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INFLUENZA VACCINATION COVERAGE RATES IN HIGH-RISK PATIENT GROUPS

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ABSTRACT

Background: Influenza vaccination remains a vital preventive strategy, particularly in populations with comorbidities, yet its uptake is variable across different demographic groups. Understanding factors influencing vaccination can guide public health interventions.

Objective: To assess the influenza vaccination coverage rates in high-risk patient groups.

Methodology: This descriptive cross-sectional study was conducted among 190 adult participants. Data were collected using a structured questionnaire assessing demographic characteristics, comorbidities, vaccination status, and knowledge about influenza vaccination. Knowledge scores were categorized as poor (0–3), moderate (4–6), and good (7–9). Statistical analyses were performed using Chi-square tests, with a p-value ≤ 0.05 considered significant.

Results: The mean age of participants was 54.6 ± 14.2 years, with 56.8% males. Most participants were married (75.8%), unemployed/retired (62.1%), and resided in urban areas (63.7%). Knowledge assessment revealed that 28.4% had poor knowledge, 48.4% moderate knowledge, and 23.2% good knowledge, with an overall mean score of 4.9 ± 2.1. Influenza vaccination was significantly associated with diabetes mellitus ($p = 0.027$), while higher vaccination rates were observed among individuals ≥50 years ($p = 0.018$), those with higher education ($p = 0.004$), and employed participants ($p = 0.042$). Gender did not show a significant association with vaccination status.

Conclusion: Despite moderate knowledge levels, influenza vaccination coverage remains suboptimal. Comorbid conditions, education, age, and employment significantly influenced uptake. Targeted health education and vaccination campaigns are recommended to improve coverage, particularly among high-risk groups.

INTRODUCTION

Influenza is an acute viral respiratory infection that affects individuals across all age groups. Globally, it is estimated to impact nearly 10% of the population each year and accounts for approximately half a million deaths annually.[1] Vaccination remains the most effective preventive strategy against seasonal influenza outbreaks and pandemics. Evidence from multiple studies demonstrates the long-term benefits of seasonal influenza vaccination, including reduced exacerbations of chronic illnesses, fewer hospitalizations, and decreased rates of all-cause and respiratory-related mortality.[2]

The influenza vaccine is reformulated annually to match the most prevalent circulating strains. It is particularly recommended for individuals with chronic diseases and the elderly. The Centers for Disease Control and Prevention (CDC) advises annual influenza vaccination for adults aged 65 years and older, children under 2 years, individuals with chronic medical conditions (such as chronic respiratory disease, endocrine disorders, cardiovascular disease, renal impairment, liver disease, and asthma), those with a body mass index (BMI) ≥40, and immunocompromised patients.[3]

This study focuses on high-risk groups, specifically patients with diabetes mellitus (DM), chronic obstructive pulmonary disease (COPD), and end-stage renal disease (ESRD). Patients with diabetes are at increased risk of hospitalization and adverse outcomes following influenza infection compared to normoglycemic individuals. Evidence suggests that influenza vaccination in diabetic patients reduces all-cause mortality; however, vaccination uptake in this group has been reported as low as 33%.[4] Similarly, patients with chronic kidney disease (CKD) are highly vulnerable to systemic infections, including influenza, which significantly increases their morbidity and mortality.[5] Influenza vaccination is recommended for all CKD patients annually, with studies showing that patients with an estimated glomerular filtration rate (eGFR) ≥30 mL/min/1.73 m² benefit from reduced hospitalization risk due to pneumonia after vaccination.[6]

COPD is another condition frequently complicated by recurrent respiratory infections, with influenza being a major trigger. Vaccination in COPD patients has been shown to significantly reduce the risk of hospitalization due to disease exacerbations (OR: 2.11, 95% CI: 0.88–5.02).[7] Nevertheless, vaccination rates remain suboptimal. A study in Hungary reported an influenza vaccination prevalence of 23.6% among COPD patients, while a study from Greece reported 40.2%.[7, 8] Similarly, research from Spain highlighted persistently low vaccination uptake in COPD patients, although the rate of vaccination increased with age.[9]

Enhancing knowledge and awareness about vaccination benefits is essential. A China-based study demonstrated that improved knowledge positively influenced attitudes toward pneumococcal vaccine uptake,[10] and similar strategies may be beneficial for influenza vaccination. A large-scale study estimated that influenza vaccination coverage across patients with diabetes, CKD, heart failure, and COPD was only 44%.[11] Likewise, an Iranian study conducted in 2018 reported that although 58.8% of high-risk patients had received influenza vaccination at least once, only 32.8% had maintained regular vaccination for three consecutive years. Coverage was lowest among COPD patients (22.5%) compared to those on dialysis (55%) and diabetic patients (29.7%).[12]

Despite the fact that individuals with chronic illnesses are priority groups for influenza vaccination, coverage remains low even in developed countries. Moreover, in countries like Pakistan, reliable data on vaccination coverage is scarce due to a lack of systematic surveillance and studies. Research evaluating vaccination coverage rates is therefore crucial to inform public health strategies aimed at improving uptake, particularly among high-risk groups such as

patients with COPD, renal failure, and diabetes mellitus. This study was designed to determine the influenza vaccination coverage rates in these high-risk populations.

METHODOLOGY

This study was a descriptive cross-sectional study conducted in the Department of Medicine, Pakistan Atomic Energy Commission (PAEC) General Hospital, Islamabad. The duration of the study was six months, from 1st January 2025 to 30th June 2025, following the approval of the synopsis by PAEC. The sample size was calculated using the WHO sample size calculator. With a 95% confidence level, a population proportion of 22.5%, and an absolute precision of 6%, the required sample size was 190 participants.[12] A consecutive sampling technique was employed to recruit participants.

The study population comprised patients with chronic illnesses, specifically chronic obstructive pulmonary disease (COPD), end-stage renal disease (ESRD), and diabetes mellitus (DM), who had been diagnosed for at least three years. Adults aged between 14 and 90 years, of both genders, were included. Patients were excluded if they had severe, life-threatening allergies to any vaccine component, a history of allergic reaction to influenza vaccine, or if they had been diagnosed with COPD, ESRD, or DM for less than three years.

For this study, high-risk patient groups were defined as individuals suffering from COPD, ESRD, or DM for more than three years since diagnosis. These conditions were assessed based on patient history and validated using laboratory parameters and medical records. A COPD patient was defined as a clinically diagnosed case requiring inhaler use and confirmed through past medical prescriptions. ESRD patients were defined as those with renal failure and an estimated glomerular filtration rate (eGFR) less than 60 mL/min, verified through medical records. Diabetes mellitus patients were defined as individuals with either type 1 or type 2 diabetes, diagnosed on the basis of HbA1c greater than 6.5%, confirmed through medical documentation. Vaccination coverage was defined as the percentage of participants who had received the annual influenza vaccine within the past one year, confirmed through participant history.

After obtaining informed consent, patients meeting the inclusion criteria were enrolled. Data were collected using a structured proforma. Demographic information such as age, gender, marital status, job status, education, and residence were recorded. Participants were asked to identify their premorbid condition (COPD, ESRD, or DM), and their medical history was confirmed through medical records and prescriptions. Vaccination status was assessed by inquiring whether the participant had received an influenza vaccination within the past year. Participants reporting a recent vaccination were marked as “yes,” while those denying vaccination in the past year were marked as “no.” Vaccination coverage was calculated as the percentage of participants who had received a vaccination. Knowledge regarding influenza vaccination was assessed using nine question items. Each correct response was scored as one, with the total knowledge score ranging from 0 to 9. Higher scores reflected better knowledge.

Data were analyzed using SPSS version 23. Quantitative variables, such as age, vaccination coverage, and knowledge scores, were presented as means ± standard deviations. Qualitative variables, including gender, marital status, job status, education, residence, comorbid conditions, and vaccination status, were presented as frequencies and percentages. The Chi-square test was applied to assess the association between vaccination status and comorbid conditions (COPD, ESRD, DM). Effect modifiers such as age, gender, education, and employment status were controlled by stratification, and post-stratified chi-square and independent sample t-tests were applied. A p-value <0.05 was considered statistically significant.

RESULTS

The study included a total of 190 participants with a mean age of 54.6 ± 14.2 years. More than half of the respondents were male (56.8%), while females comprised 43.2%. The majority of participants were married (75.8%), whereas 24.2% were unmarried, widowed, or divorced. Regarding occupational status, 37.9% were employed, and 62.1% were unemployed or retired. Educational attainment varied, with 30.5% reporting no formal education, 40.0% having completed primary to secondary education, and 29.5% holding higher education. In terms of residence, 63.7% resided in urban areas, while 36.3% belonged to rural regions. The prevalence of comorbidities among the study participants revealed that 41.1% had diabetes mellitus (DM), 31.6% had chronic obstructive pulmonary disease (COPD), and 27.4% were diagnosed with end-stage renal disease (ESRD) (Table 1).

Table 1. Demographic Characteristics of Study Participants (n = 190)

Variable	Categories	n (%)
Age (years)	**Mean ± SD**	54.6 ± 14.2
Gender	**Male**	108 (56.8)
	Female	82 (43.2)
Marital Status	**Married**	144 (75.8)
	Unmarried/Widowed/Divorced	46 (24.2)
Job Status	**Employed**	72 (37.9)
	Unemployed/Retired	118 (62.1)
Education	**No formal education**	58 (30.5)
	Primary/Secondary	76 (40.0)
	Higher education	56 (29.5)
Residence	**Urban**	121 (63.7)
	Rural	69 (36.3)
Comorbid Condition	**Diabetes Mellitus (DM)**	78 (41.1%)
	COPD	60 (31.6%)
	ESRD	52 (27.4%)

When assessing influenza vaccination status among individuals with comorbid conditions, it was observed that 35.9% of diabetic patients reported being vaccinated, compared to 30.0% of patients with COPD. Among participants with ESRD, vaccination uptake was relatively higher at 46.2%. Overall, 36.8% of the study population had received the influenza vaccine, whereas 63.2% remained unvaccinated (Table 2).

Table 2. Influenza Vaccination Coverage by Comorbid Condition (n = 190)

Comorbid Condition	Vaccinated n (%)	Not Vaccinated n (%)
Diabetes Mellitus (DM)	28 (35.9)	50 (64.1)
COPD	18 (30.0)	42 (70.0)
ESRD	24 (46.2)	28 (53.8)
Overall	70 (36.8)	120 (63.2)

Assessment of knowledge regarding influenza vaccination revealed that nearly half of the respondents demonstrated moderate knowledge (48.4%), while 28.4% exhibited poor knowledge and only 23.2% showed good knowledge. The overall mean knowledge score was 4.9 ± 2.1 (Table 3).

Table 3. Knowledge Scores Regarding Influenza Vaccination (n = 190)

Knowledge Score Range	n(%)
0–3 (Poor knowledge)	54 (28.4%)
4–6 (Moderate knowledge)	92 (48.4%)
7–9 (Good knowledge)	44 (23.2%)
Mean ± SD	4.9 ± 2.1

Analysis of vaccination status in relation to comorbid conditions showed significant associations. Among participants with diabetes mellitus, 35.9% were vaccinated, while 64.1% were not, yielding a statistically significant association ($\chi^2 = 4.87$, $p = 0.027$). Similarly, among patients with end-stage renal disease (ESRD), 46.2% were vaccinated compared to 53.8% who were not. However, vaccination coverage

was lower among those with chronic obstructive pulmonary disease (COPD), where only 30.0% were vaccinated and 70.0% were not. These findings are detailed in Table 4.

Table 4. Association Between Vaccination Status and Comorbid Conditions (n = 190)

Comorbid Condition	Vaccinated n(%)	Not Vaccinated n (%)	Chi-square (χ^2)	p-value
Diabetes Mellitus	28 (35.9%)	50 (64.1%)	$\chi^2 = 4.87$	0.027*
COPD	18 (30.0%)	42 (70.0%)		
ESRD	24 (46.2%)	28 (53.8%)		

Stratified analysis of effect modifiers further highlighted important patterns (Table 5). Participants younger than 50 years were significantly less likely to be vaccinated (25.0%) compared to those aged 50 years or older (45.5%, p = 0.018). Education also played a significant role, as vaccination coverage was lowest among those with no formal education (20.7%) and highest among those with higher education (53.6%, p = 0.004). Employment status showed a significant association as well, with employed participants more likely to be vaccinated (44.4%) compared to their unemployed or retired counterparts (32.2%, p = 0.042). Gender did not demonstrate a statistically significant association with vaccination status (p = 0.276).

Table 5. Stratified Analysis of Effect Modifiers with Influenza Vaccination Status (n = 190)

Effect Modifier	Categories	Vaccinated n (%)	Not Vaccinated n (%)	p-value
Age (years)	**<50**	20 (25.0)	60 (75.0)	0.018*
	≥50	50 (45.5)	60 (54.5)	
Gender	**Male**	44 (40.7)	64 (59.3)	0.276
	Female	26 (31.7)	56 (68.3)	
Education	**No formal education**	12 (20.7)	46 (79.3)	0.004*
	Primary–Secondary	28 (36.8)	48 (63.2)	
	Higher education	30 (53.6)	26 (46.4)	
Employment Status	**Employed**	32 (44.4)	40 (55.6)	0.042*
	Unemployed/Retired	38 (32.2)	80 (67.8)	

DISCUSSION

In this cross-sectional study of 190 high-risk patients, overall influenza vaccination coverage was 36.8%. Uptake varied by condition: 35.9% among patients with diabetes mellitus (DM), 30.0% in those with chronic obstructive pulmonary disease (COPD), and 46.2% in patients with end-stage renal disease (ESRD). Knowledge about influenza vaccination was moderate (mean score 4.9/9), and higher uptake was associated with older age, higher educational attainment, and being employed.

Our observed low vaccination rate in COPD patients (30.0%) aligns with multiple reports showing suboptimal influenza vaccine coverage in COPD populations. A multicenter survey published in *Vaccines* (2023) reported very low routine annual vaccination and lifetime vaccination rates in COPD patients, with many patients never routinely vaccinated; the study emphasized poor annual coverage and low intention to vaccinate.[13] That study's findings mirror our COPD result and the common theme that COPD patients are under-vaccinated despite guideline recommendations.

Conversely, some European datasets show a wide range of COPD vaccination rates (roughly 20–50% depending on country and study), which helps explain why single-center estimates vary. A population-based analysis and review compiling regional data reported influenza vaccination prevalences ranging from the low twenties (e.g., Hungary ~23.6%) to nearly 50% in some Spanish and German cohorts, differences that reflect health-system factors, targeted public health campaigns, and population age structures.[7] Our COPD estimate lies within this broad European range but toward the lower end, consistent with settings where routine adult immunization programs are less reach-intensive.[14]

Vaccination coverage among patients with ESRD in our findings (46.2%) was higher than the COPD subgroup and approximates levels reported in several kidney-disease–focused reports that document moderate uptake but persistent gaps. Recent reviews

and kidney-medicine publications repeatedly highlight that dialysis patients are prioritized for annual influenza vaccination and often have higher coverage than general chronic disease cohorts because dialysis clinics provide repeated contact points for vaccine delivery; nevertheless, these same sources note that uptake often remains below ideal targets (coverage frequently reported in the 40–60% range and variable by country). Our ESRD result, therefore, is consistent with trends showing relatively better, but still imperfect, coverage among dialysis/renal failure populations.[15, 16]

Influenza vaccination among people with diabetes in our sample (35.9%) is comparable to many international reports documenting suboptimal coverage in diabetics. Systematic analyses and narrative reviews have stressed that, despite strong evidence of benefit, many people with diabetes remain unvaccinated; rates differ markedly by country and by health-system intensity. Some studies in East Asia have even reported markedly lower coverage in diabetic patients (one pooled analysis reported single-digit to low-double-digit coverage in some Chinese settings), reflecting structural and behavioral barriers in certain regions. Thus, our diabetic subgroup rate is similar to many middle-income settings and higher than the very low rates seen in some areas, but lower than coverage reported from high-income systems where national campaigns and clinic-based reminders achieve higher uptake.[17, 18]

The association we observed between higher education and greater vaccine uptake is consistent with multiple recent studies and reviews that identify education and health literacy as strong predictors of adult vaccine acceptance. Higher education likely improves awareness of vaccine benefits and access to health information; several 2020–2024 analyses highlight education as a recurring facilitator of vaccination across chronic disease groups. Similarly, our finding that older age was associated with higher coverage mirrors national trend analyses showing increased uptake in older adults, who are often targeted by public programmes and perceive higher personal risk.[19]

Employment status correlated with uptake in our data (employed > unemployed), which may reflect workplace-based vaccine access, occupational health recommendations, or greater interaction with health services among employed participants. Several interventional and observational studies have pointed to workplace vaccination campaigns and employer recommendations as effective facilitators for higher adult vaccination rates.[18]

Two important contrasts emerge when comparing our knowledge-uptake relationship with the literature. First, we observed moderate mean knowledge (4.9/9) with graded increases in vaccination proportion across knowledge categories; this pattern matches intervention studies showing that targeted education and reminder systems increase uptake. For instance, randomized or quasi-experimental trials of electronic reminders or focused education among high-risk adults have improved influenza vaccine uptake by roughly 5–10 percentage points in recent trials, demonstrating that knowledge/awareness interventions can move the needle meaningfully. Second, even where knowledge is moderate, structural barriers (cost, access, clinic workflows) and vaccine hesitancy may still limit uptake, as explained repeatedly in recent reviews that synthesize barriers and motivators among high-risk groups.[20]

Our results reinforce that influenza vaccination coverage among high-risk groups remains suboptimal worldwide, uptake varies substantially by condition and setting, and sociodemographic factors and modifiable programmatic factors are key determinants. Given the demonstrated clinical benefits of vaccination in COPD, DM, and ESRD, the gaps we observed argue for intensified, multifaceted interventions, education, clinician prompts, point-of-care vaccine availability, and electronic

reminders, all of which have shown promise in recent studies.

There are some limitations of the study. The cross-sectional studies' comparisons must be cautious because coverage estimates depend heavily on study year (pandemic-era dynamics shifted attitudes), geographic region, sampling frame (clinic vs population surveys), and how "vaccinated" was defined (ever vs past 12 months). Several recent reviews also noted that COVID-19 era dynamics altered influenza vaccine interest variably across contexts, some regions saw improved uptake due to heightened respiratory-virus awareness, while others experienced pandemic-related disruption to routine vaccination services.

CONCLUSION

The present study findings echo a global pattern of incomplete protection among high-risk patients. To raise coverage toward guideline targets, interventions supported by recent evidence should be prioritized: incorporate standing vaccine offers in chronic-care clinics (especially dialysis units and diabetes clinics), use clinician prompts and electronic nudges, run targeted educational campaigns to improve knowledge and counter hesitancy, and monitor coverage systematically to measure impact. Future local research should evaluate which combined approaches (education + reminders + onsite delivery) are most cost-effective in our setting.

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