

## Research Article

### Prevalence of Influenza and Pneumococcal-23 Vaccination in Pediatric Patients with Renal Disease: A Single Urban Center Experience

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#### Abstract

##### Background

Influenza and pneumococcal diseases, both major causes of morbidity and mortality in persons with renal disease and immunocompromised state, are vaccine preventable. In 2012, the Advisory Committee on Immunization Practices (ACIP) recommended the use of influenza and pneumococcal vaccines in renal patients. Vaccination rates among the general pediatric population are low. We were interested in vaccination rates in the pediatric renal population.

##### Methods

Immunization rates for influenza and 23-valent Pneumococcal Polysaccharide (PPV-23) vaccinations in pediatric patients with renal disease seen from July 2013 to January 2014 at a single large urban children's hospital were obtained via retrospective chart review of 102 consecutive pediatric patients aged 2 to 21 years with renal disease of various etiologies.

##### Results

Influenza vaccination rates were statistically higher in children with nephrotic syndrome. Forty percent with non-nephrotic syndrome received the influenza vaccine, 70.6% received the 23-valent-pneumococcal vaccine. PPV23 vaccination rates were higher in patients with nephrotic syndrome but this was not statistically significant.

##### Conclusion

Overall, vaccination rates were low. Influenza vaccination rates were no different in the pediatric renal population than the general pediatric population except for children with nephrotic syndrome. This greater penetration among nephrotic syndrome patients might be due to greater awareness among physicians. There was no

statistical difference in the PPV23 vaccination rate among patients with and without nephrotic syndrome. PPV23 vaccination rates in the general population were unavailable. Much work remains to be done to address barriers for optimal vaccination in this vulnerable population.

**Keywords:** Influenza vaccine; Nephrotic syndrome; Pneumococcal Vaccine (PPV23)

#### Background

Influenza and pneumococcal diseases, both major causes of morbidity and mortality in persons with renal, liver, pulmonary, cardiac disease and immunocompromised state, are vaccine preventable. Vaccination rates among the general pediatric population are low. In 2012, the Advisory Committee on Immunization Practices ACIP [1] specifically recommended the use of inactivated influenza and pneumococcal vaccines in renal patients. We were interested in vaccination rates in the pediatric renal population.

#### Introduction

Immunization remains a simple, low cost, effective and widely available way to prevent significant morbidity and mortality in pediatric immunocompromised patients. Children and adolescents also play a role in the transmission of these diseases. Immunization against influenza and pneumococcal infection is strongly recommended for high-risk populations like those with chronic kidney disease or immunocompromised states. The seasonal influenza vaccination rate in the general population in the United States was highest at 74.3% in children between 6 to 23 months but decreased to 46.4% for the 13 to 17 year old age group. The rate dropped further to 32.3% for the age group of 18-49 years (CDC 2013-2014).

It is well established that children with renal disease like nephrotic syndrome are immunocompromised and thus have increased susceptibility to infections. This is specifically the case for children with nephrotic syndrome due to immunosuppressive treatment with steroids. Steroids cause CD-4 cell inhibition which contributes to lower antibody titers [2]. In addition, patients with nephrotic syndrome are also immunosuppressed due to T and B cell dysfunction and low IgG levels [3,4]. The underlying immunocompromised state in patients with renal disease is further complicated in dialysis and transplant patients. Nevertheless, a sufficient immune response to vaccination has been confirmed in these patients and studies widely recommend vaccination [5].

In the United States, a routine vaccination schedule starting in infancy is recommended. This has substantially decreased the morbidity and mortality of infectious diseases. In 2012, the Advisory Committee on Immunization Practices (ACIP) and the Centers for Disease Control (CDC) issued recommendations for the prevention and control of influenza and pneumococcal infection [1] and strongly recommend that patients with nephrotic syndrome, chronic renal failure, renal transplant and dialysis be given the influenza and polysaccharide PPV23 vaccines. The latter offers protection against 23 types of pneumococcal bacteria and has a 56-75% efficacy in the prevention of invasive pneumococcal infection [6]. Of note is that the inhaled influenza

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vaccine is contraindicated in the immunocompromised population. Due to a rapid decline of antibody titers in the pediatric population, polyvalent pneumococcal polysaccharide PPV23 is recommended in high risk children over the age of 2 years [6].

We report the prevalence of influenza and polyvalent pneumococcal polysaccharide vaccination rates in our pediatric patients with renal disease, comparing children with and without nephrotic syndrome. Individual vaccination rates in renal disease patients and the general population are not well studied.

## Methods

We evaluated immunization rates for influenza and 23-valent Pneumococcal Polysaccharide (PPV-23) vaccinations in pediatric patients with renal disease seen from July 2013 to January 2014 at a single large urban children's hospital. We conducted a retrospective chart review of 102 consecutive pediatric patients aged 2 to 21 years with renal disease of various etiologies. Patients with transplants or on dialysis were excluded. We included patients taking steroids. Patients who did not receive one or both vaccines were contacted by phone to establish the reason.

## Results

Of the 102 patients with renal disease, 21 (20.5%) had nephrotic syndrome. 41 out of 102 children (40.2%) with non-nephrotic syndrome received the influenza vaccine for the 2013 strain. 72 out of 102 (70.6%) received the 23-valent-pneumococcal vaccine. Of the 21 patients with nephrotic syndrome, 14 (66.6%) had received the influenza vaccine and 16 (76.1%) had received the PPV-23.

Influenza vaccination rates were statistically higher in children with nephrotic syndrome. PPV23 vaccination rates were higher in patients with nephrotic syndrome but this was not statistically significant (Table 1).

	Vaccination Rates General population	Vaccination Rates in Patients with Renal Disease N=102	Vaccination Rates in Patients with Ne- phrotic Syndrome N=21
	6 months - 17 years	2 - 21 years	2 - 21 years
Influenza	46.2%	40.2% (41)	66.6% (14)
PPV-23	Not available	70.6% (72)	76.1% (10)

**Table 1:** Influenza and PPV-23 vaccination rates in the general population and among patients with renal disease and nephrotic syndrome.

## Discussion

In the United States, a routine vaccination schedule starting in infancy is recommended and yearly updates are provided by the ACIP, CDC and Committee on Infectious Diseases of the American Academy of Pediatrics. Different high risk groups should receive appropriate variations of this schedule and additionally receive varicella, meningococcal, pneumococcal, influenza and/or hepatitis vaccines [7]. Patients with renal disease, in addition to their underlying immune deficiency, are also frequently treated with various immunosuppressive medications, making them even more susceptible to infections. Immunosuppressed patients in general should not receive live vaccines during active disease or on low dosage of immunosuppression [8].

Patients with steroid dependent, frequently relapsing nephrotic syndrome or steroid resistance are on long-term steroids or alternative immunosuppressive treatments. Vaccine related studies addressing the immune response in this group are limited.

There is conflicting data regarding the efficacy of the PPV vaccine in patients with nephrotic syndrome receiving immunosuppressive therapy. In two small studies the anti- PPV titers were not maintained in patients receiving immunosuppression [9,10]. In another study antibody titers were similar in patients receiving steroids and additional immunosuppressive therapy [11].

There are no specific studies addressing influenza vaccine in patients with renal disease receiving immunosuppression. However, studies conducted in rheumatological conditions including systemic lupus erythematosus showed that the vaccine response in this patient group was similar to that in the control population [12]. In end-stage renal disease, only 32% of patients aged 0-19 years received the influenza vaccine, and 13% or fewer received PPV vaccination [13].

The wide availability and high efficacy of vaccinations against influenza and pneumococcal infections suggest that, this should be a ubiquitously followed practice in the vulnerable pediatric renal population. This, however, is not the case.

The influenza vaccination rate in our renal disease population was only slightly higher than the seasonal influenza vaccination coverage for healthy American children 6 months to 17 years in 2013/14 (Centers for Disease Control and Prevention). Overall, we found vaccination rates were low, ranging from 40.2 to 70.6%, with significantly greater vaccine penetration of PPV-23 versus influenza vaccine. This could be due to lacking physician awareness of the appropriateness of influenza vaccination in this population or to the assumption that influenza vaccine had been administered by the primary care provider or at one of the increasingly common retail stores. In patients with nephrotic syndrome, the penetration of PPV-23 remained statistically the same, but the rate of influenza vaccinations was higher when compared to the overall renal population, at 66.6% versus 40.2%. A possible explanation could be the heightened awareness of clinicians as to the need for vaccination in this particularly common clinical subgroup. It is also plausible that non-nephrotic renal patients were assumed non-immunogenic, as suggested by the similar vaccination rates of 46.2% and 40.2% for the general population and the renal population, respectively.

We attribute our low immunization rates to several factors: subspecialty clinics that do not routinely offer vaccines, hesitancy by primary care pediatricians to immunize immunocompromised patients, the lack of a unified and universally accessible vaccination record for every child, and insufficient parental understanding of the importance of immunization. Due to the complexity of managing children with renal disease and the modifications in the standard vaccination schedule they require, we believe that it is paramount that the pediatric nephrology team take the lead in recommending the required vaccines for children with renal disease [14].

Our study specifically compares the rates of influenza and PPV-23 vaccines in a pediatric renal disease population (except dialysis and transplant patients) with the general pediatric population. The vaccination rates by age range among the renal and general pediatric population are not equated, constituting a limitation. In our opinion a larger study is needed to better address barriers to this life-saving and easy intervention, particularly in the adolescent age group, where we anecdotally believe the vaccination rates are even lower.

## Conclusion

We propose the following interventions to improve immunization rates and decrease the morbidity and mortality in this vulnerable patient population:

- Establish a standard nursing protocol that includes checking and documenting vaccination status at every clinic visit
- Educate primary care physicians regarding the safety of immunizing immunocompromised patients with renal disease
- Make vaccines available in subspecialty clinics (patients with chronic disease tend not go to their primary provider on a regular basis)
- Create a universally available immunization record that documents all immunizations a child has received regardless of location, including retail stores
- Implement vaccine administration at school
- Keep pamphlets on vaccination in waiting rooms to educate parents
- Household contacts should receive the seasonal inactivated influenza vaccine
- Patients over 2 years of age with nephrotic syndrome should receive PPV 23 and be revaccinated 5 years later. It should be given 8 weeks following the final dose of PPV 13

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