

tigate further the relatively poor handwashing rate among medical staff, we recently conducted a similar study in our unit (a dedicated colorectal surgery ward). Over a 3-week period, all of the medical staff's contact with patients on the twice-daily ward rounds was observed. The overall rate of compliance with the departmental hand hygiene policy (which states that hands must be decontaminated immediately before and after every episode of direct patient contact and/or care with either soap and water or alcohol-based gel) was 10% (guidelines were followed during 14 of 140 interactions). Interestingly, the most junior medical staff (ie, senior house officers) appeared to be more compliant with the handwashing guidelines (they followed them during 8 [40%] of 20 patient interactions) than either specialist registrars (who followed the guidelines during 4 [4%] of 103 interactions) or consultants (who followed the guidelines during 2 [12%] of 17 interactions). These results were observed despite the large number of interactions for which bedside alcohol-based gel dispensers were available (136 [97%] of 140).

It is unclear why the rate of hand decontamination is so low in our unit compared with the rate observed in the unit evaluated by Duggan et al.¹ Numerous factors affect adherence to hand hygiene guidelines, although staff in technical specialties such as surgery are recognized to have a poorer rate of hand hygiene compliance than staff in other specialties.² However, our finding that more senior surgical staff are less compliant with hand hygiene guidelines has implications for infection control on surgical wards because junior medical staff are recognized to follow the hand hygiene behavior of senior staff.³ We would, therefore, agree with the suggestion by Duggan et al.¹ that further research is required to investigate the motivating factors for hand hygiene among different types of healthcare workers.

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Use of Microbiologic Findings to Manage Antimicrobials in the Intensive Care Unit

To the Editor—The journal recently published articles by Delit et al.¹ and by Cook et al.² that strongly highlight the need for multidisciplinary approaches to antimicrobial therapy in the fight against the ever-growing antimicrobial resistance of pathogens. Antimicrobial resistance is often due to antibiotic misuse, and therefore local microbiologic findings should contribute to drive a more appropriate treatment of hospital-acquired or intensive care unit (ICU)-acquired infections.

As part of a wider antimicrobial management program implemented since 2003 at Bolzano Central Hospital, a 1,400-bed, public referral hospital in the northeastern part of Italy, we performed an interdisciplinary, interventional program in our 18-bed, general ICU. The aims of the antimicrobial management program were to improve antimicrobial use and to reduce the resistance of pathogens. The most important interventions performed in the antimicrobial management program were (1) withdrawal of antimicrobial prophylaxis for patients in critical condition at the time of admission to the ICU; (2) empirical therapy for patients with suspected ICU-acquired infections, according to protocols based on local epidemiologic data and on pharmacokinetic and/or pharmacodynamic criteria; and (3) subsequent regular tailoring of antimicrobial therapy, according to microbiologic findings, with a commitment to streamlining.

Important variations in antibiotic consumption, measured in defined daily doses per 100 patient-days, have been observed over time: reductions of vancomycin (−73%), teicoplanin (−95%), ceftazidime (−79%), and imipenem (−60%), along with huge increases of oxacillin and antistaphylococcal β -lactams (at least 1,550% for each), from 2003 through 2007. At the same time, we monitored antimicrobial susceptibility in pathogens, recording for each patient admitted to the ICU only 1 isolate recovered within 30 days after admission, from 2002 (taken as a historical comparison) through 2007.³ Some pathogens were analyzed differently than others: *Staphylococcus aureus* was monitored from lower respiratory tract specimens (bronchial and tracheal aspirate and bronchoalveolar lavage) either alone or together with other samples (blood, wound swab specimens, cerebrospinal fluid, and urine) that were collected because of clinical suspicion of infection. Isolates of pathogens belonging to each single species recovered from all specimen types were analyzed together. Pearson regression analysis was used to determine the significance of susceptibility trends.

In the ICU, the percentage of *S. aureus* isolates recovered from lower respiratory tract specimens that were identified as methicillin-resistant *S. aureus* (MRSA) decreased progressively and significantly from 37.5% (95% confidence interval [CI], 29%–47%) in 2002 to 11.5% (95% CI, 6%–20%) in 2007 (–5.2 % per year; $r = -0.99$; $P < .001$); this yields a significant decrease in resistance rates, from 7.2 MRSA isolates recovered per 1,000 patient-days in 2002 to 1.9 MRSA isolates recovered per 1,000 patient-days in 2007 (–0.95 MRSA isolates per 1,000 patient-days; $r = -0.90$; $P = .015$). Also in the ICU, the percentage of *S. aureus* isolates recovered from all specimen types that was identified as MRSA decreased progressively and significantly from 38% (95% CI, 29%–47%) in 2002 to 15.6% (95% CI, 6%–20%) in 2007 (–5.1% per year; $r = -0.99$; $P = .001$), which corresponds to a likewise significant decrease in resistance rates: from 9.3 MRSA isolates per 1,000 patient-days in 2002 to 3.3 MRSA isolates per 1,000 patient-days in 2007 (–1.3 MRSA isolates per 1,000 patient-days; $r = -0.97$; $P = .001$) (Figure). Overall, 39 blood samples yielded *S. aureus*; 18 were MRSA isolates, and 21 were methicillin-susceptible *S. aureus* isolates. Only 9 vancomycin-resistant *Enterococcus faecium* isolates (1 from blood) and 2 *Enterococcus faecalis* isolates were recovered during the 6 years of observation in the ICU (all *E. faecium* and *E. faecalis* isolates had VanA phenotype); no vancomycin-intermediate *S. aureus* or vancomycin-resistant *S. aureus* isolates were recovered.

For all non-ICU wards, a more modest decrease in the rate of recovery of methicillin-resistant isolates, from 44% (95% CI, 35%–53%) in 2002 to 36% (95% CI, 28%–44%) in 2007, was observed; however, the decrease occurred only for *S. aureus* isolates recovered from lower respiratory tract speci-

mens (–2.08 % per year; $r = -0.81$; $P = .05$) and not for *S. aureus* isolates recovered from other specimen types.

Despite a remarkable decrease in antipseudomonal drug consumption (ie, –93% for amikacin and –45% for ciprofloxacin), the percentage of *Pseudomonas aeruginosa* isolates recovered from all specimen types that was resistant to such drugs decreased only slightly, but the small size of the sample (428 *P. aeruginosa* isolates overall) does not allow a reliable statistical analysis.

The percentage of *Escherichia coli* isolates that represented extended-spectrum β -lactamase (ESBL)–producing *E. coli* showed no clear trend of change (overall, of 532 *E. coli* isolates, 58 were ESBL-producing isolates). In 2002, the percentage of *E. coli* isolates that was ESBL producing was 6.1%; in 2003, 7.8%; in 2004, 16.3%; in 2005, 11.0%; in 2006, 9.6%; and in 2007, 13.7%. Polymerase chain reaction examination of 106 ESBL-producing *E. coli* isolates collected from 2005 through 2007 from patients in various hospital wards (including 2 patients in the ICU) revealed that 94 (89%) were positive for *bla*_{CTX-M} and that all but 1 of these belonged to *bla*_{CTX-M} group 1.⁴ Of 173 *Klebsiella pneumoniae* isolates, only 18 were ESBL producing; of 107 *Klebsiella oxytoca* isolates, only 13 were ESBL producing. Finally, from 2005 through 2007, 24 VIM-1 metallo- β -lactamase–producing Enterobacteriaceae isolates were recovered from patients in all hospital wards (1 *K. pneumoniae* isolate and 1 *K. oxytoca* isolate were recovered from ICU patients).⁴

The implementation of the antimicrobial management program, through microbiologic surveillance and a pharmacokinetic-driven and/or pharmacodynamic-driven approach to antimicrobial therapy, yielded an impressive re-

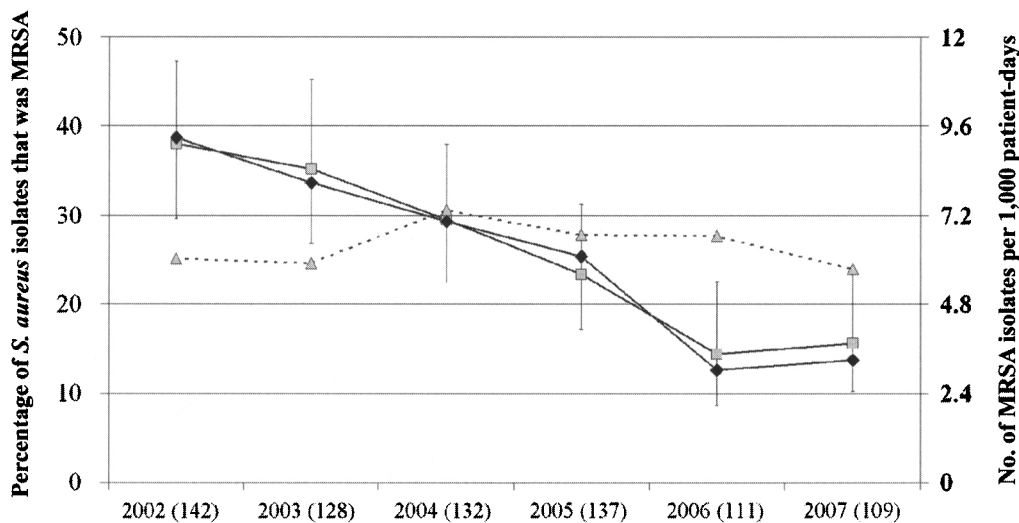


FIGURE. Comparison of the rate of recovery of methicillin-resistant *Staphylococcus aureus* (MRSA) isolates in the intensive care unit (ICU) and in the non-ICU wards during the period 2002–2007. Squares, Percentage of all *S. aureus* isolates recovered from patients in the ICU that were MRSA; triangles, percentage of all *S. aureus* isolates recovered from patients in all non-ICU wards that were MRSA; diamonds, no. of MRSA isolates recovered per 1,000 patient-days in the ICU. The number in parentheses corresponds to the total no. of *S. aureus* isolates, and the error bars show 95% confidence intervals.

duction in MRSA prevalence in our ICU. The results for gram-negative pathogens did not show statistically significant variations, but the total number of isolates of these bacterial species was relatively low. Moreover, the program led to a remarkable containment of drug expenditure. Indeed, despite a similar number of patients receiving therapy and despite a greatly increased consumption of last-generation, expensive drugs in the most recent years, the overall cost of antibiotic acquisition did not increase (€109,627 in 2002 vs €115,492 in 2007).

These results confirm that an integrated and multidisciplinary stewardship program may contribute to the optimal use of currently available antimicrobial agents and can strongly help reduce antimicrobial resistance in the ICU.

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