Urgent: Stop Preventable Infections Now

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Introduction

In 2009, the US Renal Data System (USRDS) presented trends in rates of hospitalization for cardiovascular disease and infection in the first year of dialysis, 1991–2006 (1), highlighting a marked rise in infection-related hospitalizations and a need for providers and policymakers to address infection complications. Over the subsequent 8 years, recognition of infectious adverse events, particularly bloodstream infections, increased as noted by the Centers for Disease Control and Prevention (CDC) (2). In October 2016, the CDC and the American Society of Nephrology jointly announced an initiative called Nephrologists Transforming Dialysis Safety targeted at reducing infectious complications among patients receiving in-center hemodialysis (3). A series of perspectives articles in the *Clinical Journal of the American Society of Nephrology* will provide important information on infection and infection prevention. This first article in the series focuses on broad areas of infectious morbidity and mortality, with some contrast to cardiovascular disease.

The importance of infectious complication has been highlighted by several investigators. Using data from the Centers for Medicare and Medicaid Services, the Peer Kidney Care Initiative Dialysis Care 2016 report (4) noted changing hospitalization patterns: for the first time, infection-related mortality and hospitalization rates became equal to or exceeded cardiovascular disease–related events in the first year of dialysis. Here, we highlight findings from Medicare freestanding dialysis units with data through 2014. All hospitalization data reported are unadjusted, except as noted for standardized death rates. The unadjusted and adjusted findings are similar as noted in the USRDS 2017 Annual Date Report (5).

Trends in All-Cause, Cardiovascular-Related, and Infection-Related Mortality in the United States

All-cause annual mortality rates declined 27% from 1999 to 2014 (figure 1 at http://www.peerkidney.org/wp-content/uploads/2017/09/CollinsKligerStopPreventableInfectionsFiguresSlides.pdf). The lowest annual percentage reduction in death rates occurred in 2013 and 2014: 1% and 0.8%, respectively. The quarterly death rate trend showed an upturn in 2014, a major change in direction since 2004.

Trends in cardiovascular-related and infection-related death rates show a 19% overall decline in adjusted death rates and a 42% decline in cardiovascular-related death rates but only a 6% decline in infection-related death rates in the first year on dialysis. These trends in the incident population may reflect higher use of catheters at dialysis initiation than in the prevalent population. Prevalent patient 1-year all-cause death rates decreased 31% between 1996 and 2014; cardiovascular-related death rates declined 51%, and infection-related rates declined 40%, the latter an improvement over incident patient first-year infection rates (figure 2 at http://www.peerkidney.org/wp-content/uploads/2017/09/CollinsKligerStopPreventableInfectionsFiguresSlides.pdf).

In 2014, regional cardiovascular-related death rates varied by 25%, ranging from 7.4 deaths per 100 patient-years in the region with the highest rate to 5.5 deaths per 100 patient-years in the region with the lowest rate. In contrast, variation in infection-related death rates was 53%, double the variation for cardiovascular-related deaths (figure 3 at http://www.peerkidney.org/wp-content/uploads/2017/09/CollinsKligerStopPreventableInfectionsFiguresSlides.pdf). Infection-related death rates were particularly high in 2005 in the New England and Mid-Atlantic regions. Infectious complications can arise from many sources, such as vascular access, pneumonia, and bloodstream infections, and environmental factors, such as influenza-like illnesses reported by the CDC under FluView (6), as discussed below.

Morbidity Reported from Hospitalizations, Influenza-Like Illnesses from FluView, and Cause-Specific Complications

Hospitalization rates have been declining slowly since 2005, but a sudden downturn occurred in 2011 (figure 4 at http://www.peerkidney.org/wp-content/uploads/2017/09/CollinsKligerStopPreventableInfectionsFiguresSlides.pdf), coinciding with the warmest winter in decades and a mild influenza season as reported by the CDC and the National Oceanic and Atmospheric Administration (6,7). Additional decline in 2012–2013 coincided with Medicare's Readmission Reduction Metric for hospitals initiated in October 2012 (8).

The USRDS reports an influenza vaccination rate of 65% for patients on dialysis across the United States, representing only vaccinations billed to Medicare (9). However, the type of vaccine used may be an important consideration, because patients on dialysis have generally reduced immune responses exemplified by hepatitis B antibodies from vaccinations; this may provide an opportunity for improved care, at least in a targeted group.

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Hospitalization rates for incident and prevalent dialysis populations are shown in Figure 1. The incident population has had higher infection-related than cardiovascular-related hospitalization rates since 2010. The prevalent population has shown improvement in cardiovascular-related hospitalizations but far less improvement in infection-related hospitalizations, a source of major concern. This is important even as prevalence of dialysis central venous catheter use declines as reported by the USRDS (9). Over the past 15 years, rates of infection-related hospitalizations finally decreased to 1999 levels, but clearly, more progress is needed.

Vascular Access, Bloodstream Infection, and Clostridium Difficile Infection Admissions

Although the hospitalization rates for vascular access infections appear to have decreased, a parallel increase occurred in hospitalizations coded for bacteremia-sepsis or sepsis syndrome (figure 7 at http://www.peerkidney.org/wp-content/uploads/2017/09/CollinsKligerStopPreventableInfectionsFiguresSlides.pdf). It is unclear whether these two trends are inter-related on the basis of hospital coding practices for billing purposes. We did not assess sepsis syndrome separately for patients on hemodialysis and patients on peritoneal dialysis. For more than a decade, patients on peritoneal dialysis have experienced more infection-related hospitalizations and hospital days per year than patients on hemodialysis (5). Pneumonia hospitalization rates have not changed over the past 15 years, a finding requiring greater attention. Risks of pneumonia related to respiratory viral infections are well known, and patients on dialysis with suppressed immunity are particularly vulnerable to secondary pneumonias.

Lastly, clostridium difficile (C. Diff) is an important source of infectious morbidity in the dialysis population. As noted in the 2016 Peer Report (4), C. Diff is an important cause of hospitalization, and the readmission rate reaches 45% within 30 days after discharge, the highest for all primary causes of hospital admissions. Because C. Diff infections are

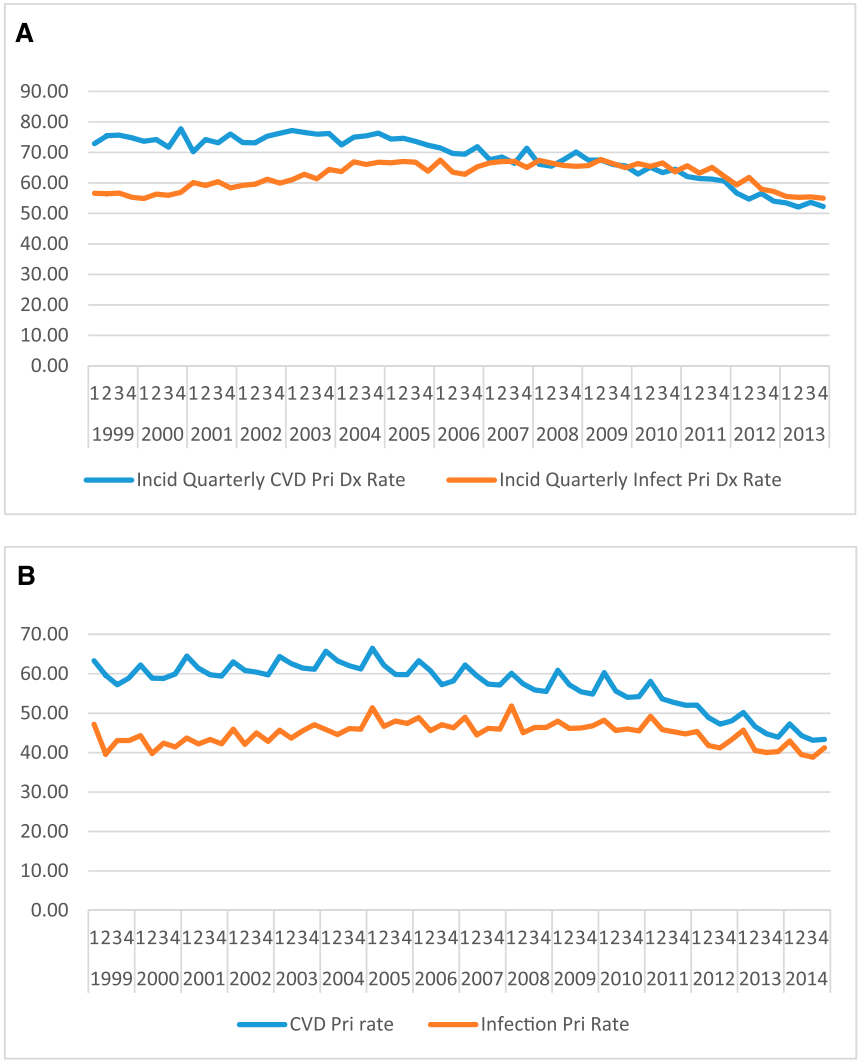

Figure 1. | Rates of infection-related hospitalizations surpassed rates of cardiovascular-related hospitalizations for incident patients in 2010; for prevalent patients, rates of cardiovascular-related hospitalizations improved, but rates of infection-related hospitalizations improved far less. (A) incident patients and (B) prevalent patients. Dx, diagnosis; Pri, primary.

usually sequelae of antibiotic use, antibiotic stewardship and more appropriate antibiotic use by nephrologists may reduce this complication.

Strengths and Limitations

Medicare data have important strengths and limitations in assessing these event rates. We focus on freestanding, nonhospital-based dialysis providers in the United States, representing 90% of the dialysis population and therefore, broadly applicable across the country. The methods used are the same as those developed by the investigative team that ran the USRDS from 2000 to 2014, and they are well documented. Use of unadjusted rates is intentional to show actual rates, regardless of the population being served. The findings noted are similar to those reported in the USRDS 2017 Annual Data Report (5). The standardized death rates differ little from the unadjusted rates, providing further rationale for direct assessment of actual rates within an area.

The hospitalization data take advantage of the coding system that hospitals use for billing for services. Hospital readmission rates have been a recent focus of quality improvement efforts. However, reductions in readmission rates may have unintended mortality-related consequences, possibly including infection (10). The decline in vascular access infection codes being offset by an increase in bacteremia-sepsis coding may represent a coding shift and may not represent a real change in rates.

In summary, death rates of patients on dialysis have declined over the past 10–12 years, but progress stopped in 2013–2014. Death rates in the first year of dialysis show infection as the leading cause of death, and in the prevalent population, infection is a very close second most frequent cause. Although hospitalizations of patients on dialysis have declined, the persistence of life-threatening bloodstream infections requires greater focus on prevention. The lack of progress in reducing pneumonia-influenza hospitalization is troubling. Clinical trials are needed to determine how best to prevent these types of infection. The American Society of Nephrology and the CDC initiative, Nephrologists Transforming Dialysis Safety, can help target efforts to reduce morbidity and mortality in the dialysis population, which can be tracked by the USRDS and the Peer Kidney Care initiative.

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Disclosures

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See related articles, "Systems Thinking and Leadership: How Nephrologists Can Transform Dialysis Safety to Prevent Infections," "Addressing the Problem of Multidrug-Resistant Organisms in Dialysis," "What We Learned from Ebola: Preparing Dialysis Units for the Next Outbreak," and "100% Use of Infection Control Procedures in Hemodialysis Facilities: Call to Action," on pages 655–662, 666–668, 669–670 and 671–673, respectively.