from 16 in 2009 to 6 in 2010 and finally to 2 in 2011. Independent of CVC bundle implementation and antibiotic coated CVCs, this was achieved primarily by implementing key infection control interventions, that is, avoiding drawing blood cultures through CVCs, and by decreasing dwell times.[3-5]) Keeping CLABSI rates to a minimum, but not zero, is reasonable and attainable as our experience shows.

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## Antimicrobial Stewardship on the Frontier: A Pilot Study of Training Using an Electronic Learning Network

*To the Editor*—Rural hospitals in the United States often care for elderly patients who may prefer to stay in their communities for acute and long-term care. The challenges of delivering high-quality care are complicated by limited access to subspeciality experts, including those skilled in antimicrobial stewardship.[1] Antimicrobial stewardship programs originated in large academic healthcare centers, but extension of stewardship to community hospital settings and rural areas is a pressing need.[2]

The Extension for Community Health Outcomes (ECHO) model at University of New Mexico (UNM) Health Sciences Center has demonstrated effectiveness in training primary care providers at distant sites in the management of complex diseases.[3] In New Mexico, 14 of 33 counties are designated rural (6–39 persons per square mile) and 15 are frontier (less than 6 persons per square mile). We used the ECHO technology and concept to deliver a curriculum in antimicrobial stewardship to a group of rural hospitals and surveyed the participants 3 months after the conclusion of the program.

We recruited rural and frontier hospitals to participate in a curriculum on antimicrobial stewardship using the videoconferencing technology provided by the ECHO network. The curriculum consisted of 7 lecture sessions delivered over 14 weeks from March to June 2011, supported by electronic materials, including guidelines, links to open-access literature, and order sets, made available to the participants through a web-based link or via electronic mail. Each session consisted of a lecture with question-and-answer sessions and opportunity for all participants to share their own interventions. Teams were linked together and to the faculty in Albuquerque by desktop computer cameras and microphones, which allowed participants to see and interact with each other as well as faculty. A diverse faculty of infectious diseases physicians, antimicrobial pharmacists, and clinical microbiologists participated. Topics covered included making the case for stewardship, key formulary interventions, developing clinical guidelines, reviewing individual orders, working with the microbiology laboratory and infection control staff, and measuring the impact of the program. Three months after the end of the curriculum, the participating teams were surveyed using an electronic survey to assess the impact of the curriculum on their facilities as well as barriers encountered in accessing the curriculum. The study was approved by the UNM Institutional Review Board.

Four hospitals were recruited to the training program. The hospitals had 22, 25, 91, and 106 beds; 1 hospital had critical access designation. Three hospitals were in rural counties, and 1 was in a frontier county. Responses to the assessment section of the survey are shown in Table 1. At the beginning of the curriculum, 1 of the 4 hospitals had an antimicrobial stewardship team (AST). None of the hospitals required an indication on antimicrobial orders, and none added this element. Three months after the end of the curriculum, 1 hospital had added an AST; both teams included a physician, pharmacist, laboratory technician, and infection preventionist. Two hospitals were planning to create teams. Two of 4 hospitals reviewed selected antimicrobial orders prior to the

TABLE 1. Number of Participating Hospitals with Element of Antimicrobial Stewardship in Place prior to the Curriculum, Implemented or Expanded during or after the Curriculum, and Planned for Implementation at the Time of the Assessment Survey and Percentage of Total Elements Implemented or Planned

| Antimicrobial stewardship element | In place prior to curriculum | Implemented during or after the curriculum | Expanded during or after the curriculum | Planning to add this element at time of survey |
|---|---|---|---|---|
| Antimicrobial stewardship team | 1 | 1 | 0 | 2 |
| Regular review of selected antimicrobial drug orders | 2 | 0 | 1 | 2 |
| Review of antimicrobial therapy for patients with selected organisms in blood culture | 2 | 1 | 1 | 1 |
| Dissemination of antibiograms to medical staff | 3 | 1 | 1 | 0 |
| Indication required for all antibiotic orders | 0 | 0 | 0 | 0 |
| % of elements implemented | 40 | 15 | | 25[a] |

[a] Planned implementation.

curriculum, and 2 were planning to add this element 3 months later. Two hospitals reviewed selected positive blood cultures for antibiotic appropriateness prior to the curriculum, 1 added this intervention, and another expanded the scope of this review. Three disseminated antibiograms to the medical staff at baseline, 1 expanded this intervention, and the fourth added this intervention during or after the curriculum. Barriers included bandwidth in rural areas and the availability of information technology support at the facilities to achieve full connectivity. One facility used e-mailed materials and conference calls instead of videoconferencing and was successful in implementing a new team. Firewalls were also a barrier; 1 participant elected to follow the curriculum from home to avoid firewall problems. Among the 3 facilities without an AST at baseline, 2 reported that "learning what other facilities were doing," "hearing questions from other participants," and "learning how other facilities had solved problems" were "very useful" aspects of the program.

Our survey showed that 3 months after participation in an interactive distance curriculum, 4 rural hospitals increased antimicrobial stewardship activities by 38% and were planning to implement more elements of stewardship to cover 80% of the elements measured. The feasibility of antimicrobial stewardship in a rural healthcare setting was demonstrated by 1 participant who had already established a team.[4,5] The example of such "positive deviants" is a powerful force for change in resource-poor environments.[6] Critical-access hospitals comprise over a quarter of U.S. acute care facilities and are, by definition, no larger than 25 beds and geographically remote, with limited subspeciality support and health information technology resources.[1] Our 2 smallest hospitals did not implement an AST during the curriculum but were planning implementation. Our study did not examine long-term sustainability or outcomes among the participants. While national meetings and pharmacy societies may offer certifications in antimicrobial stewardship, funding and time for rural hospital staff to attend such programs may be limited. We found a means of providing speciality training to antimicrobial stewardship teams at their desks and fostering a peer-to-peer dialogue spanning hundreds of miles. Performance measures for antimicrobial stewardship have been proposed and may be required for hospital certification.[7] This requirement may accelerate change at smaller hospitals. Electronic media, if adequately supported, can provide the platform for formal training and exchange of ideas between rural hospitals as they expand their stewardship activities.

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