OBJECTIVE: To determine the effects of pH on the activity of clinically relevant antibiotics against bacterial uropathogens. Numerous factors affect antibiotic efficacy within the urinary tract including pH. Because human urine can substantially vary from acidic (pH 4.5) to alkaline (pH 8) conditions and can be easily clinically manipulated, it would be a great advantage to better understand the role of pH in antibiotic treatment of urinary tract infection.

MATERIALS AND METHODS: This in vitro study investigated the activity of 24 widely used antimicrobial agents against bacterial strains comprising 6 major uropathogenic species (Escherichia coli, Klebsiella pneumoniae, Proteus mirabilis, Enterococcus faecalis, Staphylococcus saprophyticus, and Staphylococcus epidermidis) over the range of pH 5-8. Standard disk-diffusion and broth-microdilution assays were used. One-way analysis of variance was applied to determine significance (P <.05).

RESULTS: For 18 of the 24 agents, pH was shown to play a significant role in overall inhibitory activity. Although most agents behaved similarly across most or all of the uropathogens tested, several only showed pH-dependent effects against certain organisms. The fluoroquinolones, co-trimoxazole, aminoglycosides, and macrolides all functioned optimally at alkaline pH, whereas the tetracyclines, nitrofurantoin, and many of the β-lactams tested exhibited their highest activity under more acidic conditions. Sulfamethoxazole, oxacillin, amoxicillin and clavulanic acid, vancomycin, imipenem, and clindamycin were largely unaffected by pH.

CONCLUSION: Clinicians should consider the urinary pH of their patients when treating urinary tract infection, especially in complicated scenarios. Future clinical investigations examining urinary pH and antibiotic efficacy may result in the application of decreased antibiotic dosages and regimen durations, potentially reducing antibiotic resistance development.