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MAJOR ARTICLE

Understanding the Determinants of Antimicrobial Prescribing Within Hospitals: The Role of "Prescribing Etiquette"

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Background. There is limited knowledge of the key determinants of antimicrobial prescribing behavior (APB) in hospitals. An understanding of these determinants is required for the successful design, adoption, and implementation of quality improvement interventions in antimicrobial stewardship programs.

Methods. Qualitative semistructured interviews were conducted with doctors (n = 10), pharmacists (n = 10), and nurses and midwives (n = 19) in 4 hospitals in London. Interviews were conducted until thematic saturation was reached. Thematic analysis was applied to the data to identify the key determinants of antimicrobial prescribing behaviors.

Results. The APB of healthcare professionals is governed by a set of cultural rules. Antimicrobial prescribing is performed in an environment where the behavior of clinical leaders or seniors influences practice of junior doctors. Senior doctors consider themselves exempt from following policy and practice within a culture of perceived autonomous decision making that relies more on personal knowledge and experience than formal policy. Prescribers identify with the clinical groups in which they work and adjust their APB according to the prevailing practice within these groups. A culture of "noninterference" in the antimicrobial prescribing practice of peers prevents intervention into prescribing of colleagues. These sets of cultural rules demonstrate the existence of a "prescribing etiquette," which dominates the APB of healthcare professionals. Prescribing etiquette creates an environment in which professional hierarchy and clinical groups act as key determinants of APB.

Conclusions. To influence the antimicrobial prescribing of individual healthcare professionals, interventions need to address prescribing etiquette and use clinical leadership within existing clinical groups to influence practice.

Keywords. prescribing etiquette; antimicrobial prescribing; prescribing behavior.

Antimicrobial usage in acute care is widely reported to be suboptimal [1]. Suboptimal use of antimicrobials is a major contributing factor to emergence of multidrug-resistant pathogens and healthcare-acquired infections [2].

To address the growing concern of emergent multidrug-resistant pathogens and waning supply of active antimicrobial agents, governments and healthcare institutions continue to produce policy and practice-based interventions [3, 4]. The aim of these policies and interventions is to optimize antimicrobial prescribing behaviors [4–6] and promote quality improvement. However, these policies and interventions often fail to consider the social and behavioral determinants of antimicrobial prescribing [7, 8] and the multiple factors that can influence the clinical decision-making process [9,10]. This is despite research both from primary care [11–14] and secondary care [7, 14–21] that shows that antimicrobial prescribing behaviors are influenced by psychosocial determinants (attitudes, social norms, and beliefs). Healthcare institutions often focus their

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efforts primarily on junior doctors, failing to recognize that doctors and other healthcare professionals work within complex clinical groups and specialties that influence their behaviors [22]. In particular, antimicrobial prescribing occurs within the context of a wide social network with multiple "agents" who continuously interact, including doctors, nurses, pharmacists, patients, and carers [21–24]. Lack of engagement with this broader group of agents may fail to account for what truly influences prescribing practices and, more importantly, fails to deliver interventions that optimize prescribing behaviors [7].

To optimize antimicrobial prescribing behavior of healthcare professionals, it is necessary to understand what appears to work for whom and when [25]. When designing and implementing quality improvement interventions (including antimicrobial usage) in any healthcare setting, engagement with multidisciplinary staff and inclusion of local practice and knowledge has been shown to facilitate implementation and compliance [26–30]. Applying this approach to quality improvement interventions in antimicrobial stewardship programs requires research into the social determinants of antimicrobial prescribing to understand how to design interventions that are implemented and adopted by healthcare professionals and successfully influence behaviors [22, 31].

The study reported here investigated the social determinants of antimicrobial prescribing in the hospital setting and adds to the existing knowledge in this field. To date, there have been only a few qualitative studies investigating antimicrobial prescribing in hospitals [7, 8]. The present study aimed to identify (1) attitudes and perspectives of healthcare professionals on antimicrobial prescribing; (2) barriers to and facilitators of adherence to quality improvement interventions in antimicrobial prescribing; and (3) determinants of antimicrobial prescribing behaviors including contextual, environmental, and social factors.

METHODS

Setting

This study was conducted in 4 hospitals of the Imperial College Healthcare National Health Service Trust (ICHNT), across West London, United Kingdom. ICHNT is a multisite, 1500-bed healthcare delivery organization that operates in partnership with Imperial College London. All the hospitals within the ICHNT operate within one organizational structure. There is a mature antimicrobial stewardship program delivered through a multidisciplinary team including antimicrobial pharmacists, research pharmacists, infection control teams, and infectious disease and medical microbiology teams. Measures of antimicrobial stewardship quality are embedded within the key performance indicators of the organization, and multimodal, cross-professional interventions are used to deliver the key objectives of the stewardship strategy [32, 33].

Inclusion and Exclusion Criteria

To be eligible for the study, participants had to be healthcare professionals (defined as doctors, pharmacists, nurses, and midwives) with regular contact with patients and/or actively prescribing antimicrobials.

Sampling and Recruitment

Hospital databases provided by the hospitals' human resources departments were analyzed and clinical staff were stratified by profession, hospital site, and seniority (as defined by job title). Two researchers (R.E., E.C.) sent out electronic study recruitment invitations in December 2010, with a 2-week reminder follow-up email. Participants were recruited until data saturation was achieved.

Qualitative Semistructured Interview Methodology

Between December 2010 and July 2011, 80 healthcare professionals were invited to participate in the study. Of these, 39 (10 doctors, 10 pharmacists, 18 nurses, 1 midwife) agreed to participate and were interviewed face-to-face using a semistructured interview guide. In this article, the term *doctors* refers to both physicians and surgeons. In the United Kingdom, doctors undergo a training program that includes 2 years of foundation training (junior doctors) and 6 years of specialist training before they qualify to become senior doctors—consultants and surgeons (see Supplementary Data for further information). To ensure content and face validity, the interview guide was designed through a systematic review of the literature on determinants of antimicrobial prescribing behaviors previously carried out by our group [7]. As per standard qualitative interview practice [34], in addition to the key questions, each interview guide included a series of supplementary questions to steer the interview (Table 1).

The purpose of the study was described to all participants and a consent form completed prior to interview. The majority of the interviews were conducted by 2 experienced researchers in hospital pharmacy and clinical nursing with qualitative research expertise (E.C., R.E.). Four additional researchers were recruited to the study (O.B., J.D., L.D., S.F.) and helped conduct the interviews. The interviews took place in the participants' workplace either during working hours where consent from line managers was given or in participants' own time. Participants who carried out the interview in their own time received a £50 incentive with the choice to accept the cash incentive or recommend it as a donation to charity. All interviews were audio recorded and transcribed verbatim. Interviews lasted on average 45 minutes each (range, 17 minutes to 1 hour 45 minutes). Participants were recruited and interviews conducted

Table 1. Interview Guide, Including Supplementary Questions

Role of antibiotic prescribing in infection control Knowledge of antibiotic prescribing guidelines	What aspects of antibiotic prescribing and management are you involved in? • Prescribing? Monitoring? Restricting? Administering? • Are you aware of any specific standards associated with antibiotic prescribing and management? • Are you aware of any Imperial Trust policy on antibiotic prescribing and management? • Do you think antibiotic prescribing has potential to put patients at risk of infection? If so, how?
Barriers to compliance with antibiotic prescribing guidelines Potential facilitators to compliance with antibiotic prescribing guidelines	Is it easy or difficult to adhere to Trust policy on antibiotic prescribing and management? Why? • To what extent do you have confidence in the current antibiotic policy? • Do you feel you have had sufficient education and training on antibiotic prescribing and management? Do your colleagues comply with the policy? • Do you feel you are in a position to question the antibiotic prescribing/management behavior of your colleagues and superiors? • How would your attitude differ depending on type of colleague (senior, junior, trainees)? • Who, in your view, is responsible for making sure that the prescribing and management of antibiotics is optimal? • How clear do you think it is, within your department, where responsibilities lie? What barriers do you personally face when optimizing your prescribing and monitoring practices? • What would facilitate you to optimize antibiotic prescribing? • What do you think could be done on an organizational level to improve antibiotic prescribing and management?

until saturation of themes was reached. Approval from a National Health Service Research Ethics Committee was obtained prior to data collection. Participants were coded using numbers and the interview data anonymized using this coding system.

Analysis

Following standard practice in qualitative data analysis [34, 35], a deductive and inductive approach was used in analyzing the data. Open coding was used to identify relevant concepts in the data and group them into categories, seeking evidence of what could constitute influences on antimicrobial prescribing behaviors. The inductive themes were compared with relevant themes from a systematic review of the literature on determinants of antimicrobial prescribing behaviors (this also informed our interview guide) [7] and were used to develop and refine a series of first-order codes that formed the thematic framework. Examples of the first-order codes used include "role of policy as a facilitator/barrier to practice," "positioning of self in hierarchy," and "role definition in antimicrobial prescribing." Three researchers (E.C., E.C.S., N. Shah) then used this framework to analyze the data independently. All the data were analyzed line-by-line for themes to surface until a clear sense of the relationships among the themes emerged. This process continued until additional analyses did not provide further insight into the relationships between the themes. The relationships that were corroborated by multiple informants were kept and recorded as findings. The data structure is presented in Table 2, highlighting the themes from which the inferences were developed. To ensure reliability in the coding and analysis of the data and prevent dilution of the analysis by prespecified conceptual models, the researchers participated in weekly meetings to explore the data in the transcripts and the emerging themes. To ensure robustness of findings, all 3 researchers read all the interviews and any ideas about emerging themes were discussed in detail until a consensus was reached. All researchers agreed to the final major themes.

RESULTS

The staff interviewed represented a wide range of specialties and expertise (Supplementary Data). The analysis identified 3 key themes in relation to antimicrobial prescribing behaviors: (1) decision-making autonomy, (2) the limitations of evidence-based policies, and (3) a culture of hierarchy (Table 2). A cross-cutting determinant and source of tension that emerged under each of these themes was the existence of a set of unwritten but widely accepted cultural rules around prescribing and the

Table 2. Verbatim Quotes From Interview Transcripts to Illustrate and Validate the Themes That Emerged

Theme	Quote Relevant to Theme	Quote in the Theme Relevant to Prescribing Etiquette
Decision-making autonomy	Q1 Very occasionally if I have a very strong feeling about the patient deteriorating, despite not any other markers suggesting of infection, I would definitely push my case [with infection specialists] to start antibiotics or make changes. —*Senior Doctor, Pediatric Intensive Care (10 y)*	Q4 I think doctor to doctor, it's very difficult for clinician to clinician, especially different specialties to go and criticize one another. I think that's not collegial practice, so people don't want to do that. —*Nurse, Outpatient Parenteral Antimicrobial Therapy Services (14 y)*
	Q2 Sometimes during a procedure, if the surgeon feels there's a need to introduce antibiotics, they say so and I have never challenged that, no one has ever challenged that. —*Nurse, Orthopedics (12 y)*	Q5 . . . they [doctors] may have more information that I'm not yet aware of which may then mean that actually it is entirely appropriate. —*Pharmacist, Medicines for the Elderly (4 y)*
	Q3 Sometimes you come on the ward round and you realize that something's prescribed which you don't really understand. Not to say that your colleague's done something wrong but I always try and understand why that step's been taken. Whether there's something that I have missed or I have overlooked which is why this person's prescribed a different drug. —*Senior Doctor, Pediatric Intensive Care (10 y)*	Q6 Even if they're [visiting doctors] doing the wrong thing, which they do do sometimes, the intensive care consultant probably knows about it. So it's difficult for me to go and say you can't do this . . . —*Pharmacist, Intensive Care Unit (7 y)*
Limitations of local evidence–based policies	Q7 There's no evidence base looking specifically at the immunosuppressed end-stage renal failure population. But my anecdotal experience is that they get sick very quickly and so for that reason I think for each individual patient it's a good antibiotic the long-term consequences of that, there's no evidence really to say . . . but I'm fully aware of the risks. —*Specialist trainee Doctor, Renal Medicine (7 y)*	Q11 But in reality you wouldn't, just because you have to get on with your senior colleagues and all your colleagues really. And so a more direct approach such as that, I just wouldn't—I would never question a consultant. —*Junior Doctor, Accident and Emergency (2 y)*
	Q8 . . . you've got patients who don't actually fit in the guidelines and that's when it becomes difficult because you've got different consultants and different doctors willing to try different treatments, they have different opinions and then they kind of go with what they want, even if you refer them to infectious diseases they don't take things on board . . . —*Pharmacist, General Medicine Training (2 y)*	Q12 If I want to change something and I think it's appropriate that we just switch this as per policy, I might go straight to the registrar for example and find the time to, for them to get it changed. Rather than maybe the more junior doctor who may be reluctant because actually the consultant mentioned it on the ward round that they actually wanted a particular drug. —*Pharmacist, Medicine for the Elderly (4 y)*
	Q9 Sometimes it is difficult to . . . use the policy because the policy will be your average sort of thing, it's not looking at someone at the top or at the bottom. —*Pharmacist, General Medicine (2 y)*	Q13 I think that the current policy is rational. The decision was made by a subgroup within my specialty, composed of people whose judgment I respect and chaired by people whose judgment I respect and I'm very happy to comply with the decisions that they make. —*Senior Doctor, Renal Medicine (32 y)*
	Q10 I think everyone I work with and personally we're acutely aware of the issues of antibiotic resistance and that we do prescribe lots of broad-spectrum antibiotics. And we're aware of the implications of that . . . But it's that balance and there's unfortunately no real evidence base in our specific population with regards to what the best way forwards is. —*Specialist Trainee Doctor, Renal Medicine (7 y)*	Q14 I find sometimes doctors don't think sometimes that they need a policy to tell them what to prescribe. And that can make it difficult. *Pharmacist, Medicines for the Elderly (4 y)*
	So I find that when you explain the rationale for prescribing something and not the other, then you are listened to more. —*Pharmacist, General Medicine (5 y)*	Q15 . . .the problem is that different consultants would use different antibiotics. —*Nurse, Vascular Surgery (8 y)*
	You can tell like some consultants are just not interested in what [patients are] on whereas some consultants will ask if they're on antibiotics. So it varies a lot between consultants, I think if they all start feeding it down it will work. —*Pharmacist, General Medicine (5 y)* I was very aware that I needed to stick to the guidelines because I'm quite likely to overstep them if I was left to my devices. And it's very variable. Some of the consultants in general medicine were quite pedantic about making sure that you stuck to the guidelines. —*Specialist Trainee Doctor, Renal Medicine (7 y)*	The junior doctors tend to change it and the junior doctors won't change it if their senior doctors, if the consultant or registrar's specifically asked them to prescribe something else, in which case you can normally work out why and sometimes it's just that the reg wasn't sure of what to give, he's just said oh use this when they could have used something from the policy and get them to change it or you'll get cases where their specific consultants or regs want to use certain things that are outside policy. —*Pharmacist, Intensive Care Unit (7 y)*

Table 2 continued.

Theme	Quote Relevant to Theme	Quote in the Theme Relevant to Prescribing Etiquette
Culture of hierarchy	Q16 The junior doctors tend to change it and the junior doctors won't change it if their senior doctors, if the consultant or registrar's specifically asked them to prescribe something else . . . —*Pharmacist, Intensive Care Unit (7 y)*	Q19 The prescribing sometimes is very difficult because it's basically the junior doctor who does the prescribing and there is quite a lot of place for error because they take advice from us and they sometimes even ask how do you spell the drug. So they are prescribing something they have no idea about. I might be doing the prescription course next year, that would help because I could then take direct advice from the microbiologist and just do it myself, rather than phoning somebody else and getting a third person to prescribe. —*Nurse, Intensive Care Unit (21 y)*
	Q17 That [micro ward rounds] was led by our lead clinician who felt very strongly about it and he met a like-minded microbiologist who also felt very strongly about it so they led on that and got that started. And now it's in our culture. —*Nurse, Intensive Care Unit (19 y)*	Q20 I think the nurses have a big influence, they say "oh no, we haven't got that in stock but we've got this, this is what we normally use." —*Pharmacist, Neonatal Medicine (40 y)*
	Q18 Visiting consultants, they'll come with their team, an entourage of people with them. Obviously therefore they're role modelling to their team. So if they've got bad practice and it's not challenged then it's actually absorbed by all the people that are standing behind them who are consultants of the future. So you really do need to challenge. —*Nurse, Intensive Care Unit (19 y)*	Q21 I mean I think the junior doctors actually are sometimes quite glad to see us because they often want advice on what to do with . . . how to prescribe certain drugs because they often don't know, especially the brand-new qualified doctors . . . —*Pharmacist, Respiratory Medicine (18 y)*
	Yeah I would but I would probably challenge it at a higher level, ie, I would probably go back to our consultants and say one of the registrars has got a habit of just putting everybody on this and when I've talked to them about it doesn't seem to have any particular rationale except when they worked somewhere else that's what they did and I'm a bit concerned. —*Nurse, Intensive Care Unit (19 y)*	Q22 Because my experience of working on the wards here is that as a doctor you are very busy and you don't necessarily have time to do everything, so it is very useful to have other people who can ratify things, and they [pharmacists] do make valuable contributions and they are very good at kind of flagging up issues, particularly in terms of the escalation and stepping down and rationalizing when the time is right, making sure that kind of empirical prescriptions, broad spectrums aren't left for days and days at a time. —*Specialist Trainee Doctor, Renal Medicine (7 years)*
	The consultants rarely, they rarely prescribe for inpatients themselves because they'll always have a team of doctors with them so they'll make a suggestion on the ward round but it will be a junior doctor writing the drug out . . . —*Pharmacist, Respiratory Medicine (18 y)*	I think it goes from the top down so everybody has to do the same thing. If the consultant or registrar doesn't set a good example, the junior will certainly not follow it. —*Specialist Trainee Doctor, Stroke (11 y)*
	To be honest I don't go round checking the drug chart of 10 patients on the ward, to see they're on the right drugs. There isn't enough time in the day. I rely that people are sensible, that are following guidelines, that the pharmacist has checked them, the middle ranking doctor's checking them. Whilst it's my responsibility the patient has the right treatment, I don't have the time to check every detail of it. So I don't, to be honest I assume my patients are on the right treatment, I can't tell you they are, I haven't seen their drug charts. —*Senior Doctor, Oncology (25 y)*	

significant influence of these rules on healthcare professionals' behaviors. This set of unwritten rules, or "prescribing etiquette," dictates not only the prescribing behavior of doctors but also how other healthcare professionals (ie, pharmacists and nurses) view and exert influence on the antimicrobial prescribing, administration, and monitoring processes. In the sections that follow, each of these 3 themes is presented in detail. The cross-cutting theme of "prescribing etiquette" is discussed in relation to each of the 3 main themes. To illustrate and validate each theme, selected relevant verbatim quotes are provided in the text, with additional quotes provided in Table 2. The number of years the participants have been qualified in their profession at the time of the interviews is provided in parentheses after their specialty.

Decision-Making Autonomy

Senior doctors rely on their own professional judgment and the need to freely choose what they judge to be the most appropriate when prescribing antimicrobial prophylaxis or treatment (Table 2, Q1 and Q2). This may involve making antimicrobial prescribing decisions that overrule infection specialist advice (Table 2, Q1). This assumption to exercise clinical decision-making autonomy leads to their practice being rarely questioned by others:

> . . . and then there are consultants that just do what they want and they're known and like all the pharmacists know that oh that doctor's just going to do what he wants so that's quite difficult, you can't really do much about that, when it actually comes down to it. . . . —*Pharmacist, Intensive Care Unit (7 years)*

There is a clear shared view of "noninterference" when it comes to doctors judging or intervening in the antimicrobial prescribing behavior of their colleagues:

> I think you have to . . . build a working relationship with various teams . . . Once you get to know them, and they you, they begin to listen. But if you go onto the wards once a month and say: do this, do that, they won't necessarily do that. —*Senior Doctor, Medical Microbiologist (19 years)*

This concept of "noninterference in prescriptions written by others" is one that is understood by all healthcare professionals (Table 2, Q3–5). Perceived decision-making autonomy affects how and when nonmedical healthcare professionals choose to intervene in the antimicrobial prescribing process (Table 2, Q6).

The social environment in which the prescribing process occurs is heavily influenced by the behavior of senior doctors within their different specialties. The quotes here illustrate the importance of the impact of senior doctors, other than infection specialists, on the antimicrobial prescribing decision process. There exists a social network within which antimicrobial prescribing decisions are made, and healthcare professionals report awareness of the need to work within this network in their specialties. The rule of "noninterference with the clinical decisions of others," despite the existence of local policies guiding antimicrobial prescribing, is an example of the influence of this social network on behaviors.

Limitations of Evidence-Based Policies

Doctors rely on their own clinical knowledge and experience to guide their antimicrobial prescribing practice and frequently consider their patients to be "outside" the boundaries of local evidence-based treatment policies for infection. They use anecdotal experience to justify their clinical decisions for individual patients, and this can be seen as a continuum of exercising decision-making autonomy. This attitude comes to the fore in the different specialties where policies are considered to be for the "average" patient and therefore seldom adhered to (Table 2, Q7–9). In this context, patients are referred to as "special" or atypical cases that require interventions different to that prescribed by local policy. There is a clear sense of affiliation of healthcare professionals to clinical groups and specialties in which they work: that is, the local social network within specialties acts as a strong determinant of antimicrobial prescribing behaviors. Outside of their own autonomous decision making, healthcare professionals are happy to comply with practice that is a marker of their clinical group or identified social network (Table 2, Q10). Senior doctors are conditioned to exert independent thought and to exercise clinical judgment, and they report policies to be counter to this autonomous process:

> I'm a clinician and have some degree of independent practice; protocols are quite constrictive and restrictive for individual patient use. So I don't feel that their protocols are necessary in my practice to guide me, but definitely for people that are working on the ward such as nursing stuff, protocols are good. —*Specialist Trainee Doctor, Orthopedics*

Senior doctors will overrule policy as they consider it subordinate to their knowledge and clinical experience that is gained over their years of practice—this pattern only gets reversed if the policies have the clear endorsement of senior peers within their own clinical groups. This is indicative of the role of hierarchy in influencing practice (Table 2, Q11–13).

The limitations of policy and the role of autonomous decision making in antimicrobial prescribing are also recognized by nurses and pharmacists (Table 2, Q14 and Q15):

> . . . anything you try to force upon people doesn't go down well, especially with doctors. If you tell them that this is the rule, they're certainly not going to adhere to that. —*Nurse, Outpatient Parenteral Antibiotic Therapy Services (14 years)*

A Culture of Hierarchy

The practice of prescribing is primarily performed by junior doctors at the coalface, but it is the seniors who decide what needs to be prescribed:

> We'll do a ward round with either the registrar, plus or minus the consultant and see all the patients. . . . jobs [eg, prescribing] will be allocated down to the junior doctors . . . —*Specialist Trainee Doctor, Stroke (11 years)*

Although the organizational approach focuses on junior doctors in the implementation of antimicrobial policy, local

Table 3. Rules of Antimicrobial Prescribing Etiquette

1. Noninterference with the prescribing decisions of colleagues: reluctance to interfere with the prescribing decisions of colleagues. In the case of antimicrobial prescribing, there is a reluctance to intercept antimicrobial prescriptions started by colleagues. This recognizes the autonomous decision-making process of prescribing.
2. Accepted noncompliance to policy: Deviations from policy recommendations are tolerated and put in the context of the prescriber's experience and expertise and the specific clinical scenario. This leads to hierarchy and expertise, and not policy as determinants of prescribing practice behaviors.
3. Hierarchy of prescribing: Prescribing as an activity is performed by junior doctors. But it is the senior doctors who decide what is prescribed.

practice is driven by senior doctors who act as role models for the junior staff. It is this local practice of seniors and not policy that is emulated and sets the culture within the specialties and clinical groups (Table 2, Q16–18). Within the context of hierarchy and autonomous decision making, there may be a limited tacit influence on prescribing behaviors of doctors from nurses and pharmacists (Table 2, Q19–22). This influence may be transient, only limited to the behaviors of the more junior doctors, and only valid in situations where there is no conflict with the opinion or direction of senior medical staff, in which case the latter prevails:

> Consultants. Those are the people who we listen to. It's partly because we know the hierarchy, from the doctor's side of things. —*Junior Doctor, Accident and Emergency (2 years)*

DISCUSSION

This study shows that in the case of antimicrobial prescribing, prescribing etiquette is a key determinant of behavior, with prescribing decisions influenced not only by clinical and therapeutic goals but also by a host of cultural determinants and clinical groups across different specialties. The principles of prescribing etiquette are clearly understood by all healthcare professionals (Table 3). The majority of participants described an understanding of the prevailing culture and etiquette of prescribing, including those who stated lack of awareness of the existence of specific formal hospital policies or interventions. This demonstrates the strength of local practice and culture as a key determinant of clinical behavior. Healthcare professionals are reluctant to question the prescribing habit of their peers. In the case of antimicrobials, prescribing etiquette and its role as a key determinant of prescribing behaviors is highly significant.

These findings have clear implications for quality improvement interventions in the area of antimicrobial prescribing. The unwanted consequence of emergence of antimicrobial resistance and the need for conservation of the remaining drugs, as well as the safe and effective treatment and prophylaxis of infection, are key drivers of quality improvement interventions in antimicrobial stewardship. Understanding and addressing the determinants of antimicrobial prescribing behaviors therefore hold the key to successful quality improvement interventions. The majority of efforts undertaken to influence antimicrobial prescribing behaviors, including policy and interventions, target junior doctors, primarily because they are the workforce that undertake prescribing in acute care. However, the ability of the junior clinical team for undertaking such tasks is limited [13, 14, 35, 36], and there is a dichotomy between the organizational expectation from juniors to follow official policy and the social and contextual norm of adhering to "prescribing etiquette" set by one's senior colleagues in their clinical groups, as the evidence in this study suggests.

Because of their exposure to different clinical specialties and greater movement across them, junior doctors can facilitate organizational coherence in antimicrobial prescribing initiatives if supported by senior colleagues. In contrast, however, interventions targeting junior doctors are likely to be ineffective if they are expected to exhibit behaviors that run against the local prescribing etiquette endorsed by their seniors. In this context, the leadership role of seniors in the prescribing process needs to be fostered by organizations adopting a culture that recognizes the influence of clinical hierarchy and the perceived autonomous decision-making process. Peer approval is one of the essential rules in the successful implementation of interventions [30, 37–39]. Whereas nurses and pharmacists reported a reliance on policy to help promote compliance of junior doctors to evidence-based practice, doctors reported adhering to policy only if it was endorsed by peers from their own specialties and clinical groups.

The reported acceptance of noncompliance of senior staff with local policy is another element of prescribing etiquette. This noncompliance is justified first by recognition of the experience and expertise of senior staff and second, by a broader definition of "evidence base," which includes personal experience of individuals and the perception that polices are for the "average" cases. Personal experience/expertise seems to win over evidence-based policies and guidelines.

To optimize antimicrobial practice, organizations need to engage more broadly outside infectious disease and microbiology specialties and have an open dialogue with their senior colleagues across the different specialties with regard to antimicrobial prescribing behaviors. Quality improvement interventions in antimicrobial prescribing must aim to understand prevailing practice, and the only way to do that is to engage with senior doctors from different specialties. Both the local and national cultural influences on antimicrobial prescribing should be incorporated into local policy and practice by involving local opinion and expertise and recognizing the key

influencing agents within existing clinical groups and the potential role of social networks. To go further, quality improvement interventions in antimicrobial prescribing can aim to build elements of prescribing etiquette into the decision architecture (eg, in the redesign of medication charts) to introduce dedicated sections for antimicrobials [40] and positively reinforce best practice via leadership at local level within clinical groups.

The main limitation of this study was that it was conducted in 4 teaching hospitals, with reliance on self-reporting. This study could be replicated more widely in different institutions and could be further supplemented with a survey based on the themes we found here (to achieve larger-scale generalization).

CONCLUSIONS

This study broadens the scope of research on prescribing behaviors and extends our understanding of how to optimize them by describing the social context of prescribing and the influence of prescribing etiquette on antimicrobial practice in hospitals. The impact of prescribing etiquette on the behavior of healthcare professionals must be recognized and addressed in the antimicrobial stewardship agenda. Leadership within existing social networks and clinical groups needs to be harnessed for the delivery of quality improvement in antimicrobial stewardship.

Supplementary Data

Supplementary materials are available at *Clinical Infectious Diseases* online (http://cid.oxfordjournals.org/). Supplementary materials consist of data provided by the author that are published to benefit the reader. The posted materials are not copyedited. The contents of all supplementary data are the sole responsibility of the authors. Questions or messages regarding errors should be addressed to the author.

Notes

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