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National Kidney Month — March 2012

March is designated National Kidney Month to raise awareness about kidney disease prevention and early detection. In 2010, kidney disease was the eighth leading cause of death in the United States (*1*). Approximately 20 million U.S. adults aged ≥20 years have chronic kidney disease (CKD), and most of them are unaware of their condition (*2,3*). If left untreated, CKD can lead to kidney failure, requiring dialysis or transplantation for survival (*2,4*). Among persons on hemodialysis because of kidney failure, the leading causes of hospitalization are cardiovascular disease and infection (*4*).

CDC, in collaboration with partner agencies and organizations, [illegible] created the *National Chronic Kidney Disease Fact* [illegible] and is establishing a national CKD surveillance [illegible] to document and monitor the burden of CKD in the United States. Diabetes and high blood pressure are major risk factors for CKD, but controlling diabetes and blood pressure [illegible] prevent or delay CKD and improve health outcomes (*2*).

Information about kidney disease prevention and control is available at http://www.nkdep.nih.gov. Information about CDC's Chronic Kidney Disease Initiative is available at http://www.cdc.gov/diabetes/projects/kidney.htm.

References

1. Murphy SL, Xu JQ, Kochanek KD. Deaths: preliminary data for 2010. Natl Vital Stat Rep 2012;60(4).
2. CDC. National chronic kidney disease fact sheet 2010. Atlanta, GA: US Department of Health and Human Services, CDC; 2010. Available at http://www.cdc.gov/diabetes/pubs/factsheets/kidney.htm. Accessed March 5, 2012.
3. Plantinga LC, Boulware LE, Coresh J, et al. Patient awareness of chronic kidney disease: trends and predictors. Arch Intern Med 2008;168:2268–75.
4. US Renal Data System. USRDS 2011 annual data report: atlas of chronic kidney disease and end-stage renal disease in the United States. Bethesda, MD: National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases; 2011. Available at http://www.usrds.org/adr.aspx. Accessed March 5, 2012.

Reducing Bloodstream Infections in an Outpatient Hemodialysis Center — New Jersey, 2008–2011

Patients undergoing hemodialysis are at risk for bloodstream infections (BSIs), and preventing these infections in this high-risk population is a national priority (*1*). During 2008, an estimated 37,000 BSIs related to central lines occurred among hemodialysis patients in the United States. This is almost as many as the estimated 41,000 central line–associated BSIs that occurred during 2009 among patients in critical-care units and wards of acute-care hospitals. In 2009, to decrease BSI incidence in a New Jersey outpatient hemodialysis center, a package of interventions was instituted, beginning with participation in a national collaborative BSI prevention program and augmented by a social and behavioral change process to enlist staff members in infection prevention. Rates of BSIs related to the patient's vascular access (i.e., access-related BSIs [ARBs]) were evaluated in the preintervention and postintervention periods. The incidence of all ARBs decreased from 2.04 per 100 patient-months preintervention to 0.75 ($p=0.03$) after initiating program interventions and to 0.24 ($p<0.01$) after adding a behavioral change intervention. Only one ARB occurred during the last 12 postintervention months. At this hemodialysis facility, participating in a collaborative prevention program along with implementation of a behavioral change strategy was associated with a large decrease in ARBs. Other outpatient hemodialysis facilities also might reduce ARBs by adopting similar approaches to prevention.

To address BSI prevention in outpatient hemodialysis centers, CDC established the CDC Hemodialysis BSI Prevention Collaborative in mid-2009. As part of this effort, member

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hemodialysis centers report BSIs to the National Healthcare Safety Network and adopt a uniform package of BSI prevention interventions.* Participating facilities also can implement a "positive deviance" approach to social and behavioral change† to engage staff members in these efforts and thereby improve adherence to recommended interventions. A premise of positive deviance is that in most communities or organizations, uncommon (deviant) practices of persons or groups within the organization can yield better (positive) results (e.g., better adherence to recommended practices) than traditional practices of their peers who have access to the same resources (*2*). The process helps members of an organization identify, generate, and diffuse positive deviant practices.

The dialysis unit at AtlantiCare Regional Medical Center is a 12-station, hospital-based outpatient hemodialysis center serving patients in Atlantic City, New Jersey, and the surrounding region. Several interventions already were in place to reduce BSIs before introduction of the prevention program and positive deviance; despite this, BSI incidence remained above facility goals. The facility joined the collaborative in September 2009 and during the next 3 months worked to implement the collaborative's prevention program interventions, which included, in addition to dialysis event surveillance, 1) observation of catheter care and vascular access care, 2) use of chlorhexidine for skin antisepsis, 3) auditing of hand hygiene adherence, 4) patient education and engagement, 5) catheter use reduction programs, and 6) staff member education and competency testing. Program members also participated in monthly telephone conferences and yearly face-to-face meetings that served as a forum for presenting infection prevention topics, sharing best practices, and problem solving.

The positive deviance process was introduced to leaders from the medical center and dialysis center in early 2010. Two identical kick-off sessions were held in August 2010 to orient dialysis staff members and support personnel to positive deviance. After the kick-off sessions, discovery and action dialogue sessions were held (*3*). These sessions were designed to tap the expertise of front-line staff members, identify positive deviant practices and their potential use, and encourage staff members to take personal responsibility for BSI prevention. For example, one nurse used a mnemonic device to achieve near-perfect hand hygiene compliance, which she taught to the other nurses. To assess and promote the progress of initiatives developed by staff members during these discussions, follow-up activities were built into regular staff meetings.

ARBs were measured using Dialysis Event surveillance in the National Healthcare Safety Network. An ARB was defined as a positive blood culture attributed to either the vascular access or an unknown source and collected from a hemodialysis outpatient or from a maintenance hemodialysis patient within 1 day after a hospital admission. Infection rates were reported as events per 100 patient-months and were sequenced for analysis

* Additional information is available at http://www.cdc.gov/dialysis/collaborative/index.html.

† Additional information is available at http://www.positivedeviance.org.

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into three periods: 1) preintervention (January 2008–August 2009), 2) participation in the prevention program (September 2009–July 2010), and 3) participation in the program with positive deviance (August 2010–December 2011). Trends in infection rates over the three periods were analyzed with Poisson regression using the three periods as indicator variables. Two interrupted time series models using Poisson regression were used to evaluate the effect of the two main interventions (i.e., participation in the prevention program and implementation of positive deviance) on ARBs (*4*). The first modeled the pre–prevention program rate trend, the rate change immediately after joining the program, and the difference between pre–prevention program and program rate trends. The second modeled the same rates but also modeled the rate change immediately after implementing positive deviance and the difference between the pre–positive deviance and positive deviance rate trends. Using the Durbin-Watson statistic, neither model appeared to demonstrate autocorrelation (i.e., no significant correlation of adjacent monthly outcomes within each model). To assess adherence to interventions, process measures were monitored for five infection prevention practice categories at least eight times per month. A z-test comparing proportions was performed to determine whether adherence differed with each process measure category before and after implementation of positive deviance.

ARB incidence rates were reported for the preintervention, prevention program, and program with positive deviance periods (Table 1) and compared (Figure). The comparison revealed a significant decrease in ARB from the preintervention to the second postintervention period (2.04 per 100 patient-months to 0.24 per 100 patient-months [$p<0.01$]). For the model using enrollment in the prevention program as the intervention point, monthly ARB incidence did not change before the intervention (incidence rate ratio [IRR] = 1.00, $p=0.94$); at the time of the intervention, the slope of the postintervention monthly ARB incidence did not change significantly, but the IRR suggested a more downward trend compared with the preintervention period (IRR = 0.91, $p=0.08$); and the ARB incidence postintervention decreased approximately 9% per month (IRR = 0.91, $p=0.045$). For the model that used enrollment in the prevention program and positive deviance as two different intervention points, none of the changes reached statistical significance; however, a decreasing trend occurred in the ARB incidence after prevention program enrollment (IRR = 0.85, $p=0.25$), which continued downward at nearly the same rate after the addition of positive deviance (IRR = 1.06, $p=0.75$) (Figure). Changes in adherence rates for the five process measure categories were tracked over the pre– and post–positive deviance periods (Table 2).

What is known on this topic?

In 2008, an estimated 37,000 bloodstream infections (BSIs) related to central lines occurred among hemodialysis patients in the United States. Despite national decreases in BSIs in other health-care settings, the incidence of these infections in dialysis settings does not appear to be decreasing.

What is added by this report?

At one dialysis center, participation in the CDC Hemodialysis BSI Prevention Collaborative, use of collaborative interventions, and introduction of a social and behavioral change process (positive deviance) were associated with significant reductions in BSIs that were related to the patient's vascular access.

What are the implications for public health practice?

Health-care–associated infections, including BSIs, are an ongoing hazard for patients who receive their care primarily as outpatients. Based on the success at this facility and the success of similar programs in other health-care settings, the approach described in this report might be effective in other outpatient dialysis facilities to prevent BSIs.

Reported by

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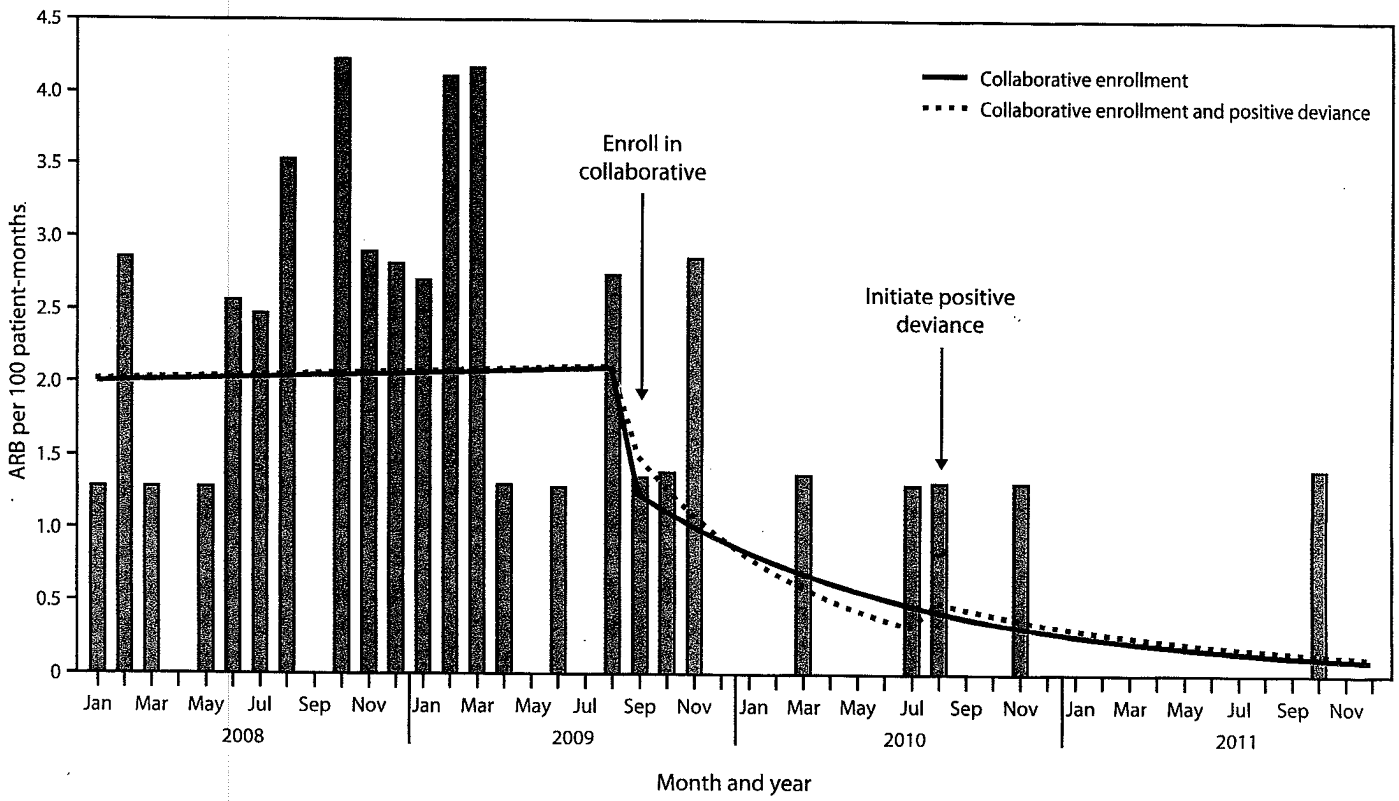
TABLE 1. Incidence rates of all vascular access-related bloodstream infections in an outpatient hemodialysis center across the preintervention and two postintervention periods — New Jersey, 2008–2011

Period	Patient months	Access-related bloodstream infections	Incidence rate (per 100 patient-months)	Incidence rate ratio	p-value
Preintervention (Jan 2008–Aug 2009)	1,518	31	2.04	Referent	Referent
Prevention program (Sep 2009–Jul 2010)	799	6	0.75	0.37	0.03
Prevention program and positive deviance (Aug 2010–Dec 2011)	1,268	3	0.24	0.12	<0.01

FIGURE. Actual access-related bloodstream infection (ARB) incidence per 100 patient-months at an outpatient hemodialysis center and predicted ARB incidence using enrollment in the CDC Hemodialysis BSI Prevention Collaborative (collaborative enrollment) (September 2009) as the intervention, and predicted ARB incidence using collaborative enrollment (September 2009) and addition of a social and behavioral change process (positive deviance initiation) (August 2010) as separate interventions — New Jersey, 2008–2011



Editorial Note

At this outpatient hemodialysis center, use of a package of interventions, combined with a behavioral change intervention (positive deviance), was associated with a decline in ARB incidence. Only one ARB was identified in the final 12 months of the intervention period that included more than 1,200 patient-months. Adherence to process measures that are markers for important infection prevention practices was high and improved after implementation of positive deviance. These results demonstrate the utility of a collaborative prevention program that promotes important prevention practices to decrease BSIs in hemodialysis settings and the potential for a behavioral change strategy, such as positive deviance, to increase adherence to prevention strategies.

BSIs are potentially life-threatening infections sometimes associated with the provision of health care. Preventing these infections is a priority; however, prevention efforts have focused primarily on acute-care facilities. Some patients who receive their care primarily as outpatients, including maintenance hemodialysis patients, also are at risk for BSIs. Nationally, the number of BSIs among hemodialysis patients is substantial. Since 1993, hospitalizations for bacteremia or septicemia have increased 40% among hemodialysis patients (*5*). This increase occurred while the number of BSIs declined in intensive-care units of acute-care hospitals (*1*).

Preventing BSIs can be a challenge in outpatient hemodialysis settings. However, a number of interventions have been recommended for prevention, particularly among hemodialysis patients with central lines (>20% of hemodialysis patients) (*6–8*). The members of this prevention program worked together to identify a package of evidence-based interventions that could be implemented in dialysis centers to prevent BSIs and to develop solutions to the challenges of implementation and sustainability. A similar collaborative approach has been used successfully in intensive-care units to decrease the incidence of central line–associated BSIs (*9*). Effective BSI prevention programs such as this include implementation of evidence-based practices, endorsement by facility leaders, and empowerment of frontline health-care personnel to intercede on behalf of patients when infection control breaches are observed.

TABLE 2. Process measure adherence rates in an outpatient hemodialysis center across two postintervention periods — New Jersey, 2008–2011

	Period				
	Collaborative only		Collaborative and positive deviance		
Process measure	No.*	(%)	No.*	(%)	p-value
Equipment handling†	236/245	(96)	378/380	(99)	0.005
General practice§	1,166/1,190	(98)	1,538/1,546	(99)	<0.001
Medication administration	333/344	(97)	267/269	(99)	0.040
Isolation precautions	84/88	(95)	26/29	(90)	0.240
Dialysis initiation and termination procedures	458/490	(93)	328/332	(99)	<0.001

* Number of observations in which successful practice was observed / total number of observations.
† Included equipment storage and segregation of clean and dirty equipment.
§ Included use of personal protective equipment and disinfection of the treatment station.

Potentially contributing to this dialysis center's success was the use of positive deviance to improve adherence to recommended practices and infection prevention principles. Use of positive deviance or similar interventions has resulted in reductions in health-care–associated infections in other settings (*10*). The significant increases in compliance with infection prevention processes at this facility suggest that positive deviance helped improve staff member attention to important infection control practices.

The findings in this report are subject to at least three limitations. First, results are based on the experience of one dialysis center and might not be generalizable to other centers. Second, each intervention period included only a few months, which diminished the power of the interrupted time series model to detect statistically significant differences. Finally, this evaluation is observational. Because no control group was included, the interventions implemented in this study cannot be attributed definitively as the cause of the decrease in ARBs.

Prevention of health-care–associated infections, such as ARBs among hemodialysis patients, is a public health priority. Prevention efforts at this outpatient hemodialysis center were improved by including strategies for engaging staff members in the infection control process and by collaborating with other facilities to discover practices that can help overcome barriers to prevention. Other outpatient hemodialysis facilities might consider similar approaches to BSI prevention.

References

1. CDC. Vital signs: central line–associated bloodstream infections—United States, 2001, 2008, and 2009. MMWR 2011;60:243–8.
2. Marsh DR, Schroeder DG, Dearden KA, et al. The power of positive deviance. BMJ 2004;329:1177–9.
3. Lindberg C, Norstrand P, Munger M, et al. Letting go, gaining control: positive deviance and MRSA prevention. Clinical Leader 2009;2:60–7.
4. Wagner AK, Soumerai SB, Zhang F, Ross-Degnan D. Segmented regression analysis of interrupted time series studies in medication use research. J Clin Pharm Ther 2002;27:299–309.
5. US Renal Data System. USRDS 2011 annual data report: atlas of chronic kidney disease and end-stage renal disease in the United States. Bethesda, MD: National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases; 2011. Available at http://www.usrds.org/adr.aspx. Accessed March 5, 2012.
6. National Kidney Foundation. KDOQI clinical practice guidelines and clinical practice recommendations for 2006 updates: hemodialysis adequacy, peritoneal dialysis adequacy and vascular access. Am J Kidney Dis 2006;48(Suppl 1).
7. O'Grady NP, Alexander M, Burns LM, et al. Guideline for the prevention of intravascular catheter-related infections. Clin Infect Dis 2011;52:e162–93.
8. Mid-Atlantic Renal Coalition. 2010 Fistula First Breakthrough Initiative annual report. Lake Success, NY: IPRO ESRD Network of New York; 2011. Available at http://www.fistulafirst.org. Accessed February 29, 2012.
9. CDC. Reduction in central line–associated bloodstream infections among patients in intensive care units—Pennsylvania, April 2001–March 2005. MMWR 2005;54:1013–6.
10. Ellingson K, Muder RR, Jain R, et al. Sustained reduction in the clinical incidence of methicillin-resistant *Staphylococcus aureus* colonization or infection associated with a multifaceted infection control intervention. Infect Control Hosp Epidemiol 2011;32:1–8.