Vaccinations are available for primary prevention of many infections in adults. Morbidity and mortality from invasive diseases such as influenza and Streptococcus pneumoniae (pneumococcus) remain high and may be largely preventable by vaccination of high-risk adults, including dialysis patients. The current 23-valent vaccine—eficacious, with a low adverse event profile—is widely available. Revaccination is also recommended in patients with immunocompromising conditions, including chronic kidney disease. Despite having many opportunities to be vaccinated, adult hemodialysis and peritoneal dialysis patients are often missed. During the recent H1N1 influenza outbreak, we conducted a performance improvement project to increase the vaccination rates for pneumococcal pneumonia, hepatitis B, and influenza, with a special focus on prevention. The project included an education phase, baseline assessment of vaccination rates, intervention, and a follow-up assessment of vaccination rates.

The geographic jurisdiction of ESRD Network 13 encompasses the states of Arkansas, Louisiana, and Oklahoma. At the beginning of the network-wide project, the documented state-specific rates for influenza immunization were below the average influenza immunization rates for adults reported by Centers for Disease Control and Prevention and far below its target for adults. Our improvement project incorporated educational interventions to improve patient acceptance of vaccinations, educational interventions to improve staff participation in quality improvement activities, and improved techniques of quality improvement data collection and analysis by participants. During this project, the immunization rates for hepatitis B and pneumococcal pneumonia were also reviewed.

At project’s conclusion, improvement was demonstrated in all three focus areas, with statistically significant improvements noted in both influenza and pneumococcus vaccination rates. The use of educational interventions to improve staff participation in quality improvement, and the collection and analysis of quality improvement data can be replicated in many practice settings to improve immunization rates for dialysis patients and other patients with chronic illnesses.

Key words
Immunization, quality improvement, infection control, prevention

Introduction
Vaccinations are a key component of preventive medicine overall and of infection prevention strategies (1). Vaccines recommended for adults include those for influenza; for tetanus, diphtheria, and pertussis; for varicella and human papilloma virus; for zoster; for measles, mumps, and rubella; for pneumococcal (polysaccharide) and meningococcal disease; and for hepatitis A and B (2). The greatest benefit of immunization is achieved among populations with the highest risk for infectious diseases and complications. Those populations include infants and children, elderly people, and people with chronic illnesses, such as dialysis patients.

Dialysis patients represent a unique population of people with chronic illness: the multiple episodes of
care that they experience on an ongoing basis present many opportunities to intervene with vaccinations. For example, over the course of a week, in-center hemodialysis patients come for treatment 3 times, for several hours per session. Additionally, local policies may mandate vaccinations for employees of health care institutions (3). Nevertheless, many dialysis units do not meet the vaccination rates recommended (Figure 1) by the U.S. Centers for Disease Control and Prevention (CDC) (4). Multiple clinical practice guidelines recommend routine immunizations for chronic kidney disease and end-stage renal disease (ESRD) patients (5–7), but written policies for patient or staff vaccination, or both, can vary widely, and most of the mechanisms used to increase vaccination rates are voluntary (3).

Despite these multiple sources of recommendations, immunization rates among dialysis patients remain below recommended levels (4). Many strategies need to be used to improve those rates. A partnership involving patients, dialysis units, physicians, and other providers should be developed in dialysis units to achieve and maintain recommended immunization rates in these patient populations.

Often, dialysis programs are unaware of their current immunization rates, and they need to undertake
a baseline assessment before attempting to improve immunization rates to recommended levels. Thus, there is a need for development and implementation of quality improvement (QI) projects to improve and sustain vaccination rates among dialysis patients.

With the increasing emphases on quality and on infection prevention and control, strategies to reduce infection among dialysis patients have been emerging. Immunizations are a cornerstone of any infection prevention and control program at a dialysis unit. As a result of the 2009 global outbreak of H1N1 influenza, dialysis patients and providers had an increased interest in immunizations to prevent this potentially fatal infection. Additionally, dialysis providers were concerned about the impact that an influenza outbreak in dialysis units might have on patients and staff.

**Methods**

To determine vaccination rates in dialysis units in ESRD Network 13’s geographic area, a network-wide immunization program was developed and implemented. The project was designed to meet four goals:

- Assess vaccination rates for influenza, hepatitis B, and pneumococcal pneumonia across the network area
- Educate dialysis provider teams about the QI process
- Educate dialysis providers about Network 13 resources to improve clinical outcomes
- Improve immunization rates for influenza, hepatitis B, and pneumococcal pneumonia to levels recommended by the CDC

Notices about the project were sent to dialysis unit administrators, head nurses, and medical directors by regular mail, electronic mail, and facsimile. Several Internet-based teleconferences and webinars were held to introduce the project and its requirements, and to provide an overview of network resources on the website and in the facility resource CD or manual. Several sessions were offered, and the initial session was available as an archived program for viewing at later dates and alternative times.

Resources available within Network 13 were reviewed for current relevance and updated, when applicable, to assist with implementation of the project (8). Resources and strategies employed for this QI project included webinars, live and archived; conference calls; best-practice examples; expert consultation with Network 13 QI staff; peer consultation with top performers; and a Network 13 resource and tools packet (Table I), coupled with a webinar discussing implementation of the resources and tools. Post-project feedback from project participants was helpful to network staff in gauging the current project and subsequently improving future QI efforts. After conclusion of the project, its results were published in the Network 13 newsletter and also on the Network 13 website, together with the project tools.

At project start, the network collected baseline immunization data from all dialysis providers in the network area, except for prison-based dialysis units. After QI program implementation, follow-up immunization data were collected and submitted for review.

**Results**

At project start, immunization rates for prevention of disease caused by influenza, pneumococcal strains, and hepatitis B across the Network area were presumed—based on documented immunization rates in the three states covered by Network 13—to be below national rates as established by the CDC. The project therefore began with an assessment of each unit’s baseline immunization rates before implementation of the QI project. That assessment uncovered network-wide baseline vaccination rates of 77.1% for influenza,

<table>
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<th>TABLE I</th>
<th>Network 13 immunization resources and tools packet</th>
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<tr>
<td>1.</td>
<td>Information about the ‘flu for people with certain medical conditions</td>
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<tr>
<td>2.</td>
<td>Inactivated influenza vaccine 2009 – 2010: “What you need to know”</td>
</tr>
<tr>
<td>3.</td>
<td>2009 – 2010 seasonal influenza dosage chart</td>
</tr>
<tr>
<td>4.</td>
<td>Flu stickers (sun/heart), 30 per page</td>
</tr>
<tr>
<td>5.</td>
<td>CDC poster “Take 3 steps to fight the flu” (English/Spanish)</td>
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<tr>
<td>6.</td>
<td>Medicare resources:</td>
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<tr>
<td>a)</td>
<td>Billing for H1N1</td>
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<tr>
<td>b)</td>
<td>Preventive services (immunization, all other services)</td>
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<tr>
<td>7.</td>
<td>H1N1 posters (English/Spanish)</td>
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<tr>
<td>8.</td>
<td>Forum QI toolkit: vaccination</td>
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</table>

CDC = Centers for Disease Control and Prevention; QI = quality improvement.
84.6% for hepatitis B, and 54% for pneumococcal pneumonia (Figure 2). Those rates were lower than the CDC recommended rates of 90%, 90%, and 60% respectively (Figure 1).

After the educational intervention, local QI activities, and implementation of the local immunization strategy, immunization rates for influenza, hepatitis B, and pneumococcal polysaccharide were re-measured. Improvement was observed in all areas. At re-measure, the rates of immunization for influenza, hepatitis B, and pneumococcal polysaccharide were 82.1%, 86.4%, and 65.5% respectively (Figure 2). By chi-square analysis, the improvement in immunization rates was statistically significant for influenza and pneumococcal polysaccharide (both $p < 0.001$). Similar improvements were seen for the three states (Arkansas, Louisiana, Oklahoma) individually for all 3 immunization series (Figure 2). The improved rate for pneumococcal pneumonia exceeded the CDC’s recommended rate of 60%. However, the 90% immunization rate goals for influenza and hepatitis B were not met after this initial QI project.

Baseline results were obtained from 275 dialysis facilities reporting on 14,938 dialysis patients; re-measure results were reported from 278 dialysis facilities on 15,539 dialysis patients. State-specific rates were calculated using averaged per-dialysis facility rates.

**Discussion**

Immunization is an essential component of infection prevention and control strategies. The CDC targets rates for adult immunization are 90% or greater for influenza and hepatitis B and 60% or greater for pneumococcal pneumonia.

Our network-wide QI project was spurred by the 2009 worldwide H1N1 influenza pandemic, which could potentially have caused significant morbidity
and mortality in high-risk patients undergoing dialysis. The project provided participants with real-life examples of practical skills to develop for conducting and implementing future QI projects. Additionally, the project provided and emphasized the importance of implementing consistent vaccination processes as part of the facility’s infection prevention or control program.

The project incorporated

- educational interventions to improve patient acceptance of immunizations;
- educational interventions to improve staff participation in QI activities; and
- improved techniques of QI data collection and analysis by participants.

The project also reviewed immunization rates for hepatitis B and pneumococcal pneumonia. The morbidity and mortality from invasive Streptococcus pneumoniae (pneumococcal) disease remain high and may be largely preventable by immunization of high-risk adults, including dialysis patients. The current 23-valent vaccine—efficacious, with a low adverse event profile—is widely available.

The U.S. Institute of Medicine has compiled many reports related to infection and the role of immunization in preventing morbidity and mortality. Our QI project was consistent with recommendations included in the 2009 Institute of Medicine Priorities for the National Vaccine Plan regarding vaccine use and supply. The project may be replicated in other health care settings to prevent infectious complications in high-risk patients.

Conclusions

Performance measurement through QI projects is one strategy to reduce health disparities and to improve medical care. Our QI project is an example of one such strategy to improve patient outcomes and to prevent infection as part of a comprehensive infection control strategy. Network-wide QI projects can help to standardize performance and improve immunization surveillance and immunization rates overall. Implementation of established clinical practice guidelines for immunizations can be achieved over a short period of time as demonstrated in the project reported here.

Replication of this project or similar QI projects may be able to improve vaccination rates for dialysis patients and other high-risk patients in a variety of health care settings. Resources and tools are readily available to be adapted for use in various health care settings. Our project adds to the body of knowledge on the increasing role of QI in patient care to reduce morbidity and mortality.

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Disclosures

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Corresponding author:
Myra A. Kleinpeter, MD MPH, Tulane University School of Medicine, Section of Nephrology and Hypertension, 1430 Tulane Avenue, SL-45, New Orleans, Louisiana 70112 U.S.A.

E-mail: mkleinp@tulane.edu