RESEARCH BRIEFS

Device-Related Infections in Home Health Care and Hospice: Infection Rates, 1998–2008

In 2001, Dr William Jarvis aptly noted that the United States was undergoing a revolution in healthcare delivery systems, with a shift from care being delivered in acute care hospitals to care being delivered by a mixture of acute care hospitals, outpatient and ambulatory clinics, long-term care facilities, and home care.[1] He also noted that the fastest growing segment of healthcare delivery was the home care business. An estimated 1.2 million infections occur annually in approximately 8 million adult and pediatric home healthcare patients in the United States.[2] Despite the growing importance of home care and need for surveillance of healthcare-associated infections, draft definitions for surveillance of infections in home health care were not published until 2000 by the Association for Professionals in Infection Control and Epidemiology (APIC),[3] and final consensus definitions were not published until 2008 by APIC and the Healthcare Infection Control Practices Advisory Committee.[4] However, despite the use of standard definitions, the diagnosis of infections in nonhospital settings can be difficult because of a lack of direct physician assessment and the paucity of microbiologic data.

Only limited data have been published on the frequency of infections in patients who are cared for at home.[5-8] Limitations of the current data include failure to use standard definitions of healthcare-associated infection, lack of data obtained over multiple years, and failure to calculate rates of device-related infections as cases per 1,000 device days. Here we report data collected by the Department of Hospital Epidemiology of the University of North Carolina Health Care System during 11 years in the hospital's home healthcare agencies and during 10 years in the hospice program.

Hospice patients resided at home or in other facilities (eg, nursing homes or assisted living facilities). The University of North Carolina Health Care System does not operate an inpatient or free-standing hospice facility. Possible cases of healthcare-associated infection were ascertained by home healthcare nurses who had received training by the infection control staff. The cases were then reviewed by infection con-

TABLE. Rates of Central Line–Associated Bloodstream Infection (BSI) and Urinary Catheter–Associated Urinary Tract Infection (UTI) by Type of Home Care and Year, 1998–2008

	Central line–associated BSI			Urinary catheter–associated UTI		
Type of care and year	No. of patients	Cases per 1,000 device-days	No. of cases / no. of device-days	No. of patients	Cases per 1,000 device-days	No. of cases / no. of device-days
Home health						
1998	54	0.00	0/1,060	72	4.22	8/1,897
1999	179	0.73	2/2,756	218	3.61	16/4,434
2000	216	0.66	3/4,536	195	2.18	5/2,295
2001	60	0.00	0/1,161	49	0.00	0/1,402
2002	124	0.42	2/4,801	46	0.16	1/6,295
2003	81	0.00	0/3,477	51	0.79	3/3,781
2004	216	0.13	1/7,605	72	1.04	5/4,823
2005	175	0.00	0/5,233	70	1.60	7/4,363
2006	83	0.19	0/1,205	104	1.04	7/6,738
2007	31	0.00	0/1,205	49	0.32	1/3,166
2008	72	0.00	0/3,136	79	0.00	0/3,688
Hospice						
1999	4	0.00	0/31	26	2.35	1/426
2000	13	0.00	0/308	49	0.00	0/556
2001	8	0.00	0/124	24	0.00	0/321
2002	22	0.00	0/885	39	1.43	1/698
2003	22	0.00	0/731	56	2.31	2/698
2004	21	0.00	0/590	32	0.00	0/567
2005	16	0.00	0/535	38	2.46	2/813
2006	24	0.00	0/823	44	0.97	1/1,034
2007	24	0.00	0/729	39	0.00	0/635
2008	23	0.00	0/599	39	0.00	0/684

trol staff on the basis of definitions of nosocomial infections from the Centers for Disease Control and Prevention.[9] Patients were screened for possible infection on every home health care or hospice visit. Rates are reported as infections per 1,000 device days. Confidence intervals (CIs) were calculated using a Poisson distribution because of the small numerators. Comparison of device-related infection rates between home health care and hospice was calculated using a 2-tailed Fisher exact test. Time trends were calculated using simple linear regression (least-squares method).

We report our data on central line–associated bloodstream infections (BSIs) and catheter-associated urinary tract infections (UTIs) collected from 1998 through 2008 in home health care and from 1999 through 2008 in hospice (Table). The overall rate (infections per 1,000 device days) of central line–associated BSI in home healthcare patients was 0.22 (95% CI, 0.0–4.14) (9 infections per 40,763 catheter-days). The rate of catheter-associated UTI was 1.24 (95% CI, 0.6–5.98) (53 infections per 42,882 catheter-days). The overall rate (infections per 1,000 device days) of central line–associated BSI in hospice patients was 0 (95% CI, 0.0–2.99) (0 infections per 5,355 catheter-days). The rate of catheter-associated UTI was 1.06 (95% CI, 0.03–5.68) (7 infections per 6,599 catheter-days).

No national data are available against which we can benchmark home health care or hospice data. The most recent report from the National Healthcare Safety Network (NHSN) reported that in rehabilitation units, the rate of central line–associated BSI was 0.5 infections per 1,000 device days and the rate of catheter-associated UTI was 16.8 infections per 1,000 device days.[10] The rates reported from our home care and hospice care were below the rates reported by NHSN for intensive care units, medical wards, and rehabilitation units.

An analysis of our data revealed that the lower rates for central line–associated BSI and catheter-associated UTI reported for hospice patients than for home healthcare patients were not significantly different ($P > .05$, 2-tailed Fisher exact test). Further analysis revealed decreases in the rates of central line–associated BSI (slope, -0.042; $P = .12$) and catheter-associated UTI (slope, -0.31; $P = .016$) among home healthcare patients over the 11-year time frame, 1998–2008 (Figure). The rate of catheter-associated UTI (slope, -0.94; $P = .47$) decreased over the 10-year time frame, 1999–2008 (Figure). Only the rate of decrease in catheter-associated UTI in home healthcare patients was statistically significant. We believe that the most likely reason for the decreasing rates was improved infection control in the insertion and maintenance of the catheters.

In summary, our 11-year surveillance of central line–associated BSI and catheter-associated UTI in home health care and hospice patients revealed that very low rates of device-related infections occur in these patient care settings, compared with rates reported in hospitalized patients. The rates of device-related infection in home healthcare patients and

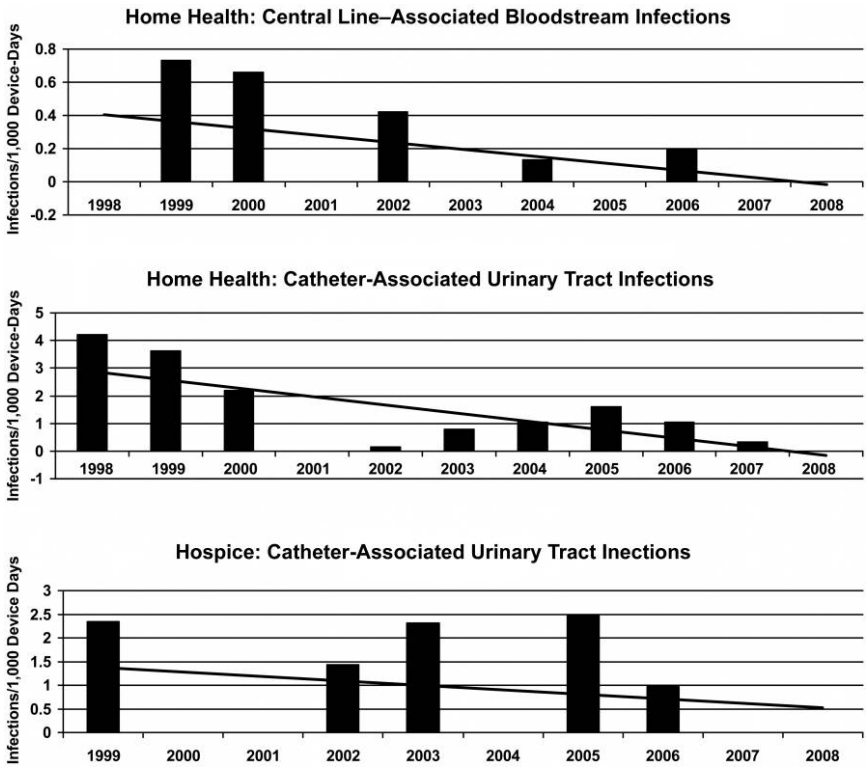

FIGURE. Device-associated infection rates in home healthcare and hospice patients during the 11-year study period.

hospice patients were not significantly different. Finally, as has been noted in acute care hospitals, the rates of device-related infections are decreasing.

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REFERENCES

1. Jarvis WR. Infection control and changing health-care delivery systems. *Emerg Infect Dis* 2001; 7:170–173.
2. Manangan LP, Pearson ML, Tokars JI, Miller E, Jarvis WR. Feasibility of national surveillance of health-care-associated infections in home-care settings. *Emerg Infect Dis* 2002; 8:233–236.
3. Embry FC, Chinnes LF. Draft definitions for surveillance of infections in home health care. *Am J Infect Control* 2000; 28:449–453.
4. Association for Professionals in Infection Control and Epidemiology (online). Surveillance Definitions, Reports and Recommendations. Available at: http://www.apic.org/AM/Template.cfm?Section = Surveillance_Definitions_Reports_and_Recommendations&Template = /CM/HTMLDisplay.cfm&ContentID = 10428. Accessed January 12, 2009.
5. White MC, Ragland KE. Surveillance of intravenous catheter-related infections among homecare clients. *Am J Infect Control* 1994; 22:231–235.
6. Rosenheimer L, Embry FC, Sanford J, et al. Infection surveillance in homecare: device-related incidence rates. *Am J Infect Control* 1998; 26: 359–363.
7. Friedman ND, Kaye KS, Stout JE, et al. Health care-associated bloodstream infections in adults: a reason to change the accepted definition of community-acquired infections. *Ann Intern Med* 2002; 137:791–797.
8. Gorski LA. Central venous access device outcomes in a homecare agency: a 7-year study. *J Infus Nurs* 2004; 27:104–111.
9. Garner JS, Jarvis WR, Emori TG, Horan TC, Hughes JM. CDC definitions for nosocomial infections, 1988. *Am J Infect Control* 1988; 16:128–140.
10. Edwards JR, Peterson KD, Andrus ML, Durdeck MA, Polluck DA, Horan TC. National Healthcare Safety Network (NHSN) report, data summarized for 2006 through 2007, issued November 2008. *Am J Infect Control* 2008; 36:609–626.

Use of Peripherally Inserted Central Catheters to Prevent Catheter-Associated Bloodstream Infection in Children

Bloodstream infection (BSI) is the most common healthcare-associated infection in pediatric intensive care units (ICUs).[1,2] Risk factors for central venous catheter (CVC)–associated BSI are poorly understood in middle-income developing countries. We used a prospective cohort study design to evaluate the infection rate and risk factors for BSI associated with short-term use (duration, less than 30 days) of a CVC in a pediatric hospital in Rio de Janeiro.

The Instituto de Puericultura e Pediatria Martagão Gesteira (IPPMG) is a tertiary care pediatric hospital with 60 beds in 6 wards. This is a reference center for patients requiring specialists in multiple diseases and admits patients aged 0–18 years. Because there is no pediatric ICU, patients with critical conditions are admitted to the wards.

All patients admitted to the wards from March 2003 through March 2006 who had a short-term CVC inserted at the IPPMG were monitored daily by the infection control team for development of CVC-associated BSI. A structured questionnaire based on National Nosocomial Infection Surveillance System criteria was used for active surveillance.[3] If a patient had multiple CVCs in place simultaneously, 1 catheter-day was assigned for each day of multiple CVC use, and the first catheter placed was used for surveillance purposes. CVCs inserted at another hospital, CVCs in place before admission to the wards, and CVCs placed for less than 1 day were excluded from analysis in this study.

Peripherally inserted central catheters (PICCs) were inserted by a nurse, and other CVCs for short-term use (ie, those placed in the subclavian, intrajugular, and femoral veins) were inserted by surgeons. Before catheter insertion, 4% chlorhexidine-germicide solution and 0.5% chlorhexidine-alcohol solution were used to prepare skin. After insertion, 5% chlorhexidine-alcohol solution was applied, and dressings were monitored by nursing staff. Conventional gauze dressings were applied to CVCs and were replaced with new dressings every 48 hours. Transparent dressings were applied to PICCs and were changed if bleeding and soiling occurred or if they did not stay in place.

CVCs (PICCs or conventional catheters) were removed immediately if patients showed signs of local infection or, for febrile patients, if their fever had no explanation other than local infection. The 5-cm portion of the tip of each CVC removed because of suspected infection was sent to the microbiology laboratory for culture; 2 samples of peripheral blood from the corresponding patient were also sent for culture.[4] Patients were observed for up to 48 hours after CVC removal.

Data analyses were performed using Stata, version 9.0