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Short communication

Infectious diseases consult improves vaccination adherence in kidney transplant candidates

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ABSTRACT

Background: Vaccines prevent infections and avoid related complications. Low rates in immunocompromised patients are concerning due to increased morbidity. Vaccinations are less effective when administered post-transplant and should be administered prior. We describe pre-transplant vaccination rates among kidney or kidney-pancreas transplant recipients.

Methods: Retrospective review including adults receiving kidney or kidney-pancreas allografts at Cleveland Clinic from October 2013 to October 2016. Pre-transplant vaccinations, serologies, and transplant data were collected.

Results: 393 patients were included; median age was 53 years with most (46%) being Caucasian males. Influenza vaccination rate was 48%; receipt of at least one pneumococcal vaccine was 77%. Vaccination rates were higher among dialysis patients for pneumococcal, hepatitis B, and varicella vaccines; rates were also higher with infectious diseases consults.

Conclusions: Vaccination rates at our institution for kidney or kidney-pancreas transplant candidates are consistent with previous literature. Rates were higher for candidates with infectious diseases consults or receiving dialysis.

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1. Introduction

Vaccines are a critical component of preventative medicine that provides immunity for multiple infections [1,2]. Based on age and comorbid conditions, the Advisory Committee on Immunization Practices (ACIP) recommends vaccines to prevent infectious diseases and potential complications [3]. Vaccination rates across age groups and populations remain significantly below target goal [1,4,5]. One of the *Healthy People 2020* initiatives is to increase immunization rates and reduce occurrence of preventable diseases within the U.S. [5]. In 2015, pneumococcal vaccination rate in high-risk adults 19–64 years old was 23.0% and influenza vaccination rate in adults ≥18 years was 44.8% [4]. Unfortunately, these rates were below the targets of 60% and 70%, respectively [5]. Low vaccination rates in the general population are concerning, even more so in the immunocompromised population. This study evaluates kidney and kidney-pancreas transplant recipients.

Vaccinations are less effective when administered to immunosuppressed individuals, including transplant recipients and live

vaccines are generally not recommended in transplant recipients [6,7]. The Infectious Diseases Society of America (IDSA) and the American Society of Transplantation (AST) recommend administration prior to transplantation for maximal immune response [6,7]. Immunocompromised adults can be 20 times more likely to suffer from invasive pneumococcal disease [4]. Additionally, ACIP recommendations are complex, requiring both 13-valent pneumococcal conjugate (PCV-13) and 23-valent pneumococcal polysaccharide (PPSV-23) vaccines [4].

Lee et al. report vaccination rates in waitlisted kidney transplant candidates of 35.9% and 55% for pneumococcal and influenza vaccines, respectively [1]. This illustrates the importance of focusing on vaccination adherence in transplant candidates. Our study evaluates vaccination rates in potential kidney/kidney-pancreas recipients and identifies opportunities to improve preventative care.

2. Methods

This was a single-center, retrospective, descriptive cohort study completed at Cleveland Clinic (CC) Main Campus. CC Glickman Urology and Kidney Institute receives 900 referrals and performs 150 kidney transplants annually. Approximately 650 patients are

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on the waitlist. Kidney and kidney-pancreas recipients at least 19 years of age, transplanted between October 2013 and October 2016 were included; there were no exclusions.

The primary outcome was pre-transplant vaccination rate for influenza and pneumococcal vaccines. Influenza vaccination was determined if administration was documented during the previous or current influenza season dependent of transplant time. Complete pneumococcal vaccination was defined as receiving both PCV13 and PPSV23. Secondary outcomes included vaccination rates (and/or associated immunity) for other ACIP recommended vaccines including hepatitis B, varicella, herpes zoster, measles, mumps and rubella (MMR), tetanus, diphtheria (with/without pertussis (Td)), and human papillomavirus (HPV). Hepatitis B immunity was defined as documentation of at least one vaccine, hepatitis B surface antibody quantitative result >12 mIU/mL, or qualitatively positive. Varicella immunity was defined as varicella zoster IgG > 165 IU. The study also evaluated vaccination/immunity rates for patients with infectious diseases consult.

The study was approved by CC and Ohio Department of Health (ODH) Institutional Review Boards. Subjects were identified from an internal transplant database, and reports included demographic, transplant, vaccination, and serologic data. Additional vaccination data was extracted from ODH Impact Statewide Immunization Information System (ImpactSIIS) to increase vaccination history yield.

Vaccination rates were descriptively reported. Univariate analyses were completed for categorical data using Chi-Square test or Fisher's Exact test, and *T*-test or Mann-Whitney *U* test for continuous data. Statistical analyses were performed using Stata IC 14.1 (StataCorp. 2015).

3. Results

During the study period, 393 patients received a kidney/kidney-pancreas transplant. Baseline characteristics are summarized in Table 1. Median age was 53 years and most subjects were Caucasian (72%). Common transplant indications were diabetes mellitus (25%) and sclerotic diseases (16%), with 81% being dialysis dependent prior to transplant. Subjects spent approximately

17 months on the waitlist; 34 months if receiving a deceased donor organ and 10 months for living donor.

Vaccination rates and immunities are described in Table 2. Utilization of ODH ImpactSIIS database provided an additional 10% of vaccination data. Immunization rates were 48% for influenza, 77% for receipt of one pneumococcal vaccine, and 6% for both pneumococcal vaccines. Receipt rates of either PPSV-23 or PCV-13 was 91% for subjects ≥65 years and 75% for 19–64 years. PPSV-23 was more frequently administered compared to PCV-13 with 282 and 47 administrations, respectively.

Sub-group analysis showed dialysis patients had higher vaccination rates compared to those receiving preemptive transplant for all vaccines except MMR. Rates were statistically significant higher for receipt of one pneumococcal vaccine (83% v. 55%; $p < 0.01$), hepatitis B (77% v. 55%; $p < 0.01$), and varicella (98% v. 91%; $p = 0.01$) in the dialysis population (Table 3).

Few subjects (27/393, 7%) completed an Infectious Diseases (ID) consult. Indications for ID evaluation included: extensive travel history, international origin/birth, or HIV positive status. The majority (56%) of evaluations resulted in recommendations for vaccine administrations or serology verification, specifically hepatitis B, varicella, and MMR. Other recommendations included *Mycobacterium tuberculosis* screening/treatment, CD4 count and HIV viral load testing. ID evaluated subjects had higher vaccination rates compared to those not evaluated: influenza, 67% v. 46% ($p = 0.04$); pneumococcal, 92% v. 76% ($p = 0.05$); and complete pneumococcal, 33% v. 4% ($p < 0.01$). Higher vaccination rates were significant for hepatitis B, herpes zoster, MMR and Td in the ID consult population (Table 3).

4. Discussion

Limited literature details vaccination adherence within the transplant population. Tawhari et al., retrospectively evaluated vaccination rates for pneumococcus, influenza, and hepatitis B in non-dialysis kidney transplant candidates [8]. They reported rates below the *Healthy People 2020* goal for pneumococcus (37%), influenza (48%), and hepatitis B (26%). In a point-prevalence study by

Table 1
Baseline characteristics.

	n = 393
Age (years), median (IQR)	53 (42–60)
Male gender, n (%)	259 (66)
Race, n (%)	
Caucasian	285 (72)
African American	91 (23)
Other	17 (4)
Primary diagnosis for transplant, n (%)	
Diabetes	98 (25)
Sclerotic disease	64 (16)
Other/Unknown	53 (13)
Hypertension	51 (13)
Graft failure	46 (12)
Polycystic kidney disease	45 (11)
Other	36 (9)
Type of Transplant, n (%)	
Kidney	365 (93)
Kidney-Pancreas	28 (7)
Donor Type, n (%)	
Deceased	215 (55)
Living	178 (45)
Dialysis, n (%)	317 (81)
Time on Waitlist, months (IQR)	17 (8–42)
Deceased donor	34 (11–50)
Living donor	10 (7–18)

Table 2
Vaccination rates and associated immunity.

	n/total (%)
Influenza	188/393 (48)
Pneumococcal	
PPSV-23 OR PCV-13	304/393 (77)
PPSV-23 AND PCV-13 (complete)	25/393 (6)
Hepatitis B	
At least one Hepatitis B administration	130/369 (35)
Hepatitis B immunity ^a	212/369 (57)
Hepatitis B immunity with vaccine documentation	88/212 (42)
Hepatitis B immunity without vaccine documentation	124/212 (58)
Varicella	
At least one varicella administration or immunity	380/393 (97)
Varicella immunity ^b	378/393 (96)
Zoster ^c	27/113 (24)
MMR (measles, mumps, rubella)	60/393 (15)
Td in the past 10 years (tetanus, diphtheria)	119/393 (30)
Human papillomavirus (HPV) ^d	
At least one HPV administration	1/14 (7)
Complete HPV series	0/14 (0)

^a Hepatitis B immunity: immunization history documenting at least one vaccine, hepatitis B surface antibody quantitative result >than 12 mIU/mL, or qualitative result of positive.

^b Varicella immunity: varicella zoster antibody IgG quantitative result >165 IU.

^c Age ≥ 60 years ($n_{total} = 113$).

^d Age ≤ 26 ($n_{total} = 14$).

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