The Wisconsin Veterans Home is a 721-bed skilled facility with four buildings and 14 nursing units (50-60 beds). Annual mortality is 17.4%. The home has an on-site bacteriology laboratory open 45 hours per week. The laboratory has strict policies for plating specimens. Approximately 650 clinical cultures are performed each year. All cultures are entered into a database. Every month, culture isolates from the previous 2 months are displayed for each of the 14 nursing units, stacked by bacterial species and date, with antibiotic sensitivity. This printout is examined by the medical director to identify clusters of identical bacterial species and sensitivity. Although this process is based only on reasonable judgments and may identify clusters that are not genetically related, the purpose of reporting a cluster is to initiate an investigation of possible transmission. Common-source transmission was thought to be more likely when rooms on the same 13- to 17-bed wing were involved or if the organism was unusual. An expected 2-month isolation rate per nursing unit was calculated from 12-month facilitywide (14 nursing units) rates to help gauge the possibility of chance occurrence (ie, N isolates in facility over 12 months ÷ by 14 nursing units ÷ by 6, as there are six 2-month periods/12 months). Between February 1999 and October 2000, 12 clusters were identified. We referred five clusters of only two organisms for investigation because they were unusual organisms and occurred on the same 13- to 17-bed wing, although perhaps a cluster of at least three isolates should be required to improve specificity at the expense of sensitivity. Three clusters were unique because the residents shared two organisms, an observation that strengthens the likelihood of a common source. All clusters included residents who shared living space and caregivers with isolates within 2 months. Transmission could occur between nursing units (within a wider space) or require a longer time span to appear (ie, the time between colonization and culture of infected secretions may be longer than 2 months). Full validation of our technique would require genetic analysis of isolates and more precise epidemiological investigations.

We present three clusters involving *Pseudomonas aeruginosa*. Cluster 1 involved three individuals, two with Foley catheters. A number of investigators have noted clustering of gram-negative bacterial species from urinary catheters in nursing homes.[3] Cluster 2 involved the only two ciprofloxacin-resistant *Pseudomonas* strains isolated that year in the entire 721-bed facility. The residents socialized directly and lived on the same 15-bed wing. Cluster 3 included three individuals who shared two organisms, *P aeruginosa* and β-hemolytic *Streptococcus* (not group A).

The clusters were referred to the director of nursing on a preprinted form that asked:

1. Do the residents have direct contact (on the nursing unit, socializing, activities, meals, etc)?
2. How much staff assistance in the activities of daily living do the patients require?
3. At what level do the residents share staff: registered nurse, licensed practical nurse, nursing assistant, therapists, volunteers?
4. How high is the likelihood of transmission directly between residents or via staff members?

The nursing supervisors believed that the inquiries were helpful, impressed caregivers with the importance of good technique, and led to improved secretion containment when resident-to-resident transmission seemed likely.

The technique presented does not replace tracking infection syndromes. Stevenson stated, "The variability of . . . LTCF-acquired infection (syndrome) rates can be confusing and may offer little value to an individual facility attempting to understand the significance of its infection rates."[1] It is our impression that substantial effort is expended on this type of reporting, often with little payoff. However, tracking infection syndromes is critical to the identification of explosive outbreaks (ie, viral respiratory or enteric infections). Rates of infection syndromes reflect transmission, as well as the burden of resident disability (eg, aspiration, malnutrition, immobility). There is a place for interventions to prevent transmission, as well as interventions to prevent the individual from becoming infected with endogenous flora. Increasing or outlier rates of pneumonia (not readily explained by case mix) could direct a facility toward quality improvement in areas such as vaccination, respiratory therapy, swallowing interventions, and dental care, or in the case of increased rates of urinary tract infections, toward portable bladder ultrasound determinations and increasing fluid intake.

In the vast majority of cases, it is easy to get away with poor technique. The identification of clustered bacterial isolates in time (over 2 months) and space (on a 50- to 60-bed nursing unit or 13- to 17-bed wing) provides a strong and specific reminder to staff that bacterial pathogens may be transmitted between individuals. This prompts staff members to review their secretion techniques, as well as basic hygiene maintenance by and for residents in public areas (ie, assisted hand washing and extra environmental cleaning). These simple techniques are within the resources of many nursing homes and deserve further study.

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Paul J. Drinka, MD
Cathy Gauerke, MT
J. Todd Faulks, RPh
Wisconsin Veterans Home
King, Wisconsin

Incidence and Mortality of Proven Invasive *Candida* Infections in Pediatric Intensive Care Patients

To the Editor:

Invasive *Candida* infections represent a clinical challenge in critically ill patients, with a growing incidence over recent years[1]; huge increases have been reported in preterm infants[2]. These infections carry a significant morbidity and mortality,[1,3] as well as an increasing cost and length of intensive care unit and hospital stay.[4] In children, epidemiological studies on candidiasis have focused

mainly on patients with neoplasia and neutropenia and also in newborns and preterm infants.[2] There are few reports in the literature that specifically address the risk of children other than neonates acquiring invasive candidiasis, although older children have been included among pediatric liver transplant recipient series, and some of the reported series included both neonates and older children.[5]

To determine the current incidence and mortality of invasive *Candida* infections in critically ill children, we conducted a prospective, observational, multicenter study. We evaluated 116 episodes of confirmed invasive *Candida* infection from 109 critically ill children, aged between 1 month and 16 years, during a 2-year period (May 1996-April 1998) in 20 pediatric ICUs (PICUs) from Spain. These units are comparable in terms of patient population; they had a total of 203 beds, and a total of 16,786 admissions were recorded during the study period.

Inclusion criteria included proven invasive *Candida* infections (defined as histo- or cytochemistry showing yeast cells or pseudohyphae from a needle aspiration or biopsy, excluding mucous membranes, or positive culture obtained by a sterile procedure from a normally sterile and clinically or radiologically abnormal site consistent with infection, excluding urine, sinuses, and mucous membrane) or candidemia (defined as positive *Candida* blood culture in a patient with temporally related clinical signs and compatible symptoms). When included, each patient was followed until hospital discharge or death.

The calculated incidence of confirmed invasive *Candida* infections was 0.69 cases per 100 PICU admissions. Mean age of children was 4.8±5.3 years (range, 1 month to 16 years; median, 4 years), without gender bias. No differences in rates were detected by age strata. The most frequent underlying diseases were hematological diseases and neoplasia in 38 cases (33%), cardiac defects and other congenital anomalies in 37 (32%), transplant in 16 (14%), neurological disturbances in 13 (11%), infectious diseases in 9 (8%), and other conditions in 3 (3%). Etiological agents were *Candida albicans* in 56 cases (48%), other identified *Candida* species in 35 (30%; 22 *Candida parapsilopsis,* 6 *Candida glabrata,* 5 *Candida tropicalis,* 1 *Candida lipolitica,* 1 *Candida krusei),* and unidentified *Candida* species in 23 (20%). In 2 instances (2%), 2 *Candida* species (*albicans+parapsilopsis* and *tropicalis+krusei*) were present. Overall, mortality of these patients was 22% (26 cases), and the attributable mortality from invasive candidiasis, estimated by the attending pediatrician in each case, was 5% (6 patients).

The epidemiology of nosocomial invasive *Candida* infections has changed significantly in recent years; the incidence has increased, and a shift toward non-*albicans* species has been detected.[1,2] New at-risk populations have been identified, including surgical, critically ill, and preterm patients,[1,2,5] but until now few data related to children, other than neonates admitted to PICUs, were available.[5] Our study has quantified in a prospective way the crude incidence and mortality of invasive candidiasis in such a population in Spain. The reported incidence of these infections was very variable, depending on the patients and geographical area studied. In critically ill adults, rates had a wide range, from 0.2 to 1.6 cases per 100 admissions,[1] and, in preterm infants, incidences as high as 2.8 per 100 admissions were reported.[2] Our estimated incidence of 0.69 cases per 100 PICU admissions compares with that reported in adult patients and reflects the importance of invasive infections caused by *Candida* species in critically ill children. The impact of invasive candidiasis in terms of mortality is also variable depending on the study population; reported mortality rates range from 25% to 65%.[1,3] We found a crude mortality rate of 22%, which can be considered quite low when compared with available data, mainly from adults series, and which is influenced by factors such as underlying disease, localization of infection, and species of *Candida.* The mortality directly attributable to the *Candida* infection should be a more interesting endpoint of studies, but an objective way to ascertain this was lacking, and we had to rely on the subjective opinion of the physician responsible for each patient. In our study, 5% of deaths were attributed to the fungal infection, a rate located in the low margin of the values from 6% to 40% reported in other populations.[1-3] In conclusion, our data add information to the epidemiology of fungal infections in critically ill children, a quite special subset of patients, clearly different from adults, oncology subjects, and newborns. We think our results could be useful to design adequate infection control and treatment strategies in this field.

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Antonio Rodríguez-Núñez, MD, PhD
Hospital Clínico Universitario de Santiago
Santiago de Compostela, Spain
The Fungal Infections Study Group of the Spanish Society of Pediatric Intensive Care