

Uncovering doctors' perceived barriers and facilitators of antibiotic prescribing behaviours: a qualitative study using the theoretical domains framework

Marta Acampora^{1,2}, Massimo Guasconi³, Chiara Schirotti¹, Cristina Coschignano³, Nicole Cassinari³, Rosalba Cipolla³, Giovanna Artioli³, Antonio Bonacaro³, Leopoldo Sarli³, Serena Barello⁴

¹EngageMinds HUB – Consumer, Food & Health Engagement Research Center, Università Cattolica del Sacro Cuore, Milan and Cremona, Italy; ²Department of Psychology, Università Cattolica del Sacro Cuore di Milano, Milan, Italy; ³Department of Medicine and Surgery, Università di Parma, Parma, Italy; ⁴Department of Brain and Behavioural Sciences, Università di Pavia, Pavia, Italy

Abstract. *Background and aim of the work:* Uncovering the barriers and facilitators of antibiotic prescribing is crucial in order to develop effective strategies for promoting responsible and evidence-based antibiotic use, thereby combating antibiotic resistance and enhancing patient care. This qualitative study, informed by the Theoretical Domains Framework (TDF) – specifically designed to understand and analyze the factors that influence human behavior, with a focus on identifying barriers and facilitators to behavior change, was aimed to explore the determinants (barriers and facilitators) of antibiotic prescribing behaviors from the perspective of doctors. *Research design and methods:* Semi-structured interviews were conducted with healthcare professionals, and data analysis followed a theory-driven approach guided by the TDF. *Results:* The analysis identified eight TDF domains influencing antibiotic prescribing, including memory, attention, and decision processes; knowledge; skills; belief about capabilities; goals; belief about consequences; emotions; and environmental context and resources. These domains were clustered into three overarching themes according to a bottom-up logic: the decision-making prescribing process itself, intrinsic factors related to the physician, and extrinsic factors influencing the decision. *Conclusions:* This research provides a comprehensive understanding of the complex interactions between these determinants in antibiotic prescribing. The evidence gained from the study offers valuable information for developing targeted interventions to improve antibiotic prescribing practices and combat antimicrobial resistance considering psychosocial and environmental variables impacting on antibiotic prescription decision making. (www.actabiomedica.it)

Key words: antibiotic prescribing, determinants, qualitative research, human health, theoretical domains framework, antimicrobial resistance; patient-doctor relationship

Introduction

The overuse and misuse of antibiotics present a significant global health challenge, as it contributes to the alarming rise of antibiotic resistance (1). Italy, like many other countries, grapples with the dilemma of responsible antibiotic prescribing (2). Healthcare

professionals, particularly doctors, are on the front lines of this issue, making crucial decisions about when to prescribe antibiotics. Traditionally, research in this area has predominantly focused on the clinical aspects of these decisions, such as the type of infection or the latest treatment guidelines (3). However, the growing body of evidence suggests that psychosocial

and environmental factors also play a substantial role in influencing antibiotic prescribing patterns (4). Neglecting these crucial aspects not only jeopardizes individual patient care but may also perpetuate the concerning over-prescribing practices, leading to an increase in antibiotic resistance (5).

This research paper embarks on a journey into the unique healthcare landscape of Italy to explore doctors' perceptions of the facilitators and barriers involved in antibiotic prescribing. To undertake this exploration, we employ the Theoretical Domain Framework (TDF) (6) as a structured and comprehensive lens for analysis. The TDF, rooted in the field of behavioral science, offers an organized framework for disentangling the complex web of psychosocial and environmental determinants that significantly influence healthcare decisions. These factors are often overlooked in the traditional medical model, which predominantly focuses on clinical symptoms and diagnostic criteria. More in depth, the Theoretical domain framework (TDF) is a conceptual framework used in the field of behavioral science, particularly in the context of health and social care research. It is designed to understand and analyze the factors that influence human behavior, with a focus on identifying barriers and facilitators to behavior change. The TDF consists of a set of 14 theoretical domains, each representing a broad category of potential determinants of behavior. The Theoretical Domains Framework (TDF) comprises a set of 14 theoretical domains, each representing a broad category of potential determinants that can influence human behavior. These domains are used as a structured framework for understanding the factors affecting behavior change in various contexts. The 14 domains within the TDF are the following:

- Knowledge: This domain refers to what individuals know or understand about a particular behavior, including its consequences and benefits.
- Skills: It encompasses the abilities, competencies, and techniques necessary to perform a behavior effectively.
- Social/Professional Role and Identity: This domain examines how an individual's professional and social roles influence their behavior.
- Beliefs about Capabilities: It deals with self-confidence and perceived competence in carrying out a behavior.
- Optimism: This domain considers the overall positive outlook and expectations for successful behavior change.
- Beliefs about Consequences: It involves the perceptions of the anticipated positive or negative outcomes of a particular behavior.
- Reinforcement: This domain explores the presence or absence of rewards and punishment associated with the behavior.
- Intentions: It focuses on the individual's readiness and commitment to perform the behavior.
- Goals: Examines the specific objectives or targets associated with the behavior.
- Memory, Attention, and Decision Processes: Investigates how cognitive processes affect behavior and decision-making.
- Environmental Context and Resources: This domain considers external factors, such as the physical environment, resources, and support available to an individual.
- Social Influences: It examines the impact of social and peer pressure, as well as the influence of others on the behavior.
- Emotion: This domain delves into the emotional and affective aspects associated with the behavior.
- Behavioral Regulation: Focuses on self-monitoring and self-control in relation to the behavior.

These domains offer a comprehensive framework for analyzing and understanding the complex interplay of factors that shape human behavior. Researchers and practitioners use the TDF to identify which specific domains are most relevant to a given behavior, helping to design interventions and strategies that address the key determinants of behavior change. The TDF's versatility makes it a valuable tool for various fields, including healthcare, psychology, and social sciences, where understanding and modifying behavior is a central goal. Researchers and practitioners use the TDF to assess the factors that impact a specific behavior, such as adherence to a medical regimen or the

adoption of healthier lifestyle choices. By identifying which domains are relevant to a particular behavior, the TDF helps in developing targeted interventions and strategies to promote behavior change. It provides a structured and comprehensive way to explore the psychological and contextual factors that influence human actions, making it a valuable tool for designing effective behavior change interventions.

In our study, the application of the TDF serves as a reminder that healthcare decisions are not made in a vacuum. They are deeply intertwined with cognitive, social, and contextual elements, which collectively mold the antibiotic prescribing process. The significance of this exploration lies in the understanding that tackling the antibiotic resistance crisis is not solely a matter of enforcing guidelines or medical education. It also involves recognizing the deeply ingrained beliefs, social pressures, and environmental influences that affect doctors' prescribing practices.

Study aims

By unearthing these often-concealed facets of antibiotic prescribing, our study was aimed at exploring the multifaceted dynamics at play in antibiotic prescribing practices and providing a comprehensive perspective on the factors impacting the decision-making process behind the prescribing behaviour. It is our belief that this insight will be pivotal in the development of targeted interventions and strategies aimed at optimizing antibiotic use in Italy and beyond. Ultimately, we hope that this research will contribute to the global effort to mitigate antibiotic resistance and safeguard the effectiveness of antibiotics for future generations.

Material and methods

Study design

To achieve this aim this study adopted a qualitative research design. Qualitative research methods allow for an in-depth understanding of the experiences, perspectives, and behaviors of individuals involved in the prescribing process (7). Specifically, this study

employed a theory-driven approach informed by the lenses of the Theoretical Domain Framework.

Participant recruitment

Recruitment was conducted through non-probabilistic sampling procedures - based on personal contacts of the research team -, seeking individuals with varying levels of experience, specialties, and demographic characteristics (i.e., age, gender, medical specialty, years of professional experience and type of ward/dept) to ensure diversity of prescribers' experience and a maximum variability sample (8).

Data collection

Semi-structured online interviews were conducted by three researchers trained in qualitative methods (CC, RC, and NC) with physicians to gather rich qualitative data. The interview guide (Table 1) was developed based on the TDF. The interview questions were designed to elicit participants' perspectives on each TDF domain. Thematic saturation occurred between 10 and 11 interviews and an additional 3 were conducted to confirm no additional ideas related to the research question. Each interview session lasted on average 35 min.

Analysis

The analysis followed a theory-driven approach informed by the lenses of the TDF. Here following a detailed description of the data analysis process.

Step 1: Data Familiarization. The qualitative interviews have been transcribed by two researchers (CS and CC) while ensuring utmost confidentiality and anonymity for the participants. Following this, two independent coders (MA and CC) and a third researcher (SB) familiarized themselves with the dataset by reading through the transcripts.

Step 2: Training and TDF Familiarization. To maintain consistency and alignment, the coders and the third researcher received in-depth training on the Theoretical Domains Framework. This involved understanding the 14 domains and how they relate to behavior, with specific reference to antibiotic prescribing.

Table 1. Interview Guide.

Section 1: Decision-Making Prescribing Process	<ul style="list-style-type: none"> • Can you describe your typical decision-making process when prescribing antibiotics for patients? • What role does the patient-doctor relationship play in your antibiotic prescribing decisions? • How do you perceive your role as a final decision-maker in the prescription process? • How do you handle situations where patients have different expectations or preferences regarding antibiotic treatment?
Section 2: Intrinsic Factors Related to the Physician	<ul style="list-style-type: none"> • How would you describe your clinical knowledge and skills related to antibiotic prescribing? • How do you assess a patient's condition and medical history when making antibiotic prescribing decisions? • Can you share any experiences where your clinical knowledge played a crucial role in making appropriate antibiotic prescribing decisions? • How aware are you of antibiotic resistance and its implications for antibiotic prescribing? How does this awareness influence your prescribing practices?
Section 3. Effective Communication and Patient-Centered Care	<ul style="list-style-type: none"> • How do you approach communication with patients when discussing antibiotic prescriptions? • Can you share examples of effective communication strategies that you use during patient consultations? • How do you address patients' expectations or demands for antibiotics when you believe they may not be necessary? • How do you tailor your communication style to individual patients' characteristics and preferences? • How do you establish rapport and trust with patients to foster a positive patient-doctor relationship?
Section 4: Extrinsic Factors Influencing Prescribing Decisions	<ul style="list-style-type: none"> • Have you encountered situations where patient expectations influenced your antibiotic prescribing decisions? If yes, can you provide examples? • How do external factors, such as time constraints and workload pressures, impact your antibiotic prescribing practices? • Are there any challenges related to the patient-doctor relationship that you face when making antibiotic prescribing decisions?
Section 5: Impact of the Patient-Doctor Relationship on Responsible Prescribing	<ul style="list-style-type: none"> • How does your relationship with patients influence your willingness to engage in shared decision-making for antibiotic prescriptions? • Can you share instances where a strong patient-doctor relationship facilitated non-prescribing scenarios and the use of alternative treatments? • In your experience, how does the patient-doctor relationship contribute to responsible antibiotic prescribing?
Conclusion	<ul style="list-style-type: none"> • Is there anything else you would like to add about the patient-doctor relationship's role in antibiotic prescribing practices?

Pertinent literature and examples were also reviewed to enhance comprehension.

Step 3: Initial Open Coding. Each independent coder proceeded to independently code the transcripts using an open-coding approach. They identified any content that appeared to relate to the TDF domains, either using dedicated software or manual highlighting.

Step 4: Coding Agreement and Discrepancy Review. After the initial coding, the two independent coders met to compare their coding results. They discussed areas of agreement and discrepancy, paying particular

attention to instances where their interpretations differed. Any disagreements were documented in a coding disagreement log, which recorded the specific text passages in question.

Step 5: Involvement of the Third Researcher. The third researcher (SB) subsequently entered the process by independently coding the same set of transcripts using the TDF framework. This phase aimed to identify any additional discrepancies or provide insights into the existing discrepancies noted by the independent coders.

Step 6: Consensus Discussion. The two independent coders and the third researcher then convened to review and discuss any remaining discrepancies. By engaging in comprehensive discussions, they sought to reach a consensus on the final set of codes. These discussions were meticulously documented to ensure transparency and rigor in the coding process.

Step 7: Final Coding and Analysis. Upon reaching a consensus, the final set of codes was applied to the entire dataset. These coded data were then used to identify patterns, themes, and insights pertinent to antibiotic prescribing experiences.

Step 8: Data Synthesis. To synthesize the qualitative data effectively, we opted to condense through a bottom up approach, the domains of the Theoretical Domains Framework (TDF) into three overarching themes. This approach was employed to present a coherent and comprehensive picture of the multifaceted nature of antibiotic prescription decision-making. In our analysis, we organized the identified TDF domains into three primary categories:

- **The Decision-Making Prescribing Process Itself:** This theme encapsulated the domains associated with the actual process of antibiotic prescription. It delved into the factors that directly influenced how physicians decide when and how to prescribe antibiotics. These encompassed domains such as “Knowledge,” “Skills,” “Intentions,” and “Beliefs about Consequences.”
- **Intrinsic Factors Related to the Physician:** This category focused on domains that explored the internal factors linked to the healthcare provider. It delved into the individual physician’s characteristics and their influence on antibiotic prescription decisions. Domains within this category included “Beliefs about Capabilities,” “Optimism,” and “Social/Professional Role and Identity.”
- **Extrinsic Factors Influencing the Decision:** The third overarching theme addressed the external influences that impact antibiotic prescribing. It examined the social, environmental, and contextual factors that healthcare providers grapple with when making prescription decisions. This category included domains such as “Environmental Context and Resources,” “Social Influences,” and “Behavioral Regulation.”

By collapsing the TDF domains into these three overarching themes, we aimed to simplify and clarify the complex landscape of antibiotic prescription decision-making. This approach allowed us to present a structured and theory-informed interpretation of the qualitative data, highlighting the interplay between the decision-making process itself, the intrinsic factors related to physicians, and the extrinsic factors that shape their decisions. NVivo 12 (9) was used to support the analysis process and to organize and arrange the thematic codes.

Rigor and trustworthiness

To ensure the rigor and trustworthiness of the study, several strategies were employed. These included: member checking, where participants were given the opportunity to review and provide feedback on the analysis findings, thus enhancing the credibility of the interpretations. Additionally, a subset of the transcripts and the coding framework were reviewed by an independent researcher (MA) to assess the consistency and coherence of the analysis process.

Ethical considerations

This research study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki, for the ethical conduct of medical research involving human subjects. Ethical approval was sought and obtained from the Research Ethics Board (REB) of the University of Parma (IRB-030223). Informed consent was obtained from all participants prior to their inclusion in the study. Anonymity and confidentiality were maintained throughout the research process, with all data securely stored and only accessible to the research team.

Results

Participant demographics

Fifteen physicians were interviewed. Seven participants were male (47%) and the mean age was 46,26 years (SD??). Eleven physicians (73%) reported being in practice for 10 years or more.

The interviewees work in different departments: 6 (40%) in general practice, 5 (34%) in hematology, 2 (13%) in emergency surgery and 2 (13%) in infectious diseases.

A detailed description of participants' demographic characteristics such as age, sex, years of experience, and type of practice retained are reported in Table 2.

Factors influencing the prescribing decision

The analysis of the qualitative data yielded several key findings regarding the role of the patient-doctor relationship in antibiotic prescribing practices, as guided by the TDF and the grounded theory approach. The results revealed multifaceted factors that influence prescribing decisions, highlighting the complexity of the patient-doctor relationship within this context. Eight of the fourteen domains of the TDF were identified by the analysis: memory, attention, and decision processes; knowledge; skills; belief about capabilities; goals; belief about consequences; emotions and environmental context and resources. (Figure 1). To unpack the complex antibiotic prescribing decision making processes, TDF domains identified through the analysis were categorized into overarching groupings related to the prescribing decision itself (Attention/Memory

and Decision Making), the intrinsic factors (knowledge; skills; emotions; belief about capabilities; goals; belief about consequences) and extrinsic factors (social influences; environmental context and resources) to the physician that affect that decision (Figure 1). Intrinsic factors were those understood to be playing a role intrinsic to the individual physician making the prescribing decision, while external factors were those that were dependent on others (the patient, other providers, etc.) to inform the decision.

The decision-making prescribing process

The first thematic group concerns the prescribing decision itself and involves topic related to the TDF domain Attention, Memory and Decision processes. Cognitive processes related to attention, memory, and decision making played a crucial role in antibiotic prescribing. Providers had to manage large amounts of information, prioritize relevant clinical cues, and remember patient details and preferences. These cognitive processes influenced the ability to make optimal prescribing decisions.

One of the primary factors influencing antibiotic prescribing decisions was *clinical reasoning*. Healthcare providers considered the patient's clinical presentation,

Table 2. Sample characteristics.

Participant ID	Age	Sex	Specialty	Years of experience	Ward/Dept.
ID1	47	F	Physician	21	Hematology
ID2	48	F	Physician	16	Emergency surgery
ID3	34	F	Physician	8	Infectious diseases
ID4	38	F	Physician	10	Hematology
ID5	50	F	Physician	25	Hematology
ID6	64	M	Physician	36	Hematology
ID7	61	M	Physician	34	Hematology
ID8	33	M	Physician	7	Infectious diseases
ID9	34	F	Physician	9	General practice
ID10	50	M	Physician	24	Emergency surgery
ID11	40	M	Physician	14	General practice
ID12	63	F	Physician	35	General practice
ID13	58	M	Physician	25	General practice
ID14	45	F	Physician	15	General practice
ID15	29	M	Physician	3	General practice

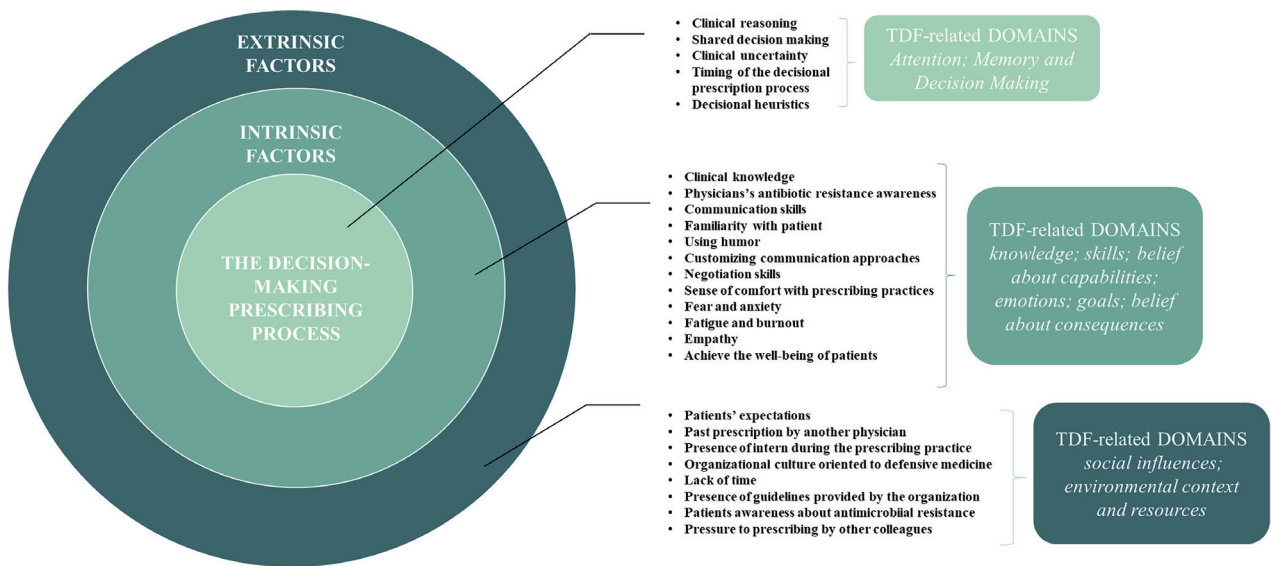


Figure 1. A visual representation of the antibiotic prescribing process and the domains that influence the intention to prescribe an antibiotic (or not).

symptoms, and medical history to make informed decisions about whether to prescribe antibiotics. Clinicians often used their diagnostic skills and medical expertise to assess the likelihood of a bacterial infection, which in turn guided their prescription choices. One interviewee said: “*I rely on my clinical judgment, patient assessment, and medical knowledge to determine if antibiotics are necessary. It’s about weighing the risks and benefits (ID11).*” In particular, *clinical uncertainty* was identified as a recurring and complex factor affecting antibiotic prescribing decisions. Healthcare providers frequently encountered cases where the diagnosis was unclear or the severity of the infection was uncertain. In such situations, clinical uncertainty often led to deliberation about whether to prescribe antibiotics or adopt a more conservative “wait and see” approach. The presence of clinical uncertainty influenced prescribing behaviors, sometimes leading to a preference for avoiding unnecessary antibiotic use. Another participant expressed the challenge of clinical uncertainty, stating, “*Sometimes it’s tough to be sure if it’s a bacterial infection or not. This uncertainty can lead to prescribing just to be safe (ID9).*” *Decisional heuristics*, or cognitive shortcuts, were found to play a role in the antibiotic prescribing process. Providers sometimes used heuristics to streamline decision-making, particularly in busy clinical settings with time constraints. These heuristics,

which could include rules of thumb or algorithms, expedited the process but also carried the risk of overprescribing if not used judiciously. The choice to employ heuristics varied based on the urgency of the clinical situation. Another provider interviewed discussed decisional heuristics, saying, “*In time-sensitive situations, I may use heuristics to expedite the process. It’s a mental shortcut to make decisions, but it can be a double-edged sword (ID4).*”

Shared decision making was another prominent and critical component of antibiotic prescribing. Healthcare providers engaged in collaborative discussions with patients, actively involving them in the decision-making process. Patients were informed about the potential benefits and risks associated with antibiotic treatment, and their preferences and concerns were carefully considered. Shared decision making had a substantial impact on whether antibiotics were prescribed and, if so, the choice of the specific antibiotic regimen. Shared decision making was emphasized by another interviewee, who said, “*Involving patients in the decision-making process is crucial. I provide information and discuss options, but the final choice should align with the patient’s preferences (ID15).*”

Finally, the *timing of the decisional prescription process* was a critical factor influencing antibiotic prescribing. Providers had to make rapid decisions in

some cases, such as in emergency or urgent care settings. In contrast, for non-acute cases or chronic conditions, they had more time for thorough assessment and deliberation. The timing of the decision affected the use of decisional heuristics, with providers relying more on cognitive shortcuts in time-sensitive situations. The timing of the decision was highlighted by one doctor, who noted, “*In emergency situations, you often have to make quick decisions. Time constraints can influence antibiotic choices (ID11).*”

When making decisions regarding antibiotic prescriptions outside of regular working hours, such as during out-of-hours periods, healthcare professionals may encounter difficulties in adhering to appropriate antibiotic prescribing practices. Indeed, healthcare professionals are responsible for deciding when and how to prescribe antibiotics to patients. This is typically done during their regular working hours. However, there are situations, particularly during evenings, weekends, or holidays, when healthcare services operate differently, and professionals may need to make these decisions outside of their usual work schedule. During these out-of-hours periods, healthcare professionals may encounter difficulties in adhering to appropriate antibiotic prescribing practices. This means that they may find it challenging to follow established guidelines and protocols for prescribing antibiotics in a responsible and evidence-based manner.

Intrinsic factor

The second overarching group concerns factors that are intrinsic to the physician prescriber, reflecting the unique combination of their clinical expertise, personal qualities, and interpersonal skills that collectively shape their antibiotic prescribing decisions.

Firstly, *clinical knowledge* was identified as a foundational factor affecting antibiotic prescribing. Healthcare providers’ understanding of infectious diseases, antibiotic mechanisms, and the principles of antimicrobial stewardship played a crucial role in making informed prescription decisions. A strong foundation of clinical knowledge served as a basis for differentiating between bacterial and viral infections and determining the appropriate antibiotic treatment. In this regard, one physician stated, “*A solid understanding of infectious*

diseases is crucial. Knowing when antibiotics are necessary and when they are not can prevent overuse (ID2).”

Awareness of antibiotic resistance emerged as another significant factor. Healthcare providers who were well-informed about the growing problem of antibiotic resistance were more cautious in their prescribing practices. Knowledge of the consequences of overuse and the emergence of resistant strains influenced their decision-making, leading to a more judicious use of antibiotics. An interviewee emphasized, “*Awareness of antibiotic resistance is a wake-up call. It influences my decisions, pushing me to be more judicious (ID8).*”

Effective communication skills were also crucial in antibiotic prescribing. Providers who could communicate clearly, listen to patients, and engage in meaningful discussions were better equipped to convey information about the benefits and risks of antibiotics. These skills fostered shared decision making and enhanced patient understanding and cooperation. A healthcare provider explained, “*Being able to explain the reasons behind antibiotic decisions clearly and listening to patients’ concerns are key in shared decision making (ID7).*”

Moreover, *familiarity with the patient* was found to influence antibiotic prescribing. Providers who knew their patients well could tailor their approach to align with the patient’s medical history, preferences, and prior experiences. This familiarity allowed for more personalized and effective prescribing decisions. A physician shared, “*Knowing a patient’s medical history and preferences allows for a more personalized approach, which can influence the decision-making process (ID6).*” Within the interaction with patients, the *use of humor* was noted as a potentially impactful factor. Humor was sometimes employed to establish rapport and alleviate patient anxiety. When used judiciously, humor could enhance patient-provider relationships and create a more conducive environment for shared decision making. One interviewee commented, “*Humor can ease tensions and create a more relaxed atmosphere, which can facilitate shared decision making (ID5).*”

Moreover, *customizing communication approaches* was a key component of effective antibiotic prescribing. Providers who adapted their communication style to the patient’s needs, whether by using layman’s terms or more technical language, facilitated better patient understanding and engagement in the

decision-making process. An interviewee elaborated, *“Adapting my communication style to match the patient’s understanding and preferences ensures they are fully engaged in the decision (ID4).”*

Negotiation skills were instrumental in cases where patients were adamant about receiving antibiotics. Providers skilled in negotiation could navigate such situations to reach a decision that balanced the patient’s concerns with judicious antibiotic use. A healthcare provider mentioned, *“Negotiating with patients who strongly believe they need antibiotics can be challenging but is often necessary (ID8).”* One physician expressed, *“Being confident in my clinical judgment and following evidence-based guidelines gives me the assurance to make the right call (ID14).”*

Also the *provider’s personal sense of comfort with prescribing practices* was identified as an influential factor. Providers who were confident in their clinical judgment and knowledge were more likely to make decisions aligned with antimicrobial stewardship principles.

Fear and anxiety were emotions that providers sometimes experienced when making antibiotic prescribing decisions. Concerns about misdiagnosis, antibiotic resistance, and patient dissatisfaction could heighten anxiety and potentially influence prescription choices. One healthcare provider shared, *“Fear of making a mistake or causing patient dissatisfaction can lead to anxiety when deciding whether to prescribe antibiotics (ID8).”* Also, the *presence of fatigue and burnout* was recognized as a factor that could affect antibiotic prescribing. Healthcare providers experiencing burnout were more likely to rely on heuristics and may opt for antibiotic prescriptions as a quick solution in demanding clinical settings. *During busy shifts, decision-making can be affected by exhaustion, and there’s a temptation to prescribe antibiotics as a quick solution (ID9).”*

Empathy was another important factor in the antibiotic prescribing process. Providers who displayed empathy and understood the patient’s concerns and anxieties were better positioned to foster trust and cooperation, which contributed to shared decision making and more appropriate antibiotic use. A physician noted, *“Empathizing with patients, understanding their fears and concerns, is central to gaining their trust and making shared decisions (ID4).”*

Finally, the overarching goal of *achieving the well-being of patients* was a driving factor. Healthcare providers aimed to balance the potential benefits of antibiotics with patient safety and the prevention of antibiotic resistance, ultimately prioritizing the patient’s health and long-term well-being. One healthcare provider emphasized, *“In the end, it’s about the patient’s health and long-term well-being. This drives my decision-making process (ID8).”*

Extrinsic factor

Finally, the study identified several TDF domains related to extrinsic factors, including and social influences and environmental context and resources.

In particular, *patients’ expectations* were identified as a significant external factor influencing antibiotic prescribing decisions. Participants expressed the challenge of managing patient expectations, as they often expected antibiotics for various conditions. One healthcare provider explained, *“Patients sometimes come in expecting a quick fix, and they can be quite insistent on receiving antibiotics even for viral illnesses (ID13).”*

The *influence of past prescriptions by other physicians* was noted by several participants. Providers mentioned instances where patients had received antibiotics from other healthcare professionals, which influenced their own decisions. As one interviewee described, *“If a patient recently received antibiotics from another doctor, it can be challenging to justify withholding antibiotics, even if I believe it’s not necessary (ID11).”*

The *presence of interns* or other medical trainees during the prescribing process was acknowledged as a factor that could influence antibiotic decisions. One participant stated, *“When there are interns observing, there’s sometimes a tendency to lean towards prescribing antibiotics to avoid appearing indecisive or withholding treatment (ID7).”*

Some participants highlighted the impact of an *organizational culture oriented towards defensive medicine*. They expressed concerns about the fear of legal consequences if antibiotics were not prescribed. An interviewee stated, *“The fear of malpractice lawsuits can lead to defensive prescribing practices, even if antibiotics aren’t clinically indicated (ID6).”*

The *lack of time in clinical settings* was recognized as a constraint on appropriate antibiotic prescribing.

Participants expressed that time constraints often made it difficult to engage in thorough patient discussions and shared decision making. As one healthcare provider noted, *“In a busy clinic, there’s not always enough time to educate patients and discuss the risks and benefits of antibiotics (ID10).”*

Participants acknowledged the influence of *guidelines provided by their healthcare organizations*. These guidelines often served as reference points for antibiotic prescribing decisions. One interviewee stated, *“Our organization has specific antibiotic prescribing guidelines that we are expected to follow. It provides a framework for our decisions (ID1).”*

The level of patient awareness about antimicrobial resistance was found to be a contributing factor. Some participants noted that well-informed patients were more receptive to non-antibiotic options. An interviewee stated, *“Patients who are aware of antibiotic resistance tend to be more understanding and willing to explore alternative treatments (ID2).”*

Several participants discussed the *influence of peer pressure within the healthcare community*. The pressure to conform to colleagues’ prescribing practices was recognized as a factor that could sway antibiotic decisions. As one healthcare provider explained, *“There’s sometimes an unspoken pressure to prescribe antibiotics when other colleagues are doing so, even if you have reservations (ID4).”*

Conclusion

The findings from this study shed light on the complexity of factors intervening in shaping antibiotic prescribing practices. The evidence gained are expected to offer valuable information for developing targeted interventions to improve antibiotic prescribing practices and combat antimicrobial resistance considering psychosocial and environmental variables impacting on (over)prescribing by promoting a relational approach to this phenomenon. In particular, the findings from this qualitative study highlighted specific groups of factors impacting antibiotic prescribing decisions among healthcare providers, encompassing the decision-making process itself, intrinsic factors related to the prescriber, and various extrinsic factors that

influence these decisions. The decision-making process for antibiotic prescribing involves a delicate balance between the need for effective treatment and the imperative to prevent antibiotic overuse and its associated consequences, such as antibiotic resistance. Our findings underscore the central role of clinical reasoning, shared decision making, clinical uncertainty, timing of the decision, and the use of decisional heuristics in this process. The importance of clinical reasoning aligns with existing literature highlighting the significance of clinical expertise in determining the appropriateness of antibiotic treatment (10,11). The ability to differentiate between bacterial and viral infections through clinical reasoning is pivotal for judicious antibiotic prescribing. Moreover, the emphasis on shared decision making is consistent with the growing recognition of the relevance of patient-centered care in treatment decision (5,12,13). As suggested by previous studies (14,15), engaging patients in discussions about antibiotic treatment empowers them to make informed decisions aligned with their preferences while ensuring responsible antibiotic use.

The presence of clinical and diagnostic uncertainty resonates with studies emphasizing the challenges of diagnosing infections accurately (16,17). Our findings reveal that this uncertainty can lead to more cautious prescribing practices, which is consistent with the principle of “watchful waiting” advocated in some guidelines (18).

The influence of timing on antibiotic prescription decision making corresponds with studies highlighting the impact of time and contextual constraints in clinical settings (19,20). In emergency or urgent care situations, rapid decisions may be necessitated, potentially affecting prescribing choices (21).

The use of decisional heuristics to expedite decision making aligns with research on cognitive shortcuts used by healthcare providers (22). These heuristics, while sometimes helpful, may also contribute to overprescribing, emphasizing the importance of their judicious application.

The intrinsic factors affecting antibiotic prescribing, such as clinical knowledge, antibiotic resistance awareness, communication skills, familiarity with patients, and emotional factors (e.g., fear, empathy), are integral to the prescriber’s decision-making process. Existing

literature supports the significance of these factors. The role of clinical knowledge and guidelines in antibiotic prescribing has been well-documented (23). Also, awareness of antibiotic resistance has gained attention in the literature, emphasizing its potential to influence prescribing behavior (24,25). In particular, as confirmed by international studies, knowledge of the consequences of resistance fosters responsible prescribing (26).

Effective communication with patients is a cornerstone of patient-centered care also in the context of antibiotic prescription (27). Providers with strong communication skills can facilitate shared decision making and patient understanding. Literature on the benefits of provider-patient relationships in antibiotic prescribing has highlighted the value of knowing a patient's medical history and preferences (28). This familiarity may contribute to personalized and patient-centered care, as confirmed by other studies (29).

Emotional factors like fear of a complaint as a consequence of not prescribing and empathy for unwell patients have been explored in the context of healthcare provider therapeutic decision making (30). The fear of making a mistake and concerns about patient satisfaction can influence also antibiotic prescribing, highlighting the need for emotional support and resilience strategies for the prescribers (31).

Extrinsic factors, including the presence of guidelines, organizational culture, time constraints, and peer pressure, reflect the broader healthcare environment in which prescribing decisions are made. These factors are also well-documented in the literature. Existing literature emphasizes the role of clinical guidelines in promoting evidence-based prescribing (32). Guidelines provide a reference point and framework for prescribing practices. Also, the influence of an organizational culture oriented toward defensive medicine is a recognized phenomenon (33,34). Such cultures can lead to defensive prescribing practices, reinforcing the importance of organizational support for appropriate prescribing. The impact of time constraints on antibiotic prescribing aligns with research on the challenges of time in clinical decision making (35). Time pressures necessitate efficient decision making while maintaining quality care.

In line with this study results, the literature also acknowledges the role of peer pressure and the

influence of colleagues on prescribing behaviour (36). Conformity to colleagues' practices can affect decision making, suggesting a need for peer education and collaboration.

In conclusion, the decision-making process for antibiotic prescribing is multifaceted, influenced by intrinsic and extrinsic factors. Our findings align with existing literature, emphasizing the importance of clinical reasoning, shared decision making, clinical uncertainty, timing, and decisional heuristics. Understanding the interplay of these factors is essential for interventions aimed at promoting judicious antibiotic use while delivering patient-centered care within the complex healthcare landscape. Additionally, strategies to support healthcare providers in enhancing their clinical knowledge, communication skills, and emotional well-being can contribute to more responsible and patient-centered antibiotic prescribing practices.

Finally, the utilization of the Theoretical Domains Framework (TDF) in guiding this study has provided a structured and comprehensive lens through which to analyze the multifaceted factors influencing antibiotic prescribing. The TDF offers a theoretical foundation that organizes and categorizes the determinants of healthcare provider behaviour, including antibiotic prescribing. The application of the TDF to our research has several valuable implications. The TDF enabled a systematic exploration of the cognitive, social, and environmental factors that impact antibiotic prescribing. By categorizing these factors into domains, we gained a holistic understanding of the decision-making process. Moreover, the TDF facilitated the identification of specific domains that play a pivotal role in antibiotic prescribing. This insight can inform the development of targeted interventions to improve prescribing practices. For example, if the "Environmental Context and Resources" domain emerged as a significant influencer, interventions could focus on optimizing the clinical environment to support responsible prescribing. The TDF allows for the customization of interventions based on the identified domains. Tailored interventions that address the specific factors within each domain have a higher likelihood of success. For instance, if "Fear and Anxiety" was identified as a key factor, interventions could include strategies to reduce anxiety and enhance emotional well-being among healthcare

providers. Finally, the TDF encourages the integration of evidence-based practices into healthcare decision making. By using the TDF, our study aligns with the broader trend toward evidence-based medicine. This emphasis on evidence is crucial in promoting responsible antibiotic prescribing practices.

In conclusion, the application of the Theoretical Domains Framework (TDF) has enhanced our understanding of the factors influencing antibiotic prescribing. The structured approach it provides has practical implications for clinical training, guideline development, behavior change interventions, patient-centered care, and organizational support. By recognizing the domains that influence prescribing behavior, healthcare providers and organizations can work together to promote evidence-based, patient-centered, and responsible antibiotic use.

Acknowledgements: The authors also thank all respondents in the study for their time and engagement and for permitting their insights to be shared.

Funding: None declared.

Statement of Conflict of Interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

Authors Contribution: *M.A.:* substantial contribution to the concept of the article; substantial contribution to the analysis for the article; drafted the article; approved the version to be published; agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. *M.G.:* revised article critically for important intellectual content; approved the version to be published; agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. *C.S.:* substantial contribution to the analysis; drafted the article; approved the version to be published; agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. *C.C.:* substantial contribution to the acquisition of data for the article; approved the version to be published; agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are

appropriately investigated and resolved. *N.C.:* substantial contribution to the acquisition of data for the article; approved the version to be published; agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. *R.C.:* substantial contribution to the acquisition of data for the article; approved the version to be published; agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. *A.B.:* revised article critically for important intellectual content; approved the version to be published; agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. *L.S.:* revised article critically for important intellectual content; approved the version to be published; agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. *G.A.:* revised article critically for important intellectual content; approved the version to be published; agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. *S.B.:* substantial contribution to the concept of the article; substantial contribution to the analysis; revised the article critically for important intellectual content; approved the version to be published; agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Ethic Committee: Ethical approval was sought and obtained from the Research Ethics Board (REB) of the University of Parma (ID:151222).

References

1. Murray CJL, Ikuta KS, Sharara F, et al. Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis. *The Lancet*. Feb 2022;399(10325):629–55. doi: 10.1016/S0140-6736(21)02724-0
2. Menichetti F, Falcone M, Lopalco P, et al. The GISA call to action for the appropriate use of antimicrobials and the control of antimicrobial resistance in Italy. *Int J Antimicrob Agents*. Aug 2018;52(2):127–34. doi: 10.1016/j.ijantimicag.2018.05.010
3. Lorencatto F, Charani E, Sevdalis N, Tarrant C, Davey P. Driving sustainable change in antimicrobial prescribing practice: how can social and behavioural sciences help? *J Antimicrob Chemother*. Oct 2018;73(10):2613–24. doi: 10.1093/jac/dky222
4. Teixeira Rodrigues A, Roque F, Falcão A, Figueiras A, Herdeiro MT. Understanding physician antibiotic prescribing behaviour: a systematic review of qualitative studies. *Int J Antimicrob Agents*. Mar 2013;41(3):203–12. doi: 10.1186/s12879-015-1332-y

5. Barello S, Acampora M. Participatory antimicrobial stewardship: fostering patient and public engagement to counter antimicrobial resistance. *Trends Microbiol.* Nov 2023;31(11):1096–8. doi: 10.1016/j.tim.2023.07.007
6. Cane J, O'Connor D, Michie S. Validation of the theoretical domains framework for use in behaviour change and implementation research. *Implement Sci.* Dec 2012;7(1):37. doi: 10.1186/1748-5908-7-37
7. Holloway I, Galvin K. *Qualitative Research in Nursing and Healthcare.* Hoboken: John Wiley&Sons; 2023.
8. Suri H. Purposeful Sampling in Qualitative Research Synthesis. *Qual Res J.* Aug 2011;11(2):63–75. doi: 10.3316/QRJ1102063
9. Dhakal K. NVivo. *J Med Libr Assoc JMLA.* Apr 2022;110(2):270–2. doi: 10.5195/jmla.2022.1271
10. Abdoler EA, O'Brien BC, Schwartz BS. Following the Script: An Exploratory Study of the Therapeutic Reasoning Underlying Physicians' Choice of Antimicrobial Therapy. *Acad Med.* Aug 2020;95(8):1238–47. doi: 10.1097/ACM.0000000000003498
11. Fontela PS, Gaudreault J, Dagenais M, et al. Clinical Reasoning Behind Antibiotic Use in PICUs: A Qualitative Study*. *Pediatr Crit Care Med.* Mar 2022;23(3):e126–35. doi: 10.1097/PCC.0000000000002886
12. Robinson JH, Callister LC, Berry JA, Dearing KA. Patient-centered care and adherence: Definitions and applications to improve outcomes. *J Am Acad Nurse Pract.* Dec 2008;20(12):600–7. doi: 10.1111/j.1745-7599.2008.00360.x
13. Barello S, Graffigna G. Patient engagement in healthcare: pathways for effective medical decision making. *Neuropsychol Trends.* Apr 2015;(17):53–65. doi: 10.7358/neur-2015-017-bare
14. van Esch TEM, Brabers AEM, Hek K, van Dijk L, Verheij RA, de Jong JD. Does shared decision-making reduce antibiotic prescribing in primary care? *J Antimicrob Chemother.* Nov 2018;73(11):3199–205. doi: 10.1093/jac/dky321
15. Coxeter P, Del Mar CB, McGregor L, Beller EM, Hoffmann TC. Interventions to facilitate shared decision making to address antibiotic use for acute respiratory infections in primary care. *Cochrane Acute Respiratory Infections Group.* *Cochrane Database Syst Rev* [Internet]. Nov 2015 [cited nov 2023];2017(2). Available on: <http://doi.wiley.com/10.1002/14651858.CD010907.pub2>
16. Wang D, Liu C, Zhang X, Liu C. Does diagnostic uncertainty increase antibiotic prescribing in primary care? *Npj Prim Care Respir Med.* Mar 2021;31(1):17. doi: 10.1038/s41533-021-00229-9
17. Shen L, Wang T, Yin J, Sun Q, Dyar OJ. Clinical Uncertainty Influences Antibiotic Prescribing for Upper Respiratory Tract Infections: A Qualitative Study of Township Hospital Physicians and Village Doctors in Rural Shandong Province, China. *Antibiotics.* Jun 2023;12(6):1027. doi: 10.3390/antibiotics12061027
18. Smolinski NE, Antonelli PJ, Winterstein AG. Watchful Waiting for Acute Otitis Media. *Pediatrics.* Jul 2022;150(1):e2021055613. doi: 10.1542/peds.2021-055613
19. Spurling GK, Del Mar CB, Dooley L, Clark J, Askew DA. Delayed antibiotic prescriptions for respiratory infections. *Cochrane Acute Respiratory Infections Group,* curator. *Cochrane Database Syst Rev* [Internet]. Sept 2017 [cited nov2023];2022(8). Available on: <http://doi.wiley.com/10.1002/14651858.CD004417.pub5>
20. Sikkens JJ, Gerritse SL, Peters EJG, Kramer MHH, Van Agtmael MA. The 'morning dip' in antimicrobial appropriateness: circumstances determining appropriateness of antimicrobial prescribing. *J Antimicrob Chemother.* Jun 2018;73(6):1714–20. doi: 10.1093/jac/dky070
21. Klein EY, Martinez EM, May L, Saheed M, Reyna V, Broniatowski DA. Categorical Risk Perception Drives Variability in Antibiotic Prescribing in the Emergency Department: A Mixed Methods Observational Study. *J Gen Intern Med.* Oct 2017;32(10):1083–9. doi: 10.1007/s11606-017-4099-6
22. Langford BJ, Daneman N, Leung V, Langford DJ. Cognitive bias: how understanding its impact on antibiotic prescribing decisions can help advance antimicrobial stewardship. *JAC-Antimicrob Resist.* Oct 2020;2(4):dlaa107. doi: 10.1093/jacamr/dlaa107
23. Charani E, Castro-Sanchez E, Sevdalis N, et al. Understanding the Determinants of Antimicrobial Prescribing Within Hospitals: The Role of "Prescribing Etiquette". *Clin Infect Dis.* Jul 2013;57(2):188–96. doi: 10.1093/cid/cit212
24. Björkman I, Berg J, Viberg N, Stålsby Lundborg C. Awareness of antibiotic resistance and antibiotic prescribing in UTI treatment: A qualitative study among primary care physicians in Sweden. *Scand J Prim Health Care.* Mar 2013;31(1):50–5. doi: 10.3109/02813432.2012.751695
25. Chukwu EE, Oladele DA, Enwuru CA, et al. Antimicrobial resistance awareness and antibiotic prescribing behavior among healthcare workers in Nigeria: a national survey. *BMC Infect Dis.* Dec 2021;21(1):22. doi: 10.1186/s12879-020-05689-x
26. Krockow EM, Colman AM, Chattoe-Brown E, et al. Balancing the risks to individual and society: a systematic review and synthesis of qualitative research on antibiotic prescribing behaviour in hospitals. *J Hosp Infect.* Apr 2019;101(4):428–39. doi: 10.1016/j.jhin.2018.08.007
27. Rawson TM, Moore LSP, Castro-Sanchez E, et al. Development of a patient-centred intervention to improve knowledge and understanding of antibiotic therapy in secondary care. *Antimicrob Resist Infect Control.* Mar 2018;7(1):43. doi: 10.1186/s13756-018-0333-1
28. Legenza L, Morris AO, Safdar N, Chui MA. "What brought you in today?": Modeling patient-provider clinic visits to characterize rural providers' antibiotic treatment decisions. *Res Soc Adm Pharm.* Jun 2023;19(6):896–905. doi: 10.1016/j.sapharm.2023.02.007
29. Van Buul LW, Van Der Steen JT, Doncker SM, et al. Factors influencing antibiotic prescribing in long-term care facilities: a qualitative in-depth study. *BMC Geriatr.* Dec 2014;14(1):136. doi: 10.1186/1471-2318-14-136

30. Courtenay M, Rowbotham S, Lim R, Peters S, Yates K, Chater A. Examining influences on antibiotic prescribing by nurse and pharmacist prescribers: a qualitative study using the Theoretical Domains Framework and COM-B. *BMJ Open*. Jun 2019;9(6):e029177. doi: 10.1136/bmjopen-2019-029177
31. Bearman G. Leadership in healthcare epidemiology, antimicrobial stewardship, and medicine: A soccer enthusiast's perspective. *Infect Control Hosp Epidemiol*. Feb 2023;44(2):171–4. doi: 10.1017/ice.2022.221
32. Rashidian A, Eccles MP, Russell I. Falling on stony ground? A qualitative study of implementation of clinical guidelines' prescribing recommendations in primary care. *Health Policy*. Feb 2008;85(2):148–61. doi: 10.1016/j.healthpol.2007.07.011
33. Broom A, Kirby E, Gibson AF, Post JJ, Broom J. Myth, Manners, and Medical Ritual: Defensive Medicine and the Fetish of Antibiotics. *Qual Health Res*. Nov 2017;27(13):1994–2005. doi: 10.1177/1049732317721478
34. He AJ. The doctor–patient relationship, defensive medicine and overprescription in Chinese public hospitals: Evidence from a cross-sectional survey in Shenzhen city. *Soc Sci Med*. Dec 2014;123:64–71. doi: 10.1016/j.socscimed.2014.10.055
35. Yates TD, Davis ME, Taylor YJ, et al. Not a magic pill: a qualitative exploration of provider perspectives on antibiotic prescribing in the outpatient setting. *BMC Fam Pract*. Dec 2018;19(1):96. doi: 10.1186/s12875-018-0788-4
36. Livorsi D, Comer A, Matthias MS, Perencevich EN, Bair MJ. Factors Influencing Antibiotic-Prescribing Decisions Among Inpatient Physicians: A Qualitative Investigation. *Infect Control Hosp Epidemiol*. Sept 2015;36(9):1065–72. doi: 10.1017/ice.2015.136

Correspondence:

Received: 22 September 2023

Accepted: 10 November 2023

Prof. Serena Barello,

Associate Professor

Department of Brain and Behavioural Sciences,

Università di Pavia, Pavia, Italy.

Piazza Botta 6, 27100 Pavia, Italy

E-mail: serena.barello@unipv.it