COMMENTARY

Economic Analysis of Universal Active Surveillance Screening for Methicillin-Resistant *Staphylococcus aureus*: Perspective Matters

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(See the article by McKinnell et al, on pages 2–13.)

Methicillin-resistant *Staphylococcus aureus* (MRSA) has been a dominant healthcare-associated pathogen worldwide—except in some European countries in which a "search and destroy" policy has been implemented that includes active surveillance testing (AST), pre-emptive isolation, and contact precautions (CP).[1] Although AST has reduced MRSA healthcare-associated infections (HAI) in various observational studies, the necessity of universal MRSA AST upon hospital admission in the United States remains controversial among experts.[2] Economic analysis has been adopted to assess the effectiveness and viability of MRSA AST.

In this issue of *ICHE*, McKinnell et al examined the economic impact of universal MRSA AST by comparing the costs of AST/CP with the benefits of preventing consecutive MRSA HAI. Their study design is unique in terms of the additional comparison elements of screening sites (ie, nares only vs nares and oropharynx vs multiple sites) and AST methods (ie, chromogenic agar vs polymerase chain reaction [PCR]). However, we must be cautious when interpreting their results for the following reasons.

The authors suggest that their results can be used to estimate the cost-benefits of universal AST for a hospital with any number of admissions using a simple calculation comprising estimated costs per 10,000 hospital admissions. This is an ambitious generalization. Without defining a specific hospital setting, this analysis cannot represent all hospital types due to variations in hospital characteristics such as MRSA incidence, CP compliance, patient population (eg, severity of illness), and services provided (eg, tertiary care). Although model input parameters were extracted from systematic reviews and parameter uncertainties were handled by sensitivity analysis, the generalizability of results from their model is restricted to hospitals with similar input parameters within the ranges of this study.

Model-based economic analysis is well suited to assist the decision-making process among alternative options given limited resources. However, it can lead us astray if bias affects any part of the modeling structure or its assumptions. In fact, the economic analysis method can be complex, and its results are often presented in a modeler-oriented way that nonexpert audiences may find difficult to follow. Even economic analysis studies on the same intervention (eg, MRSA AST) can yield significantly different results depending on the modeler's choices of (1) decision model structure and (2) weighted value of and method for combining selected costs and outcomes. In fact, one coauthor of this study (Lee) has reported contrary findings.[3] Even more troubling, if modelers had prior beliefs in the positive or negative results of a specific intervention, they might be able to manipulate or may be at risk of unconsciously affecting the economic analysis to support a particular conclusion. Additionally, because of the shortage of high-quality data available for input parameters (eg, costs, probabilities), modelers often use published data or make assumptions based on expert opinions. Therefore, when making decisions based on published economic evaluations, we need to carefully assess the modelers' choice of decision model structure and input parameters before considering any results.

In McKinnell et al, several necessary assumptions implicit in the modeling analysis remain unstated and could benefit from clarification. First, the authors do not specify how their model treated the impact of turnaround time differences in the two featured AST methods (ie, chromogenic agar vs PCR). Although both methods provide rapid turnaround times compared to a conventional microbiological culture with a diagnostic delay of 3–5 days, a Dutch multicenter study reports that a chromogenic-based method is cost-saving compared to two PCR-based methods, resulting in lower costs per test (€2.08 vs €56.22/€69.62) and increased pre-emptive isolation hours (30 vs 19.7/16.1 h).[4] In a pilot study at our hospital,

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University of Pittsburgh Medical Center (UPMC) Presbyterian, changing the routine AST method from chromogenic agar to PCR resulted in a mean decrease of 25.2 hours (42.3 vs 17.1 h) in test reporting.[5] Nevertheless, if results are not acted upon in real time, unanticipated delays in CP can lead to longer unisolated time. Although turnaround time may vary depending on the operating capacity of each hospital's laboratory, the difference in AST methods must be considered in the cost analysis model because the authors assumed that CP were not used pre-emptively; therefore, the theoretical possibility of MRSA transmission from the unisolated MRSA carriers exists while waiting for AST results.

In the authors' model, CP components were not fully reflected. The follow-up AST interval (ie, how often and when) for MRSA carriers under CP during hospitalization may require consideration to reflect a total CP process until patient discharge. Indeed, despite a lack of guidelines on discontinuing CP, a single PCR AST upon admission and a follow-up AST could significantly reduce the number of MRSA CP days.[6] Moreover, management and communication of AST results among healthcare personnel could influence costs and outcomes. For example, by adopting an automated pushed MRSA isolation order, UPMC increased CP implementation within 2 hours of MRSA-positive reporting by 44.2%.[5] Although the authors excluded physician contributions from CP cost calculations because of a separate physician billing system, this exclusion may underestimate total CP costs in hospital settings.

This analysis also included some unresolved issues. First, although extranasal AST detected one-third more MRSA carriers than did nasal-only AST, the value of universal extranasal AST is unclear except for outbreak control, and evidence on the transmissibility of extranasal MRSA carriers compared to nasal carriers is unavailable.[7] Second, the authors regarded the additional hospital stay resulting from MRSA HAI as the opportunity cost of a lost bed-day that could generate revenue. This may be true for hospitals with continuous 100% bed occupancy rates where MRSA isolation would prohibit other admissions; however, under a current diagnosis-related group-based reimbursement system, the lost opportunity to generate revenue due to MRSA-extended hospital stays is improbable. Although the incidence of MRSA HAI can induce longer hospital stays, other confounding factors, such as the less healthy condition of a patient prior to hospital admission, can also extend hospital stays.[8]

Although the authors' attempt to use cost-benefit analysis (CBA) for universal MRSA AST is ambitious and noteworthy, cost-effectiveness analysis (CEA) might be a better approach to provide helpful information such as an incremental cost-effectiveness ratio or willingness to pay to prevent additional MRSA HAI, as the 1993 Panel on Cost-Effectiveness in Health and Medicine recommended CEA rather than CBA for economic analysis in health care.[9]

McKinnell et al report that universal AST is never a cost-saving strategy, contrary to Lee's previously published MRSA AST/CP economic analysis.[3] However, if universal AST provides cost-neutral results or a hospital is willing to pay despite the increased cost, then universal AST may be worth trying. In fact, U.S. hospitals have tried to reduce MRSA HAI incidence and improve patient safety with various interventions for which cost savings was not the primary goal. Under the Centers for Medicare and Medicaid Services policy of no reimbursement for some HAI, hospitals might be able to mitigate reimbursement reductions by providing the AST results of a patient's infection/colonization upon admission.[10] For a highly MRSA-endemic hospital, any intervention can reduce MRSA transmission; however, after lowering MRSA prevalence, AST might be the next considerable intervention to sustainably reduce MRSA.[2] As the Netherlands has kept a low endemic MRSA with a nationwide AST and pre-emptive isolation,[4] if U.S. hospitals adopt universal AST despite a presumed high economic burden, each hospital's economic burden for AST may be decreased, which could initiate a paradigm shift from doubt toward belief in universal AST.

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