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Patient expectations do matter - Experimental evidence on antibiotic prescribing decisions among hospital-based physicians

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ABSTRACT

Background: The global public health crisis of antibiotic resistance is being driven in part by over prescription of antibiotics. We aimed to assess the relative weight of patient expectations, clinical uncertainty, and past behaviour on hospital-based physicians' antibiotic prescribing decisions.

Methods: A discrete choice experiment was administered among hospital-based physicians in Tuscany, Italy. Respondents were asked to choose in which of two clinical scenarios they would be more likely to prescribe antibiotics, with the two cases differing in levels of clinical uncertainty, patient expectations, and the physician's past behaviour. We fitted a conditional logistic regression.

Results: Respondents included 1,436 hospital-based physicians. Results show that the odds of prescribing antibiotics decrease when a patient requests it (OR=0.80, 95%CI [0.72,0.89]) and increase when the physician has prescribed antibiotics to a patient under similar circumstances previously (OR=1.15, 95%CI [1.03,1.27]). We found no significant effect of clinical uncertainty on the odds of prescribing antibiotics (OR=0.96, 95%CI [0.87, 1.07]).

Conclusions: We show that patient expectation has a significant negative association with antibiotic prescribing among hospital-based physicians. Our findings speak to the importance of cultural context in shaping the physician's disposition when confronted with patient expectations. We suggest shared decision-making to improve prudent prescribing without compromising on patient satisfaction.

1. Introduction

The World Health Organization (WHO) and European Center for Disease Control (ECDC) have declared increasing rates of antibiotic resistance to be a public health emergency that threatens the efficacy of modern medicine [1,2]. The implications of antibiotic resistance are compounded by the lack of novel antibiotics in the pharmaceutical pipeline and could render common bacterial infections untreatable. In addition to poor health outcomes, the economic consequences of increased antibiotic resistance would be significant, including increasing the risk of hospitalization, length of hospital stay, and mortality rates associated with resistant infections [3–5]. While the relationship between antibiotic use and antibiotic resistance is complex, mounting evidence shows resistance to be driven in part by the selective pressure introduced through indiscriminate prescribing and overconsumption of antibiotics [6–10].

Reducing antibiotic consumption is a national priority in Italy. The importance of curbing current trends was underscored in a recent OECD report that highlighted higher antibiotic consumption for systemic use in the hospital sector in Italy compared to the European Union /European Economic Area (EU/EEA) average in 2020 (1.92 defined daily doses/1000 inhabitants per day versus 1.57 defined daily doses/1000 inhabitants per day, respectively) [11]. While the majority of antibiotic prescribing occurs outside the hospital in primary care and outpatient settings [11], curbing antibiotic resistance and supporting prudent prescribing requires coordinated action across all levels of the healthcare system.

Italy has a National Health Service organized as a decentralized system where regional governments are responsible for organizing and delivering care through local health units and hospitals. The public and

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accredited private hospitals are organized at the regional level, which presents an opportunity for a coordinated and responsive strategy to combat antibiotic resistance regionally. In Tuscany, antibiotic consumption in hospital accounts for 10% of all antibiotics prescribed, half of which may be inappropriate and excessive [12–17]. While a slight decrease in antibiotic consumption was seen between 2013 and 2019 in Tuscany, it remains at concerning levels [18]. A multidisciplinary task force was recently established in Tuscany to coordinate activities following a rapid risk assessment of a large antibiotic-resistant bacterial outbreak in June 2019 by the ECDC [18]. The task force's response is also informed by a regional Performance Evaluation System (PES) that measures service quality and capacity to balance achieving optimal health for citizens with preserving financial equilibrium [19]. Antibiotics prescribing indicators are included in the PES. Previously, the PES was shown to be a valuable governance tool for system improvement among policy-makers and managers through regular and transparent review of performance results among all actors [20].

Mounting evidence shows that variation in antibiotic prescription cannot be fully explained by patient-level clinical and demographic factors alone, but that physician factors have significant influence [21–24]. Many healthcare organizations are implementing antibiotic stewardship programs that aim to improve prescribing through dissemination of evidence-based clinical guidelines and formularies [25, 26]. While antibiotic stewardship programs have been shown to have some success in reducing target antibiotic prescriptions, these strategies often do not address the social and behavioural determinants of antibiotic prescribing [27–29]. Within hospital settings, factors such as professional hierarchy, local prescribing etiquette, fear of complications, perceived patient expectations, workload, time constraints, and habits have been shown to influence prescriber decisions [26,28,30–35]. Qualitative studies have highlighted how these often interconnected factors serve as competing priorities when physicians prescribe [28,30]. In addressing inappropriate antibiotic prescribing, where a wealth of determinants have been implicated in literature, it is particularly important to consider the priority for action given the constraints of the healthcare system and sociocultural environment.

To close this evidence gap, here we investigate the relative importance of clinical uncertainty, patient expectation, and a physician's past behaviour on antibiotic prescribing among hospital-based physicians by implementing discrete choice experiments (DCEs) in a routine organizational climate survey in Tuscany. The purpose of this experiment is to support policymakers in Tuscany to prioritize initiatives that reduce antibiotic prescribing in hospital settings by identifying the relative importance of influential determinants.

2. Materials and methods

A DCE is a stated preference method where respondents are presented with at least two alternatives that differ among varying levels of attributes and are asked to choose an option that is preferred. This experimental method is well suited to examine physician preferences and allows for discerning the relative importance of different determinants of antibiotic prescribing to inform planning of effective antibiotic stewardship programs.

We used an online DCE with 1,436 physicians to investigate whether and how antibiotic prescribing decisions are simultaneously and independently affected by three attributes: clinical uncertainty, patient expectations, and past behaviour.

2.1. Setting and data collection

This experiment was embedded within a routine organizational climate survey, which is administered to all employees working in public hospitals biennially in Tuscany, Italy [19,36]. The survey was administered through the Qualtrics Software Company platform (Version November 2019). Respondents could voluntarily and anonymously complete the DCEs after submitting their responses to the organizational climate survey. Due to a lack of control over the number of potential respondents, we adhered to the rules of thumb as suggested by Orme [37] and aimed for at least 300 respondents. The data were collected at two time points during October and November 2019. Respondent demographics were collected as part of the survey.

Ethical approval was not required for the purposes of this study as deemed by the guidelines at Sant'Anna School of Advanced Studies. Respondents were required to provide their informed consent both at the beginning of the organizational climate survey and prior to the experimental section.

2.2. Choice scenario

Physicians in our DCE were presented with a choice set that includes a pair of alternatives differing from each other with respect to the following three attributes: clinical uncertainty, patient expectation, and the physician's past behavior in prescribing antibiotics. Respondents were asked to indicate in which of these two alternatives they would be more likely to prescribe an antibiotic. The underlying assumption was that when presented with two uncertain alternatives differentiated by three different attributes, respondents would evaluate each accordingly to choose the option they prefer (Table 1).

We chose to focus the DCE scenario on respiratory symptoms because this remains the top diagnosis where most misconceptions around the effectiveness of antibiotics occurs, and where physicians are most likely to prescribe antibiotics inappropriately [38,39]. The choice of diagnosis reflected our objective of designing a scenario that would be most widely applicable to all physicians working in hospitals.

2.3. Attributes and levels selection

The alternative patient profiles in this DCE were defined by three attributes that the respondents assess when making decisions about antibiotic prescription [40]. Guided by the good research practice checklist outlined by ISPOR [41] and well-established guidelines to conduct DCEs [42], we performed a two-step process to select attributes and levels [43]. First, we conducted a scoping review of literature on factors influencing hospital-based physicians' antibiotic prescribing decisions and identified seven potential attributes of interest: social norms, cost, clinical uncertainty, patient expectations, status quo bias, and time pressure [44–47]. Next, this list was narrowed down through consultations with an expert group composed of regional policymakers, managers of the regional pharmaceutical governance, and physicians from a variety of specialties. Specifically, we discussed the local relevance, plausibility, and feasibility of operationalizing this DCE within the survey context and gauged how easily physicians could identify with the scenario. As a result, our DCE features three attributes with two levels each (Table 2).

We operationalized clinical uncertainty using two different clinical diagnoses: influenza with pneumonia (symptoms: runny nose, sneezing, sore throat, and dry cough) and chronic obstructive pulmonary disorder (symptoms: shortness of breath and cough with sputum). These two

Table 1
English translation of an example choice set presented to physicians in the DCE.

To which of these two patients, X or Y, would you be more likely to prescribe an antibiotic? Patient X:	Patient Y:
Influenza with pneumonia (symptoms: a runny nose, sneezing, sore throat, dry cough)	Chronic obstructive pulmonary disease (symptoms: shortness of breath, cough with sputum)
Patient wants a check-up	Patient wants antibiotics
In the past, in similar circumstances, you did not prescribe antibiotics to this patient	In the past, in similar circumstances, you prescribed antibiotics to this patient

Table 2
Attribute and levels used in the discrete choice experiments

Attribute	Reference level	Level 1
Clinical uncertainty	Chronic obstructive pulmonary disease (symptoms: shortness of breath, cough with sputum)	Influenza with pneumonia (symptoms: a runny nose, sneezing, sore throat, dry cough)
Patient expectations	Patient is asking for check-up	Patient is asking for antibiotics
Status quo bias	In the past, in similar circumstances, you did not prescribe antibiotics to this patient	In the past, in similar circumstances, you prescribed antibiotics to this patient

diagnoses are found to have different levels of clinical uncertainty regarding whether antibiotic are warranted, with more certainty of antibiotic need for influenza with pneumonia [30]. Thus, we expect a positive preference for physicians to prescribe antibiotics for level 1 (influenza with pneumonia) compared to the reference level. Patient expectation was operationalized via patients' expressed pressure for outcome, asking either for antibiotics or a check-up. Existing literature show that physicians are more likely to meet a patient's expectation for prescription when explicitly requested [48]. Thus, we expect a positive preference for physicians to prescribe antibiotics for level 1 (patient is asking for antibiotics) as compared to the reference level. As to physician's past behaviour, we created a scenario indicating whether or not the respondent prescribed antibiotics to the patient in the past under similar circumstances. Due to *status quo* bias [49], we expect a positive preference for physicians to prescribe antibiotics for level 1 (physician has prescribed antibiotics to this patient in a similar circumstance in the past) compared to the reference level.

2.4. Experimental design

The combinations of two levels per three attributes within this DCE experiment generated a total of 8 unique alternatives (2 × 2 × 2). We employed an orthogonal and balanced design where all attributes were independent of each other, and each level appeared an equal number of times in the choice set. Using a cyclical fold-over approach [50,51] we built 8 choice sets by pairing each unique alternative with its mirror image (Table 1). Given that this experiment was implemented within an extensive survey, minimizing cognitive fatigue was a priority. Hence, each participant was presented with one randomly assigned choice set with each alternative containing the full profile (*i.e.*, with all three attributes included). Our experimental design ensures high interval validity through random assignment of participants to experimental scenarios, which eliminates the risk of preference heterogeneity and systematic differences in respondents' characteristics biasing the results [52].

2.5. Statistical Analysis

We compared the representativeness of study respondents to the target population (Tuscan physicians working in public institutions who answered the work satisfaction survey) along several demographic dimensions using frequencies. We used Pearson's chi-squared test to test the comparability of the DCE sample and target population.

The data generated from our DCE was analyzed within a random utility theory framework [53]. Under random utility theory, the utility associated with an alternative within a choice set is assumed to be a function of the attribute-levels and the unobserved characteristics of that alternative [54]. Additionally, the principle of utility-maximizing behaviour posits that the probability of choosing an alternative is equal to the utility derived from that alternative by the respondent compared to all other alternatives within the choice set.

Consistent with the random utility model of choice, we fitted a conditional logistic regression model to our data [53,54]. This procedure aligns with the widely used and well-established guidelines of Ryan and colleagues [42]. A conditional logistic model associates the choice among two or more alternatives with the attribute levels that define each alternative and assumes the independence of irrelevant alternatives [55]. This model assumes that all respondents have the same weight preferences for the different levels of patient expectations, clinical uncertainty, and status quo bias.

The baseline empirical model we specified to estimate the utility function was as follows:

$$U_{ij} = \beta_0 + \beta_1 Clinical\ uncertainty_{ij} + \beta_2 Patient\ expectations_{ij} + + \beta_3 Past\ behaviour_{ij} + \varepsilon_{ij}$$

where U_{ij} is a binary dependent variable that takes the value 1 for the preferred choice and 0 for the alternative option within the choice set, β_0 represents the "alternative-specific constant" that indicates the respondents' preference weight for patient profile Y, β_1 represents the preference weight of the diagnosis of pneumonia with influenza (compared to chronic obstructive pulmonary disorder), β_2 represents the preference weight of patients expecting antibiotics (compared to expecting a checkup), and β_3 represents the preference weight of the physicians having prescribed antibiotics in a similar circumstance in the past (compared to not having prescribed in a similar circumstance in the past).

Regression coefficients of the fitted model provide information about the relative importance of the different attributes-levels in shaping respondent choice [54]. Independent variables were dummy-coded and the regression coefficients for each corresponding attribute represent the mean part-worth utility of that attribute level relative to the reference among the respondents, holding all other factors constant. In other words, the absolute value of the coefficient indicates the strength of preference for that attribute level.

As a sensitivity analysis, we differed the operationalization of the same constructs as a robustness check to eliminate the potential bias due to differences in the perceived strength between attribute-levels because of the used language [52]. As there are two different medical terminologies that refer to COPD, we were interested in whether our results were sensitive to the specific terminology used. While the symptoms were kept identical across both iterations for the attribute "clinical uncertainty", the strength of clinical uncertainty changed. The first set (DCE1) presented a less commonly used Italian translation of chronic obstructive pulmonary disease "malattia polmonare ostruttiva cronica" as compared to the second (DCE2) "broncopneumopatia cronica ostruttiva" (a more common term used among Italian physicians). The latter alternative is deemed to have higher strength. In the same line, patient expectations also had two operationalizations with the same substantial meaning. One alternative (DCE1) is deemed to be stronger stating "the patient wants an antibiotic", compared to (DCE2) "the patient asks for an antibiotic". The original survey in Italian can be found in the Supplement-Table S1.

All analyses were conducted using R (Version 4.0.3).

3. Results

Physicians' participation rate was 72% among those that completed the work satisfaction survey, and we analyzed a total of 1,436 choice observations. The majority of respondents in our DCE were male (52%), between 50 and 59 (33%), and working in a hospital institution (78%)

Table 3
Respondents' demographics, by sample and target population of the DCEs.

	DCE N (%) Sample	Target population	Chi-squared, p-value
Total	1436	1988	
Sex (%)			0.015
Female	684 (47.6)	1032 (51.9)	
Male	752 (52.4)	956 (48.1)	
Age (%)			0.53
Less than 30	0 (0)	1 (0)	
30-39	220 (15.3)	273 (13.7)	
40-49	362 (25.2)	512 (25.8)	
50-59	467 (32.5)	638 (32.1)	
Over 60	387 (26.9)	564 (28.4)	
Organization type (%)			
Hospital	1121 (78.1)	1491 (75.0)	0.08
University teaching hospital	310 (21.6)	485 (24.4)	
Cancer Center	5 (0.3)	12 (0.6)	

(Table 3). Respondents were broadly representative of target population (*i.e.*, all hospital-based physicians in Tuscany who responded to the organizational climate survey) across demographic variables collected, except for sex distribution.

Estimates from a conditional logistic regression show that the odds of prescribing antibiotics decrease when the patient requests it (OR=0.80, 95%CI [0.72,0.89]) and increase when the physician has prescribed antibiotics under similar circumstances before (OR=1.15, 95%CI [1.03,1.27]) (Table 4). We found no significant effect of clinical uncertainty on the odds of prescribing antibiotics (OR=0.96, 95%CI [0.87, 1.07]). Among the three attributes, effect size was highest for patient expectations, followed by status quo bias and lastly clinical uncertainty (Table 4).

A sensitivity test conducted through comparison of estimates across the two subsamples showed that results were not robust to changes in terminology for operationalization of clinical uncertainty (Supplement – Table S2). Specifically, this attribute was significantly associated with antibiotic prescribing only among the sub-sample presented with the Italian translation of chronic obstructive pulmonary disease as "malattia polmonare ostruttiva cronica" rather than "broncopneumopatia ostruttiva cronica" (DCE1: OR=1.03, p=0.614; DCE2: OR=0.83, p=0.049). The pattern of results for the two other attributes appears robust across the two sub-samples. More precisely, the effect of past behavior remains similar in size although insignificant due to the reduction in statistical power (DCE1: OR=1.13, p=0.068; DCE2: OR=1.20, p=0.053). The effect of patient expectations on antibiotic prescribing remained significant irrespective of the operations used for the other attributes (DCE1: OR=0.81, p=0.001; DCE2: OR=0.79, p=0.01).

Table 4
Results of discrete choice experiment (coefficients of conditional logit models)

	Coefficient	SE	z	p	OR	[95% CI]
Intercept	0.01	0.05	0.17	0.86	1.01	(0.91, 1.12)
Influenza with pneumonia (symptoms: a runny nose, sneezing, sore throat, dry cough)	-0.04	0.05	-0.75	0.45	0.96	(0.87, 1.07)
Patient wants antibiotic	-0.22	0.05	-4.18	0.00	0.80	(0.72, 0.89)
In the past, in similar circumstances, you prescribed antibiotics to this patient	0.14	0.05	2.56	0.01	1.15	(1.03, 1.27)
McFadden's R^2 (pseudo-R^2)	0.320					
Log-Likelihood	-983.3					
LR $\chi2$	24.1					
Prob > $\chi2$	P<0.001					
N	1436					

4. Discussion

4.1. Discussion of results

To the best of our knowledge, this is the first experiment to directly quantify the concurrent and comparative effects of clinical uncertainty, patient expectations, and status quo bias on antibiotic prescribing decisions with a large and representative sample of actual prescribers in hospitals. We found patient expectation and physician's past behaviour to affect antibiotic prescribing decisions among hospital-based physicians. Additionally, we did not find evidence that clinical uncertainty has a causal influence on physician antibiotic prescribing decisions when patient expectation and status quo bias are accounted for. The use of DCE complements existing evidence on antibiotic prescribing determinants, by testing causal relationships rather than using qualitative inquiries through interviews and focus groups with prescribers [45,56,57] and quantitative non-experimental studies [58,59]. Our findings may provide novel insights to the rich discussion on evidence-based interventions to increase prudent antibiotic prescribing when designing hospital-based antibiotic stewardship programs. Furthermore, our experimental design, testing prescribing determinants embedded in a routine data collection process, offers a valuable blueprint for policymakers to replicate the process in their context.

In this experiment, we found a large and significant impact of patient expectation on antibiotic prescribing among hospital-based physicians. While the strength of this causal relationship, underscoring the weight patient expectation carries in prescribing decisions, is in line with existing literature [32,47,48,59–62], the negative directionality is surprising and will be further explored below. Existing evidence on the effect of patient expectation on prescribing decision is mainly set in primary care and also among pediatricians [32,47,62]. Lum and colleagues found patient expectations to be the second most important determinant, after duration of symptoms, in antibiotic prescribing among general practitioners participating in a DCE similar to ours in the Australian context [48]. Butler and colleagues found general practitioners more likely to prescribe antibiotics for upper respiratory tract infections when they perceive that the prescription is expected despite compromising best evidence [63]. Our study adds to emerging literature suggesting the important role of patient expectation also among specialists in hospital settings [59,61]. This may be explained by the enhanced scope of specialist care, namely increased provision of primary care services such as chronic disease management, to bridge gaps in primary care provision due to the changing perception and supply of general practitioners [64,65].

The fact that hospitalists in our DCE were significantly less likely to prescribe antibiotics when patients explicitly asked for a prescription is interesting and we offer several interpretations. First, the influence of the differences in doctor-patient relations between primary care and hospital-based physicians should be acknowledged. Most studies showing increased likelihood to prescribe antibiotics when explicitly requested by patients are based on primary care physicians who have consistent patient panels that they care for long-term and thus may prioritize relationship maintenance more. In contrast, hospital-based specialists may be more likely to engage in the autonomous expert role and less prone to give in to patient pressures as they see patients sporadically and are less concerned about maintaining patient relations [66]. Secondly, our findings may reflect the reality and limitations of an experimental setting. The hypothetical scenario in our experiment is devoid of the social consequences of this interaction. Whereas physicians may intend to prescribe in a prudent manner, they may behave differently at the point of care when patients are sitting in front of them. Third, as professionals with expertise in making clinical assessments, a perceived non-expert's request may sometimes be unwelcomed due to the time and resource consumed. Regardless of its appropriateness, when a request is made by a patient (viewed as a non-expert), a lack of trust may be engendered thus threatening the therapeutic relationship. Lastly, the Italian culture falls higher on the hierarchical spectrum [31,67–69], and is characterized by greater "power distance," whereby power imbalance is more willingly accepted and physicians take more ownership over clinical decision-making [70]. Previous research shows that in societies with greater power distance, patients show more deference towards physicians, who are expected to occupy the role of an expert [66]; less information is exchanged during the clinical encounter [71]; and physicians are held at high esteems with substantial discretion in medical decision-making [67,72–74]. The explicit request patients made for antibiotics, as operationalized within our study, may be viewed negatively as "over-stepping" and result in physicians preferentially prescribing to patients that leave the clinical judgement to the physician.

The influence of past behaviour on medical decision making can be conceptualized through the effect of status quo bias, which is well documented [75]. While relying on heuristics to make decisions in high uncertainty decision contexts is often efficient and effective [75], decision-support tools should be in place to ensure appropriateness. Meeker and colleagues have shown, for example, that integrating prompts in the electronic prescribing system requiring a free-text entry to justify inappropriate prescriptions visible to peers decreased antibiotic prescribing substantially [76]. Additionally, Langford and colleagues have summarized a range of biases and de-biasing techniques to improve antibiotic prescribing decisions, such as using checklists [75]. Within the team-based care framework, setting up structures where physicians are supported to collaborate across specialties can improve prescribing decisions. This may be particularly effective for surgical specialists, who typically work independently. Our findings show that status quo bias affects antibiotic prescribing; however, we are unable to deduce the extent to which this intuitive decision-making process presides over the concurrent deliberate mechanism as proposed in the dual-processing decision-making model [77].

Results from our sensitivity analysis revealed that the strong causal effect of patient expectation remained stable across different strengths of construct operationalization. Our results were not robust to the changes in operationalization of key constructs of clinical diagnosis. In fact, the rewording of COPD to a more commonly used equivalent term had an influence on how the physicians would prescribe. The difference in results for the clinical uncertainty construct between our main analysis and sensitivity analyses highlight the importance of using medical terms typically encountered when communicating with physicians. In light of the different (*i.e.*, not neutral) effect that the wording of the same clinical diagnosis has on prescribing decisions, our findings serve as a cautionary tale for policymakers and healthcare managers tasked with establishing shared language among professionals and enhancing appropriateness in prescription.

4.2. Implications for policy

Investing in hospital-based antibiotic stewardship programs as a national strategy to confront antibiotic resistance is recommended by the WHO and OECD [78,79]. As physicians are the unique access points to antibiotics within the healthcare system, understanding the relative importance of patient expectations, status quo bias, and clinical uncertainty in physician's prescribing decisions is an essential first step in prioritizing interventions to inform effective antibiotic stewardship design. Results from our study highlight not only the importance of patient expectation in antibiotic prescribing decisions among hospital-based physicians, but also the nuance of cultural context in shaping the directionality of this relationship. As health systems reorient toward patient-centered models of care, the patient's role in healthcare decision-making will increasingly gain prominence. Situating our study findings in this context, we offer two implications for practice and policy.

First, implementing policies that support shared decision-making may offer a path forward in reconciling the system shift toward patient-centered care and the physician's ownership over clinical decision-making, as found in our study. Shared decision-making is a process whereby physicians invite patients to participate in discussions around treatment options to identify an appropriate and acceptable course of action. Research has found shared decision-making to be effective in improving prudent prescribing in situations where antibiotics have equivocal benefit without compromising on patient satisfaction [80]. Translating shared decision-making policies into clinical practice requires well-defined standards to ensure that its value is shared among physicians. To operationalize shared decision-making within the realities of clinical environments, policy considerations include: standardizing the definition of shared decision-making to ensure no misconceptions exist; building competency among physicians in introducing decision aids during clinical encounters and eliciting patient's preferences; implementing measures to continuously monitor progress and ensure that shared decision making doesn't become a reflexive "check-box" activity; and fostering a cultural shift through workflow integration and appropriate incentives [81].

Second, in line with the WHO Global Strategy [78] and findings from our study, education around appropriate antibiotic utilization should not be limited to providers. Patient education should be bolstered to ensure that patients are not self-prescribing or pressuring physicians for prescriptions during consultations. Ensuring that patients are given the right information and are well-equipped to engage in shared decision-making is critical as the system shifts toward patient-centered care.

4.3. Strengths and limitations

In the absence of revealed preference data, we implemented DCEs that utilize stated preference data to better understand prescribing behaviour among a fairly large sample of actual prescribers as opposed to convenient samples of respondents. Research has shown preference data collected through DCEs can be representative of behaviour [82,83]. The multi-dimensionality of this experimental design allowed us to investigate simultaneously the importance of three factors on decision-making. Further, we demonstrate a simple experimental design for policymakers to consider when determining priorities for intervention.

Our study is not immune to the same limitations that affect empirical scholarship of the kind. First, like comparable DCE studies, the choice of attributes and attribute-levels results from balanced considerations of clinical relevance, choice realism, and user cognitive load. The limited attributes and the attribute-levels examined in this study and simplification of the choice scenario may not capture the full complexity of antibiotic prescribing decision-making. While substantial efforts were made during physician consultations to ensure the choice scenario is plausible in real life, this limitation is inherent to the study design as a long and complex questionnaire could result in higher cognitive loads on respondents. Second, while "opt-out" choices are suggested to improve choice realism, we did not offer this option apart from the two alternatives due to the high social desirability associated with antibiotic prescribing among healthcare providers. Third, respondents in our experiment were those who responded to the organizational climate survey and thereby self-selection bias may exist. Fourth, our experiment focuses on hospitalists working in public hospitals in Tuscany and we do not have evidence of the generalizability of our findings beyond our sample. Therefore, further research is required to determine its applicability in other healthcare settings (e.g., primary care), in different regional health systems, and at different points in time. And lastly, hypothetical scenarios do not always capture the conflict, urgency, and longer-term implications inherent to clinical situations, and thus may underestimate the importance of the determinants investigated. While stated preference experimental methods are useful in the absence of observed real-time data, they can provide an incomplete picture. To strengthen the external validity of our research, future studies could replicate this study in a different setting or utilize qualitative study designs for further validation.

5. Conclusions

Our findings enhance the understanding of antibiotic prescribing determinants, which can inform the prioritization of targets in designing interventions to increase prudent antibiotic prescribing. In this study, we found evidence that patient expectation was valued highly, though in the negative direction, when controlling for status quo bias and clinical uncertainty. Our findings speak to the importance of cultural context in shaping the physician's paternalistic disposition when confronted with patient expectations. We suggest shared decision-making as a mechanism to reconcile differences between the system shift toward patient-centered care and the physician's sense of ownership over clinical decision-making.

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Declaration of Competing Interest

None.

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Supplementary materials

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