

# New decision support tool can provide personalized antibiotic treatment recommendations

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A new study led by researchers at the Harvard Pilgrim Health Care Institute developed an algorithm that could greatly reduce use of broad-

spectrum antibiotics in outpatient settings, a step toward reducing antibiotic resistance. The findings will be published online November 4, 2020 in *Science Translational Medicine*.

As discussed by the authors, [antibiotic resistance](#) is a major threat to the practice of medicine and is driven in large part by overuse of antibiotics. Outpatient settings are where the vast majority of antibiotics are prescribed but are also where the fewest tools are available to help prescribers make optimal treatment decisions. This leads providers to prescribe [broad-spectrum antibiotics](#) in response to a real, as well as a perceived, increase in the rates of antibiotic resistant infection. However, use of broad-spectrum antibiotics, which work against a wide range of bacteria, promotes a vicious cycle where overuse further worsens the problem of resistance through a positive feedback loop. An example is urinary tract infection (UTI), which is a very common reason for using antibiotics among outpatients. Despite national guidelines urging the use of narrow-spectrum treatments as first line therapies, the most commonly prescribed treatments are ciprofloxacin and levofloxacin, which are broad spectrum, second line antibiotics associated with a host of adverse events.

Little attention has been paid to developing effective decision support tools for outpatient prescribers. Algorithms have been used for clinical decision support for [infectious diseases](#) since the 1970s but have not yet been widely adopted due to difficulties in integrating them into busy clinical practices. Sanjat Kanjilal, MD, MPH, lead author and Lecturer in Population Medicine at the Harvard Pilgrim Health Care Institute and Harvard Medical School, believes we now have the tools to do better. "Personalized decision support at the point of care may be an effective tool to manage antibiotic prescription for common infectious syndromes," said Dr. Kanjilal. His solution is to use machine learning models to predict the likelihood of antibiotic resistance, and then translate those likelihoods into recommendations that help prescribers

make optimal treatment decisions. "Our study developed a personalized decision support algorithm for UTIs as a solution to the challenge of antibiotic prescription in the era of resistance."

The study used data from the medical records of more than 13,000 women with uncomplicated UTI who received care at two large Boston hospitals between 2007 and 2016. Dr. Kanjilal's team trained their machine learning models to predict the probability of antibiotic resistance to four commonly used treatments, and then developed a novel method to translate those probabilities into decisions that can guide prescribers to avoid ciprofloxacin and levofloxacin to the greatest extent possible, while not resulting in any undue harm to patients.

The team compared the performance of the algorithm to that of clinicians and national guidelines and found that it would have reduced prescription of second-line antibiotics by 67%. At the same time, it also reduced the selection of antibiotics to which a specimen is resistant, by 18%.

Added Dr. Kanjilal, "Integrating these models into outpatient care could play an important role in reducing the use of broad-spectrum [antibiotics](#). Our future work will focus on integrating these clinical decision support tools into provider workflows and evaluating the clinical outcomes using randomized controlled trials."

**More information:** S. Kanjilal at Harvard Medical School in Boston, MA et al., "A decision algorithm to promote outpatient antimicrobial stewardship for uncomplicated urinary tract infection," *Science Translational Medicine* (2020). [stm.sciencemag.org/lookup/doi/ ... scitranslmed.aay5067](https://stm.sciencemag.org/lookup/doi/10.1126/scitranslmed.aay5067)

Provided by Harvard Pilgrim Health Care Institute

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