices were

Table 1
Summary of participants.

Characteristic		Number
Country of work	Netherlands	5
	Sweden	5
	England	5
Clinical Training	Medical Microbiology	6
	Pharmacy	5
	General practice	2
	Other medical or surgical	1
Current stewardship role	Organisational lead	4
	Member of regional body	6
	Member of national body	5

Table 2
Illustrative data coded under the sub-headings of street-level diplomatic practices.

Diplomatic practices	Data illustrations
Entry into the system: Invitation rather than imposition Long term commitment to people	*"It takes time for people to realize that you've got the patient's best interests in heart" (ENG3)*
Involvement with partners: Strong interpersonal relationships over time Trust through listening and reliability Engagement and care Embedding partnership	*"We spoke to individual GPs in a very localized area, localized basis and said look 'these are the local concerns, you're just making it worse, you're increasing your workload (…) in this situation you can just ring me". You know it's really broke down some barriers (ENG1)*
Approaches to work: Synthesising wisdom Diversifying practice in line with local context Learning orientation	*"So we presented their data and we asked them to come up with ideas of how to work with it themselves" (SWDL2)*
Overall goals: Assisting parties in address their own concerns Empowering local change agents Transforming beliefs and practice	*"So, we go to you, we listen to your problems, we look at your data and we define together our policies. That brings along accountability because then we make them accountable and that works the best." (NL1)*

effective. This orientated us towards the question of change and how this can be conceptualised in relation to street-level bureaucracy and wicked problems. To provide a balanced picture of how street-level work can and cannot contribute to addressing wicked problems, we conducted a third and final round of coding and memo writing which sought to examine those instances in which street-level diplomacy failed or could potentially fail.

In what follows, interview excerpts are transcribed as directly as possible, even where the language is not grammatical, or there are clinical inconsistencies. Text that appears in square brackets has been added to facilitate reading comprehension.

5. Findings

We present our analysis in three parts – first, we provide evidence that 'diplomacy' is a practice that is being deployed by street-level actors in the context of a wicked problem; second, we show how these practices are perceived to lead to change through the creation of deliberative moments and third, we consider the limits of street-level diplomacy as an approach to tackle wicked problems.

5.1. Doing street-level diplomacy in practice

Those working in stewardship roles and charged with changing antibiotic prescribing practices were located in diverse settings within the healthcare systems we explored. Some operated within hospital settings, occupying specific specialist clinical areas (e.g. microbiology departments) and roles (e.g. antibiotic pharmacists) and were involved in hospital risk management (e.g. infection prevention and control committees). Others operated within organisations external to direct healthcare provision such as regional bodies (e.g. Clinical Commissioning Groups (CCGs) in England) and non-governmental organisations (e.g. STRAMA in Sweden). Despite the diversity of locations in the healthcare system, stewards described facing similar challenges - regarding dilemmas of where to focus their attention and how to *gain entry* into the diverse areas in which patient-facing prescribers were operating. Data on prescribing rates within locales helped in this regard, but a lack of granularity regarding exactly which prescriber was giving what needed to be creatively circumvented by stewards. The difficulty of this task was compounded by the plurality of public and private healthcare settings in which prescribing was taking place. Stewards described often having no procedural 'right' to gain access to healthcare settings. Without such 'structures of collaboration' (Huxham et al., 2000; 341–343), they needed to engage in improvised transboundary interactions. In the following quote, a steward recalled the challenge of identifying and gaining access to a private clinic that according to national level data was over-prescribing antibiotics.

> We [Strama] have all the data in Sweden about all the prescriptions that patients get from the pharmacies (…) So, when we just looked at the top list, this clinic doing aesthetic surgery, … it was a lot of detective work to see. Okay, it's this clinic in this street. (SWD2)

Stewards were aware that habits of antimicrobial usage were well embedded in different regions and medical specialisms and that changing practices could rarely be achieved with a one-off intervention. Habits and practices were also understood as entangled with professional status (who is qualified to prescribe) and clinical governance frameworks, which further constrained speedy changes to practice. Therefore, once access was attained, stewards tended to commit to *long-term involvement* with prescribers as a realistic means of changing practice. This commitment concerned not only changing individual prescribing behaviour directly, but also collaboratively resetting institutionalised forms of knowledge, such as cocreating national clinical guidelines. In the example below we see how this co-creation was part of a gradual, long-term relational process within which the building of trust was highlighted:

> When we started the project … to produce national guidelines in an app, many regions said this will not be possible because how can we unite between the treatment traditions in Gothenburg and Stockholm and other parts of Sweden? But after forming working groups … together with team members from all parts of Sweden, it was possible to be united around one guideline. And of course, you're never in the situation where everyone is totally happy. But I would say that the trust is quite high. Also, I think to gain trust, you must show also that you listen to critics. If there is a critical view, it must be taken seriously. And it took us two years from where we started talking about it until we had the first product to deliver when it came to hospitals. (SWD5)

As well as the passage of time, participants described important hierarchies of professional status that shaped interprofessional collaborations (with physicians and surgeons normally at the top) which stewards had to negotiate. The legal frameworks for antibiotic usage could vary across jurisdictions and various professional groups (e.g. doctors/dentists, pharmacists, and nurses) were involved in prescribing, dispensing, and administering antibiotics. Therefore, even once access was attained, challenges existed involving the micro-politics of interprofessional interactions whereby 'everyone thinks they know what they're doing with antibiotics' (ENG3). Amid such hierarchies, trust and confidence were seen as vital to reduce what was felt to be a real risk that prescribers would caricature stewards as 'clipboard Nazis' (ENG4) who rigidly policed behaviour. Spending time with prescribers on the ward and/or engaging with their patients' cases was described as one way to reduce this risk. Moreover, stewards from a pharmacy background would have to accept and then work with, rather than against, medical hierarchies. For example, a steward with a pharmacy background described working with a group of GPs who were overprescribing. Pre-empting interprofessional conflict with the GPs, the steward asked a medical microbiologist to front the intervention, explaining that 'obviously [it's] much easier clinician-to-clinician sometimes, you know the respect is there and much better received' (ENG1). Recognizing and working through professional hierarchies indicated an *approach to working with others* that accommodated (rather than attempting to challenge) established norms and power relations.

5.2. Creating deliberative spaces - a mechanism of change?

Implicit within the above analysis (and the diplomatic theories that inform it) are practices of creative interaction, continual engagement and working with, rather than against, embedded cultural or professional values to create positive change. In this section of our analysis, we interrogate explicitly the relationship between practices and change, by demonstrating the ways in which the stewards in our study perceived their practices to lead to enduring shifts in prescribing cultures.

Whilst experts in their respective fields, stewards did not conform to a conventional teacher-student or mentor-mentee dynamic; rather, they described creating a space for mutual deliberation. Through these spaces, they were able to create a network of trusted relations which could proliferate across time. Despite often naming their work 'training' or 'education', implying a one-way transfer of knowledge, AMR stewards described a more complex situation in which stewards were also learning from prescribers, trying to facilitate a 'synthesis of wisdom' (Notter and Diamond, 1996) more akin to diplomatic practice.

Stewards recognised that they were operating in a field of practice where the primacy of AMR risk was not universally accepted (given the prevailing scientific uncertainty and social plurality). Indeed, there were fundamental tensions between immediate risks to patients (of infection, sepsis, or death) and the longer term need to prevent the rise of AMR. Finding a way through these tensions required multiple deliberative interactions over time, listening to the concerns of prescribers, and integrating diverse sources of knowledge on AMR. In the case below, a pharmacist uncovered repeated non-compliance to local clinical guidelines and attempted to persuade the prescribing clinicians to change their practice but was ultimately persuaded themselves that ostensible 'non-compliance' in this case was appropriate. This was in response to a dose increase policy, which are implemented when standard doses are no longer effective due to pathogens that have reduced susceptibility to antibiotics but are not fully resistant.

> We had a dose increase policy of gentamicin [a type of broad-spectrum antibiotic]. We were dosing it quite low in relation to national and international guidelines. So, we decided after long discussions … to increase that dose, and we were a bit afraid because gentamicin is a very toxic antibiotic. So, every specialty was following the new guidelines except the gynaecologists. So, we (…) had a discussion and tried to convince them (…) "We don't see any evidence why you actually use this drug for the infection that you treat. Why do you give this and not another one? Because there are other less toxic drugs". (…) We get the feeling, well, they can't give us the evidence, the scientific evidence, but they really want to hang onto this [using gentamicin]. And then of course they come up with a reason that (…) they want to give this antibiotic [at the lower dose] actually for a resistance and a stewardship reason. Because if the mother-to-be gets this antibiotic, the chances are that the newborn [would] get the same antibiotic if they are born with fever. And these neonates always receive gentamicin - that's the first line antibiotic. So, [the gynaecologists] say, "if we give the mother another antibiotic, if they are not delivering yet, [and then] also the neonate is exposed [to gentamicin], then they (…) have been exposed to both antibiotics" (…) And that's actually a stewardship perspective. We need to ask a lot of questions before this came out, but in the end, we had a better understanding of each other's arguments and accepted the way they did it. (NL3)

Successful stewardship here was understood as being achieved through creating forms of deliberative interaction in which both steward and prescriber emerge satisfied overall. Even where some differences of opinion remained, better mutual understanding had been achieved with a legacy of trust for the future, and, indeed, over time, this discussion and patience in this case paid off with the clinical team moving towards compliance with the policy:

> So now they [the gynaecologists] try to adopt the new policy, but they're still a bit afraid. So with a lot of measurements, we're going to show them that it's not … because they worry about the newborn with the new higher dose. So, we go and measure the newborn then for side effects. (NL3)

The explicit acknowledgement of scientific uncertainty regarding appropriate antibiotic treatment was considered vital in the creation of trusting, deliberative spaces. For instance, inconsistencies in national and local clinical guidelines were deliberately discussed:

> We try to offer guidance, and we sort of tell [prescribers] about the differences [in clinical guidelines]. It is difficult … when doctors see that there are differences … Nationally, they say three times a day, but you say four times a day. What should we do? … We try to sort of expose the differences and tell them about it. (SWD2)

Most of those we spoke to noted that local guidelines should usually take precedence over regional or national guidelines. This principle was a useful remedy amid uncertainty regarding inconsistent guidelines. It was further widely agreed that exposing uncertainty, being honest about the contradictions in knowledge, and sharing frustrations had the effect of enhancing trust rather than undermining it.

Prioritising reciprocal and responsive communicative dynamics to nurture trusting relationships meant that shared understanding of AMR risk and the need to change prescribing habits went beyond those immediate interactions with the prescriber. Trust 'brings along accountability' (NL5) in prescribers because it allowed for some real meetings (deliberative moments) between alternative knowledge systems to take place. Through this, prescribers came to understand the concerns around appropriate prescribing, were able to integrate this understanding into their own habits and practices. This relational form of accountability, based on trust, was described as working outside of managerial arrangements or targets and empowered prescribers to work on changing practices. The pharmacist quoted above, who deployed a medical microbiologist to address overprescribing, told us how those once problematic general practitioners were now empowered to resist patient pressures for antibiotics which was influencing patterns of prescribing at a regional level, and how this has been supported by a long-term commitment from the stewardship team.

> The [GPs] got better at [prescribing] over the years. I think it's the *permission* for them to say no. They feel like they need that, and I think the more we push that, the better it's got really, you know. I think before it was in the background; now (…) it always *in the centre of the mind*. If you look at our overall CCG [antibiotic] prescribing, it's generally quite good now, with below national average. (ENG1, *emphasis added*)

The *synthesis of local knowledge* with evidence on AMR, and co-producing problem definitions and solutions enabled stewards and prescribers to trust each other over time, with 'give-and-take' around how to act in any given situation.

> Based on the types of patients that are treated at that department, [we] have a discussion where [prescribers] can ask questions they might not have asked before, but they think a lot about; do I really need to cover this pathogen? Why do we use this antibiotic prophylaxis? There should be time to interact and discuss and educate each other. We can also learn from them about some things we didn't know that could make an impact on our treatment guidelines in the future. (SWD1)

The possibilities for change, therefore, related not only to immediate prescribing habits, but the bottom-up production of knowledge which could then transform institutionalised knowledge in the form of clinical guidelines.

5.3. Limits of diplomacy

Much of the ability for stewards to affect change stemmed from their deployment of diplomatic relational practices and the production of consensual relationships. Yet this does not mean that diplomacy works in all situations, even where time and trust are present. Our findings highlighted some particular challenges, including negotiating professional power imbalances and emergent conflict.

> Where stewards could not get close enough to prescribers to build that deliberative space, they felt that they were thwarted in their attempts to influence practices of those positioned higher up the professional hierarchy. The following steward with a pharmacist background, contrasted their current experience in an AMR policy role with a previous role in clinical practice.

> So [when I was working as a hospital pharmacist] I'd go with the admitting consultant and his team or her team to see all the patients (…) that was just fantastic because they all got to know me. I was able to interact in real time and provide advice and support and be useful to them. It's a win for both parties. So, we're helping them in all elements prescribing but also focusing on the stewardship things. It is about the relationship that you can have with people. When you start to get into a regional role, that becomes a lot more difficult because you don't have necessarily those relationships with people, so it's about influencing in a different way, I guess. As my boss keeps saying 'influencing without that authority.' That's a real challenge. (ENG3)

Stewards were aware of the limits of their influence, and some evoked this through discussing how they might manage if their diplomatic skills were ineffective or insufficient. In cases where there was strong societal and political momentum behind AMR stewardship, the awareness for both prescribers and stewards of diplomatic failure was likely to be a stronger motivator to reach a consensus. The following quote is the reflections of a Swedish steward who, while they predominantly described their work in 'diplomatic' terms, noted that they could theoretically turn to disciplinary tactics such as mobilising (the threat of) reputational damage which might re-balance the power hierarchies between stewards and medical prescribers.

> And now we really hope that they will change, actually. And I think this is such an important question, it wouldn't be good for them, for their reputations, to their customers, if they got STRAMA against them (…) We do have the public and politicians and so on with us. (SWD1)

Of course, there would have been a significant risk in enacting this approach because it would have created further distance and distrust between steward and prescriber, thus limiting their ability to create deliberative spaces in the future. Nonetheless, a hypothetical threat that might never be enacted could be effective in diplomatic work (particularly in Sweden where consensus plays a key cultural role).

In some cases, we saw that diplomatic attempts led to unanticipated outcomes in the form of emergent conflict, including disengagement of professionals from AMR priorities and potential othering between professionals. The way in which hierarchical control could undermine trust and the relational benefits that came with this was expressed by one steward when describing a conflict over an ongoing antibiotic treatment. Whilst the individual treatment was changed, the prescriber remained unconvinced by the alternative treatment, such that any influence over future prescribing decisions seemed unlikely.

> I've once saw a nonmedical prescriber run someone on IV [intravenous] levofloxacin for no good reason. And I wanted to put them on to oral levofloxacin (…). And they were like "oh no, I don't know about that." And I said, "well, here's how it is, I'm going to change it and if you feel this strongly about it, you can change it back." That was after how explaining the, you know, risk and benefits and everything to them. And they were fine with that because they hadn't made a decision, but they didn't feel strongly on the merits of the treatment. (ENG4)

> A particular concern voiced by stewards was around some professionals seeing themselves as exempt from AMR stewardship concerns (or at least that it was a lower priority than other clinical considerations). This pharmacist explained that nothing they did seemed to get through to some medical prescribers.

> Then you've got the sort of the more senior people who've been around the block a bit longer. They know what they want to do, and they will not always take kindly to you, saying, well, you can't use that choice 'cause that's not on the guideline, or you know you've gone too broad spectrum where you don't need to. … I had one consultant when I was in in the previous [hospital], and I would make 10 … different stewardship recommendations. [The consultant knew] all of them, and it's like so frustrating. Trying to escalate that [conflict] up to the medical director and stuff of that and not really getting very far. (ENG3)

> Finally, there was a potential for the 'othering' of certain professionals and patients, with socio-cultural differences being evoked by stewards as an explanation for non-compliance with AMR guidelines.

> … that is a problem, of course, cultural differences and also language barriers. And especially for immigrants coming to Sweden. Maybe they're used from their home country to get antibiotics all the time, for example. That has been an issue. And also doctors coming from those countries originally, they might bring their mode or their rate of prescribing antibiotics to Sweden (…) It used to be, I think, a bigger problem 20 years ago. But we've been working with it hard. (SWD4)

These kinds of accounts of tension between different global prescribing cultures reveals a risk of blame and conflict emerging in such circumstances, that may not be sensitive to the historical context and the responsibilities that the Global North has had in creating the current problem (Broom et al., 2023).

6. Discussion

Wicked problems: Our analysis provides a route through the tendencies in the wicked problems literature to assess intractability (Head, 2022) or to romanticise the potential for structures of 'collaboration' to solve them (Nordegraaf, 2019). By exploring street-level work in this context, we have provided evidence that wickedness (pluralism, uncertainty, and complexity) is navigated in practice through deliberative relationships, that enhance trust and create the sense of joint endeavour. The antimicrobial stewards we studied demonstrated a pragmatic and socially/politically astute orientation to their work, going beyond proposition-based conflict with antibiotic prescribers and the need for one side to compromise with the other (Forester, 2009). By embracing uncertainty with prescribers, synthesising local, specialist knowledges with their own, and creatively navigating professional power and hierarchy, stewards cultivated their interdependence with prescribers and focused on the process of changing prescribing habits just as much as the outcome in terms of specific prescription decisions (Forester, 2014). We argue that a street-level approach adds to the literature on governance for wicked problems by demonstrating the need for a critical understanding of collaboration as a form of 'deliberative practice' (Laws and Hajer, 2006). Street-level diplomacy creates space to surface contradictory engrained beliefs and habits, tailor knowledge to local contexts, and shifts in assumptions about the possibilities for action through deliberative relationships which can withstand the pressures of wickedness. In doing so, collaboration can move towards the inclusion of those who may seem to 'fundamentally' disagree, but whose conflicting

beliefs can themselves be a source for transformation through creative tension.

Street-level practices: 'Bottom-up' implementation studies have tended to emphasize the potential for street-level bureaucrats to subvert policy. However, this study demonstrates that in this 'wicked' context, stewards navigated the interplay between prescribing habits and practices and clinical governance by making the abstracted ideal of 'rational' antibiotic usage contextually meaningful for prescribers. Rather than establishing the 'facts' and attempting to educate prescribers about them, stewards worked with prescribers to render visible and to interrogate incomplete and contradictory evidence for infection treatment, challenging institutionalised forms of knowledge and building evidence from the bottom-up. Uncertainty was not just something to be 'coped' with through deliberation (Møller, 2021) but was seen as something stewards and prescribers could experiment with and was productive of new practices. The way stewards mobilised uncertainty as a gesture towards epistemic humility is a novel finding in the street-level bureaucracy literature (Raaphorst, 2018).

From deliberative practice to change? Our analysis has also generated a new line of enquiry for this field – about how we can capture *mechanisms of change* within street-level work on wicked problems. Our empirical focus on a case of 'successful' management of AMR has enabled us to explore how street-level practices *may* lead to change, and therefore may be an opportunity to explore how engaging with a 'small wins' framework (Termeer and Dewulf, 2019; Bours et al., 2022) could deepen this analysis in the future. Through our analysis, we can start to see how stewards (in small wins terminology) may 'energise' prescribers by respecting their knowledge, 'learn by doing' through experimentalism, and jointly construct forms of action which, although piecemeal and on a case-by-case basis, can reshape institutionalised knowledges across scales with a 'logic of attraction' (Termeer and Dewulf, 2019). However, our findings around distrust and the potential for othering those who do not 'get' stewardship suggest a possible dysfunctional interaction between the types of mechanisms which are expected to produce transformative change. Future research needs to pay sustained attention to the question of change and assess the balance of mechanisms for and against change.

The limits of street-level diplomacy? A final question prompted by our analysis relates to the tension between our practice-based account of stewardship and the more critical, sociological view on AMR. The literatures we have mobilised see wicked problems as irresolvable such that they can at best be 'coped' with through small wins (Termeer et al., 2016). Relatedly, stewardship has previously been described as a form of micro-improvement, thus inadequate for the problem of AMR which is structural in nature (Broom et al., 2021). While the policy framings of AMR are often criticised for the individualisation of risk and the production of blame (Chandler, 2019; Brown and Nettleton, 2017; Jensen, 2024), for the participants we studied, blame was not a prominent dynamic in practice, suggesting that the deliberative and transformative nature of such interventions are understated in the current literature. However, we offer a caveat to this observation by noting that the potential for stewardship to address effectively address AMR may be dependent on the conditions of relatively wealthy, well-resourced healthcare systems.

6.1. Limitations and areas for future research

There are limitations to our study, which potentially limit its analytic generalisability, and we would encourage further empirical research to test this in different contexts. Taking a broad case study (across three Northern European settings) we sought to identify commonalities and shared practices in countries achieving lower prescribing rates, and thus we do not closely interrogate national and cultural differences (e.g. Deschepper et al., 2008; Touboul-Lundgren et al., 2015). There is significant potential to introduce a comparative element to the analysis of street-level work, either within this kind of case, or across to other cases (such as countries with high antibiotic prescription or usage rates) (Hill and Møller, 2019). Comparisons of AMR stewardship practices in countries in the Global South is the focus of our ongoing work.

A second area of limitation to the study was that within the scope of this article we could not offer further insights into mechanisms of change. It is not possible to disentangle cause and effect of these practices in complex adaptive systems using the study design that we employed. This means we cannot state for certain whether practices emerged as the result of being in a low antibiotic prescribing context, or whether the low prescription context was a result of these kinds of practices. We propose that this should be a focus of future research.

A final limitation is that the methods that we used offered great depth around how practitioners make sense of their social practices, but did not give insights into the experiences of the recipients of these street-level practices nor provide direct evidence (such as would be gained through ethnographic observations) of the professional encounters within 'constellations' of the practitioners implicated in stewardship efforts.

7. Conclusion

Our analysis enables us to provide the first published definition of street-level diplomacy (cf. Hupe et al. (2015)'s definition of street-level bureaucracy): a relational practice seen within complex, adaptive systems, where practitioners operating with high levels of discretion build deliberative relationships to shape the implementation of policies directly impacting citizens and service users.

Secondly, our analysis demonstrates that street-level diplomacy offers a theoretical framework, grounded in policy practice, for understanding how actors can work in the context of wicked problems. It provides an analytical route through the extremes of romanticised calls for 'collaboration' to solve wicked problems or critical perspectives that suggest that wicked problems are intractable.

CRediT authorship contribution statement

Matthew McKenna: Writing – original draft, Validation, Project administration, Methodology, Investigation, Formal analysis, Conceptualization. **Carla Rodrigues:** Writing – review & editing, Project administration, Methodology, Data curation. **Patrick Brown:** Writing – review & editing, Validation, Conceptualization. **Hannah Bradby:** Writing – review & editing, Validation, Conceptualization. **Nicola Gale:** Writing – review & editing, Writing – original draft, Validation, Supervision, Methodology, Formal analysis, Conceptualization.

Ethical Approval

Ethical Approval for the study was secured by the Humanities and Social Sciences Ethical Review Committee, at the University of Birmingham. Ref: ERN_20-1838A.

Explicit statement on contribution

Funding for the study was secured by Nicola Gale. The study was designed by Nicola Gale and Matthew McKenna. Matthew McKenna and Carla Rodrigues carried out the data collection. Matthew McKenna and Nicola Gale analysed the data and wrote the first draft of the paper. Carla Rodrigues, Patrick Brown and Hannah Bradby contributed important intellectual content to the editing of the paper.

Declaration of competing interest

N/A.

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Data availability

Data will be made available on request.

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