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Teaching Infectious Diseases in the Context of a Busy Private Practice: A Pragmatic Framework for Clinician Educators

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Abstract: Teaching infectious diseases (ID) in private practice is inherently constrained by multiple external and internal factors, including time scarcity, documentation burden, and financial obligations that deprioritize educational activities. Despite these limitations, private practice presents an underutilized yet impactful opportunity to mentor trainees, especially by exposing them to real-world clinical decision-making. This manuscript outlines an educational strategy grounded in autonomy, relevance, and reflective practice. Additionally, it explores how humor and personal voice can enhance engagement and memory retention. Combined, these strategies aim to create a high-impact, learner-centered framework adaptable to the time-constrained environment of private practice.

Keywords: microbiology; pharmacology; epidemiology; trainees; epidemiology; andragogy

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Introduction

Infectious diseases (ID) remains among the most intellectually rigorous of specialties, intersecting microbiology, pharmacology, epidemiology, and systems-based care. However, ID as a specialty faces declining interest among residents, due in part to the perceived cognitive load and lower financial incentives compared to procedural fields. In private practice, the challenge is amplified by the lack of protected teaching time and variable trainee exposure. Despite these hurdles, ID educators in private settings play a vital role in shaping antimicrobial stewardship habits, diagnostic precision, and public health awareness. Studies have shown that embedding ID physicians in hospital committees and stewardship programs correlates with reduced inappropriate antimicrobial

use, lowered hospital length of stay, and improved resistance profiles [1,2]. These benefits can be amplified through structured teaching models that emphasize learner engagement, feedback, and contextual learning—skills that, when passed down to trainees, remain invaluable regardless of whether or not they ultimately pursue a career in infectious diseases.

Challenges of Teaching ID in Private Practice

Effective teaching in private practice is hindered by logistical barriers. Clinicians often round at multiple hospitals with variable electronic medical records, limiting continuity in trainee supervision. Administrative demands such as documentation, coding, and quality metrics further reduce bandwidth for teaching. Residents, on the other hand, often rotate through ID services for short durations—sometimes as little as 2 weeks—reducing their ability to build foundational knowledge. Their capacity to engage deeply may also be affected by personal and social stressors such as navigating new marriages, caring for newborns, or searching for jobs post-training. Moreover, with a curriculum saturated by competing priorities (eg, cardiology, intensive care, procedures), ID may be perceived as a less tangible or gratifying experience. Therefore, private practitioners must be strategic and efficient in both what they teach and how they teach.

Foundational Content

To optimize instructional time, educators should emphasize high-yield domains of ID that are critical to safe clinical practice but often inadequately addressed elsewhere. Clinical microbiology underpins accurate interpretation of cultures, susceptibility patterns, and diagnostic tools. Antibiotic review builds familiarity with drug classes, mechanisms, and spectrum of activity, which are keys to initiating appropriate empiric therapy. Stewardship principles are crucial given rising global resistance and have been associated with significant reductions in antimicrobial misuse and hospital-acquired infections [1,2]. Infection control principles are foundational to systems-based practice and directly impact patient outcomes in outbreaks, central line infections, and surgical prophylaxis. Disease-specific topics can also be prioritized based on their prevalence on the teaching service. Select individual cases can offer opportunities to explore foundational principles in infectious disease evaluation and management. For instance, *Staphylococcus aureus* bacteremia exemplifies clinical complexity—it necessitates source control, echocardiographic assessment, repeat blood cultures, and extended antibiotic therapy. Together, these topics create a cognitive framework applicable across clinical settings (See Table 1).

Table 1: Foundational ID Topics for Resident Teaching.

Topic	Rationale
Clinical microbiology	Rarely emphasized in other rotations; critical to diagnosis
Antibiotic review	Core to empiric and directed therapy
Antibiotic stewardship	Addresses rising resistance and misuse
Infection control	Vital for patient safety and public health
High-yield cases, ie, *S. aureus* bacteremia	Common, high-risk infection with nuanced management

How to Teach It: A Framework

Adult learners differ from traditional students in that they are goal-directed, experiential, and internally motivated [3]. Knowles' theory of andragogy emphasizes that adult learning is most effective when it is problem-centered rather than content-oriented, focusing on real-world challenges that learners are likely to encounter in their personal or professional lives. Rather than absorbing abstract concepts in isolation, adult learners benefit from engaging with material that is immediately relevant, practical, and capable of addressing specific tasks or problems they are currently facing [3]. These principles can be applied in ID teaching by using real patient cases to guide Socratic questioning, such as: What is the clinical ID problem? What are the potential differential diagnoses? What should we recommend and why? This structure helps build clinical reasoning rather than rote memorization.

Teaching Beyond the Conference Room

Teaching is most impactful when integrated into the clinical environment. While structured sessions like grand rounds or noon conferences offer breadth, they often lack immediacy and contextual grounding. In contrast, opportunistic teaching during handoffs, curbside questions, or shared note-writing can reinforce clinical concepts in real time. These interactions have the added advantage of emotional salience—learning is more memorable when tied to a real patient encounter. Mobile-based apps, text message threads, and shared teaching pearls via electronic health record comments are increasingly used as digital tools to bridge educational gaps in real-world settings.

Enhancing Retention: Cognitive Techniques

Cognitive psychology offers several tools to improve memory consolidation and retrieval, many of which are particularly useful in the complex and detail-rich field of infectious diseases. Spaced repetition—revisiting material at strategically increasing intervals [4]—can be used to reinforce key concepts such as antimicrobial spectra, diagnostic algorithms, and infection control protocols. Interleaving, which involves alternating between related topics [5] (eg, comparing gram-positive vs gram-negative organisms or bacterial vs viral meningitis), encourages learners to distinguish nuances in pathophysiology and treatment, fostering deeper conceptual understanding.

Visualization strategies, such as flowcharts, mind maps, or "memory palaces," are especially helpful in organizing multifaceted topics such as fever in the returning traveler or the workup of endocarditis. Additionally, mnemonics can be invaluable in reducing cognitive load and aiding recall in time-sensitive situations [6]. For example, acronyms like "PEK" (Proteus, *E. coli*, Klebsiella) for common gram-negative rods, or "MRS. HELP" for remembering organisms associated with endocarditis (Moraxella, Rickettsia, Staph, HACEK, Enterococcus, Listeria, Pseudomonas), provide quick mental shortcuts that learners can use at the bedside.

By incorporating these evidence-based strategies into ID teaching—through case-based learning, active recall during rounds, or reinforcing concepts across different clinical encounters—educators can support more durable and flexible learning, helping trainees better manage the cognitive demands of ID practice (See Table 2).

Table 2: Strategies to Reinforce Learning in Clinical Settings.

Strategy	Description
Spaced repetition	Repeat concepts over increasing intervals for retention
Interweaving	Alternate topics to improve cross-topic application
Visualization	Use memory palaces or diagrams to structure knowledge
Case-based learning	Use real patient scenarios for contextual relevance
Playful language	Enhance engagement through metaphor and humor

Clinical Microbiology and Antibiotics

Microbiology and pharmacology are often taught in isolation from clinical practice, leading to fragmented understanding and difficulty applying knowledge at the bedside. A more holistic approach reframes these disciplines as components of an integrated clinical ecosystem. By envisioning the human body as a "condo complex" for microbes, learners can begin to appreciate how different organisms colonize specific anatomical niches based on their environmental preferences. For instance, *Pseudomonas aeruginosa* thrives in moist, oxygen-rich environments and is frequently associated with water-related exposures such as urinary catheters, endotracheal tubes, and burn wounds. Similarly, anaerobes may be viewed as "basement dwellers," flourishing in low-oxygen environments like the gut or deep-tissue abscesses.

Pharmacology can be layered onto this metaphor by teaching the major drug classes—beta-lactams, aminoglycosides, glycopeptides, and fluoroquinolones—as "cocktail recipes" tailored to specific microbial tenants. Just as certain cocktails complement certain meals, antibiotic regimens should be selected based on the microbial flora of the affected site, patient-specific risk factors, and local resistance trends. This framework helps demystify empiric therapy by tying drug selection to patterns of microbial behavior and host environment. For example, learners might remember that aminoglycosides are especially effective "bouncers" for gram-negative residents but do not penetrate the "private units" (eg, intracellular or central nervous system spaces) without help. When this metaphorical framing is paired with local antibiograms, resistance mechanisms (eg, extended-spectrum beta-lactamases, carbapenem-resistant Enterobacterales), and institutional treatment guidelines, it fosters more intuitive, site-specific, and responsible prescribing habits.

Making It Memorable: Humor and Voice in Teaching

Humor is not always a distraction—it can be a valuable teaching tool. Cognitive science suggests that humor improves attention, reduces anxiety, and increases the likelihood of encoding information into long-term memory. Moreover, a distinct teaching voice—marked by narrative and use of analogies or pop culture references—makes material relatable and memorable. Humor can defuse tense teaching moments, foster rapport, and allow learners to admit knowledge gaps. However, humor should be constructive, inclusive, and tied to content. For example, comparing biofilms to "bacteria crashing a party"—where microbes do not just show up uninvited but also bring friends, take over the dance floor, and change the house rules through quorum sensing—can help learners retain the key concepts. When used thoughtfully, humor not only lightens the emotional load of clinical training but also reinforces complex concepts in memorable and meaningful ways.

Conclusion

Private practitioners play a vital, often underrecognized role in medical education. With access to real patient cases, continuity of care, and fewer institutional silos, they can model critical thinking, ethical reasoning, and practical stewardship in action. By focusing on high-yield content, applying cognitive science, leveraging real-time teaching moments, and incorporating humor and humanity, they can leave lasting educational impacts on trainees. The strategies presented here offer a flexible, evidence-based model for teaching ID in community settings—and for cultivating future ID specialists in the process.

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