Infectious disease

# Assessing influenza vaccination advocacy attitudes and recommendation behaviors among non-physician healthcare workers during the 2024-25 respiratory virus season

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Keywords

Influenza • Vaccine • MoVac • MoVad

Summary

**Introduction.** *Influenza is a highly contagious viral respiratory infection that spreads quickly in crowded and closed environments. Non-physician healthcare workers (HCW) play an essential role in vaccination discussions and initiatives in healthcare facilities. Our study aims to explore influenza vaccination acceptance and advocacy behavior among non-physician HCW during the 2024-25 respiratory virus season within a large healthcare system in Georgia, USA.*
**Methods.** *A cross-sectional survey was conducted using validated instruments, the Motors of influenza vaccination acceptance (MoVac-flu) and the Motors of engagement with vaccination advocacy (MovAd-flu). Data was collected via an online survey platform between February 4 and March 15, 2025.*
**Results.** *A total of 156 responses were received, with 141 included after data cleaning. Most participants were registered nurses (27.7%), aged 25-34 years (29.8%) and identified as female (84.4%). The average MoVac score was 5.31 (SD=1.43) and the average MovAd score was 4.7 (SD=1.27), both out of a maximum of 7. Linear regression analysis revealed a significant positive correlation between participants' comfort in discussing influenza vaccination with patients and their MoVac and MovAd scores. Clinical guidelines and recommendations emerged as strong motivators for initiating vaccination discussions.*
**Conclusion.** *Findings indicate that non-physician HCW demonstrate favorable attitudes toward influenza vaccination acceptance and advocacy, as reflected in consistently high MoVac and MovAd scores. These results suggest that non-physician healthcare workers may serve as effective messengers in promoting influenza vaccination within healthcare systems. Future initiatives could leverage their role to strengthen vaccination uptake and patient engagement.*

## Introduction

Influenza, or "the flu," is a highly contagious acute viral respiratory infection caused mostly by influenza viruses A and B. Its major symptoms are rapid fever, sore throat, coughing, muscular pain, exhaustion, and, in some cases, a runny nose or nasal congestion. While most cases do not require treatment for recovery, influenza can cause serious symptoms and complications, such as pneumonia and sepsis, particularly in high-risk populations [1]. In developed countries, most influenza-related deaths occur among adults aged 65 and older [2]. This age group accounts for the largest share of hospitalizations and 62% of deaths. Workingage adults (18-64 years) also experienced significant mortality, with an estimated 7,800 deaths (36% of all influenza related deaths) [1]. Seasonal influenza spreads quickly in crowded and closed environments such as schools, nursing homes, and healthcare facilities. For more than 60 years, vaccination has been the most effective and safe strategy to prevent influenza. Individuals who are vaccinated protect themselves from severe morbidity and assist to minimize the spread of the virus, particularly in vulnerable groups such as the elderly and young children, reducing serious sickness [1, 3].
Annual vaccination is recommended since influenza viruses change every year, and the virus strains used for vaccine development are updated annually to protect against the most current threats [4].
The United States has a comprehensive national plan for influenza vaccination that aims to protect public health and minimize the impact of seasonal and pandemic influenza. The flu shot is recommended annually for almost every person who is 6 months of age and older [5]. Yet, coverage of the influenza vaccine remains suboptimal in the United States. During the 2023-24 flu season, influenza vaccination coverage among healthcare professionals was 75.4% [6] and similar proportions were found during the 2022-23 flu season (75.9%) [7]. These vaccination rates experienced a decline following the pandemic, as they previously stood at 80.6% [8, 9].
Influenza continues to pose a serious risk to public health, especially in healthcare settings where healthcare workers (HCWs) play an essential role in limiting and

preventing the virus's spread [1]. Yet, suboptimal uptake of influenza vaccines suggests the need for novel interventions, potentially engaging new messenger groups. Non-physician HCWs, represent a substantial portion of the workforce who serve as key influencers in vaccine acceptance and advocacy specifically among patients. However, the attitudes and behaviors toward influenza vaccination of this key population remain understudied [10]. Non-physician HCWs often have a positive view about vaccinations [11]. The tendency for vaccine uptake can often be motivated by a sense of duty and a wish to support public health efforts. These HCWs usually identify barriers to vaccination for their patients and the general public, rather than for themselves. Despite the positive attitude toward vaccinations that non-physician healthcare workers show, the vaccination rates against influenza in this population remain relatively low globally [12]. Several factors contribute to suboptimal influenza vaccination uptake among HCWs. Perceptual barriers such as low perceived risk of influenza, doubts about vaccine effectiveness, and concerns over side effects often reduce motivation. Behavioral and social influences, including lack of time and cultural attitudes, further limit coverage [1, 4]. Prior influenza vaccination has been linked to increased odds of recommending vaccination to others (OR=10.5; 95% CI=[5.38-20.3]; $p<0.001$) [13] suggesting that healthcare workers who get vaccinated themselves are more likely to advocate for vaccination.

The primary goal of the research study is to understand influenza vaccine advocacy attitudes and recommendation behaviors among non-physician healthcare workers. Specifically, the study aims to explore two key aspects: "Acceptance," focusing on how non-physician HCWs perceive and embrace influenza vaccination, and "Advocacy," examining their roles and actions in promoting influenza vaccination within their healthcare settings. Through this exploration, the study seeks to uncover insights that can describe non-physician HCWs behavior toward the influenza vaccine and assess potential factors that may influence influenza vaccine communication and/or uptake. The research findings may help to support the implementation of interventions aimed at supporting influenza vaccine uptake and fostering engagement in discussions with patients about vaccination by this vital group of healthcare professionals.

## Methods

The study used a cross-sectional survey to explore influenza vaccination acceptance and advocacy behavior among non-physician HCWs.

This research did not receive grant funding agencies in the public, commercial, or not-for-profit sectors.

### Population and sampling

The population of our study was non physician HCWs from a large Southern academic healthcare system. This included Medical/Nursing Assistants (MA/NA), Licensed Practical Nurses (LPN), Registered Nurses (RN), Pharmacists (PharmD) and Advanced Practice Providers (APP). APPs include Nurse Practitioners (NP), Physician Assistants (PA), Certified Registered Nurse Anesthetists (CRNA), and Certified Nurse Midwife (CNM). Other non-physician HCWs with patient contact roles were also included.

To be eligible to take the survey, individuals had to meet the following criteria:

*Inclusion criteria:*

- Be 18 years of age and above
- Fluent in English
- Non-physician HCW within large academic healthcare units
- Job role with direct patient contact.

*Exclusion criteria:*

- Physicians.

Participants were primarily selected through purposive sampling methods. The recruitment flyer was published weekly within a broadly distributed healthcare newsletter. The flyer outlined the study's objectives, procedures, and benefits including a QR code for easy access to the survey. Printed flyers were distributed within the healthcare facilities, and direct email invitations including detailed information about the study and a link to the survey were sent to non-physician HCWs for recruitment.

### Study measures: MoVac-flu and MovAd-flu scales

The study utilized two previously established and validated scales:

- Motors of influenza vaccination acceptance (MoVac-flu): 9 items
- Motors of engagement with vaccination advocacy (MovAd-flu): 11 items.

The 'Motors of influenza vaccination acceptance' (MoVac-flu) and the 'Motors of engagement with vaccination advocacy' (MovAd-flu) scales were established and validated in prior studies by Vallée-Tourangeau et. al. We incorporated the most updated versions of both the MoVac-flu (9 items) and MovAd-flu (11 items) scales. Given that previous research has consistently demonstrated their accuracy and reliability [10, 14], we did not re-evaluate their internal consistency. Instead, our focus was on applying these validated scales to assess flu vaccination acceptance and advocacy behaviors. Numerous global studies have employed the MoVac and MovAd scales to evaluate vaccine acceptance and advocacy behaviors not only among healthcare workers but also across diverse key populations [14, 15]. Initially used with The National Health Service in the United Kingdom with direct patient contact, the study by Vallée-Tourangeau assessed the validity of the MoVac-Flu scale in predicting influenza vaccination status during the 2013-14 season. The analysis revealed that demographic factors alone did not significantly predict influenza vaccination behavior among healthcare workers. However, risk perception variables played a crucial role. This study confirmed that the MoVac-Flu and MovAd-

Flu scales were strong predictors of both vaccination uptake and advocacy behavior, even after accounting for demographic and risk perception variables. Because they produced more accurate results, the 9-item MoVac-flu scale and the 11-item MovAd-flu scale were adopted after it was shown that some items of the original 12-item scales were poor predictors [10, 14].The MoVac and MovAd scales are scored using a 7-point Likert scale from 1 (strongly disagree) to 7 (strongly agree) and are meant to assess different empowerment feelings of healthcare workers:

- The value (How much the vaccine is important to protect the health worker's life and their patients)
- The impact (How much vaccination reduces the risk of catching the influenza virus)
- The knowledge (How much healthcare workers understand the benefit of influenza vaccination in protecting from the influenza virus)
- The autonomy (To which extent healthcare workers are free to choose to get vaccinated against influenza).

The MoVac and MovAd scales are grounded in Cognitive Model of Empowerment (CME). Unlike simple attitude or intention scales, they measure value, impact, knowledge, and autonomy, four empowerment domains that explain why individuals accept vaccination or advocate for it [10]. They go beyond correlating attitudes with uptake; they predict actual vaccination behavior and advocacy, making them useful for designing interventions [16].

### Survey procedures

Our data collection instrument consisted of a one-time cross-sectional online survey conducted through Qualtrics XM™. Individuals who clicked on the survey link were presented with the consent form, the purpose of the study, and its voluntary nature. Individuals who clicked to continue were directed to the survey questionnaire. To guarantee that we are not collecting any identifiable data and ensuring participants can complete the survey without risking their anonymity, we used the specific tool on Qualtrics to "anonymize responses and disabled the collection of IP addresses before data collection. Consequently, identifying information was not retrievable for those responses.

Participation in the research study was completely voluntary, and no incentives were provided to individual participants.

The survey consisted of 5 sections:

- Screening questions
- Practices, attitudes, and comfort levels regarding influenza vaccination
- The MoVac-flu scale
- The MovAd-flu scale
- Demographic questions.

The survey was pre-tested and piloted with a group of 20 individuals including healthcare workers and others from the public health field whose demographic and professional features were comparable to those of the research population in order to guarantee clarity and ease of implementation. Multiple adjustments were carefully implemented in the survey, informed by valuable feedback received during the processes of survey testing and piloting.

## Analysis plan

Participants responses were transferred to an Excel file, and data was cleaned and analyzed using R studio (version 2024.12.0, Build 467) descriptively, as well as using linear regression methods. Data were imported using the readxl package, cleaned and summarized using dplyr and tidyr, and analyzed using statistical procedures from the stats package. Kendall's Tau correlation and linear regression analyses were conducted using base R functions.

The demographic data, practices, attitudes, and comfort levels regarding influenza vaccination were summarized descriptively via frequencies (n, %). Kendall's Tau Correlation was employed to assess the strength and direction of the relationship between the participants' comfort level in discussing influenza vaccination with patients and their corresponding MoVac and MovAd scores. We used Kendall's Tau correlation instead of other statistical tests like Chi-square ($\chi^2$) or Pearson correlation due to the nature of the variables as the comfort level in discussing vaccination is an ordinal variable and the MoVac and MovAd scores are continuous variables. Thus, since Kendall's Tau is used when at least one variable is ordinal, it is considered the most appropriate statistical test for our analysis. Additionally, Kendall's Tau is well-suited for small sample sizes and demonstrates robustness against outliers. Linear regression analysis was conducted to explore and quantify the meaningful association between the comfort levels and the two scores (MoVac and MovAd). This step aimed to further determine the extent to which the participants' comfort levels when engaging in vaccination discussions with patients could predict variations in MoVac and MovAd scores.

Linear regression was appropriate in this case because our outcome variables (MoVac and MovAd scores) were continuous and we used the numeric version of comfort level as the predictor to facilitate statistical analysis (1=Very uncomfortable, 2=Uncomfortable, 3=Neutral, 4=Comfortable and 5=Very comfortable).

## Ethical considerations

This study adhered to strict ethical guidelines to ensure the protection and respect of all participants. Ethical approval was obtained from Emory institutional review board (IRB #: STUDY00008646), and the research was conducted in compliance with its standards. Additional Ethical and Religious Directives compliant review approval was obtained to be able to conduct research in certain hospitals within the academic healthcare system. Participation in the study was entirely voluntary, and consent was documented through clicking on the

"continue button" in the beginning of the survey.

To safeguard participants' privacy and confidentiality, all survey responses were anonymized, and no identifying information was recorded through the data collection instrument. Data was stored indefinitely within secure systems (OneDrive). During the study, only authorized study team members had access to the data. Data may be shared with other investigators or used for future analysis upon submission of a written request to the study team, which includes details of the use and protection of the data.

Furthermore, participants were provided with detailed information about the purpose of the study, their rights to withdraw at any time, and how the data would be used. Participants were encouraged to voice any concerns or ask questions at any point during the process, and measures were taken to reduce harm or discomfort while taking the survey. The study sought to guarantee honesty, transparency, and consideration for the rights and welfare of all participants.

## Results

Of 156 survey responses collected between February 4th, 2025, and March 15th, 2025, 141 were considered complete and included in the analysis. Fifteen responses were deemed incomplete and excluded from the analysis to ensure the accuracy and integrity of the study's findings.

### A. Demographics

#### 1. Healthcare role

Figure 1 shows the summary of healthcare roles reported by the participants. Registered nurses represented the largest group, comprising 39 individuals (27.7% of the total participants). This was followed by medical and nursing assistants, who accounted for 34 individuals (24.1%). The "other" category encompassed various roles, including Pharmacists, Speech-Language Pathologists, Clinical Dietitians, Social Workers, Respiratory Therapists and Certified Ophthalmic Medical Technologists, among others.

#### 2. Age distribution

Figure 2 shows the age distribution of participants. Most participants were between the age range of 25 to 34 years (n=42, 29.8%). This group was followed by those aged 45 to 54 years (n=32, 22.7%).

#### 3. Gender

Figure 3 shows the gender distribution of the participants. Most participants identified as female (n=119, 84.4%) compared to other genders.

#### 4. Vaccination status

Figure 4 shows the vaccination status of the participants. Most participants (n=136, 96.4%) reported receiving the influenza vaccine during the 2024-2025 respiratory virus season.

### B. Behavioral analysis

#### 1. Frequency of discussing Influenza vaccination with patients

Figure 5 shows the frequency of discussing influenza vaccination with patients. The majority of participants indicated that they either sometimes (n=37, 26.2%) or rarely (n=36, 25.5%) discuss influenza vaccination with their patients during routine clinical visits. A smaller group of healthcare workers (n=11, 7.8%) reported always addressing this topic with their patients.

#### 2. Factors influencing decisions to recommend influenza vaccination to patients

Figure 6 summarizes the factors influencing decisions to recommend influenza vaccination to patients. According

**Fig. 1.** Healthcare roles of participants.

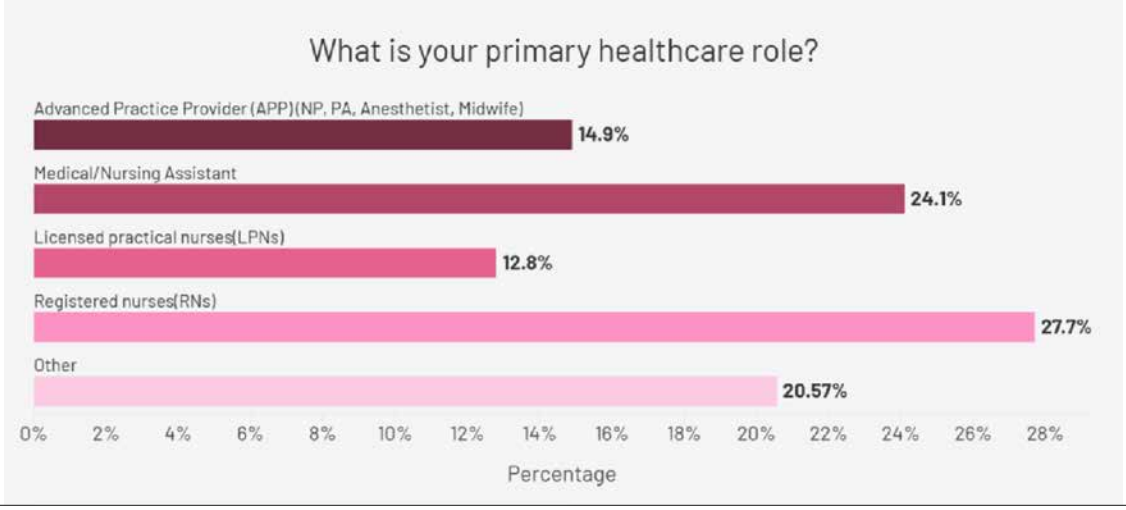


**Fig. 2.** Age distribution of participants.

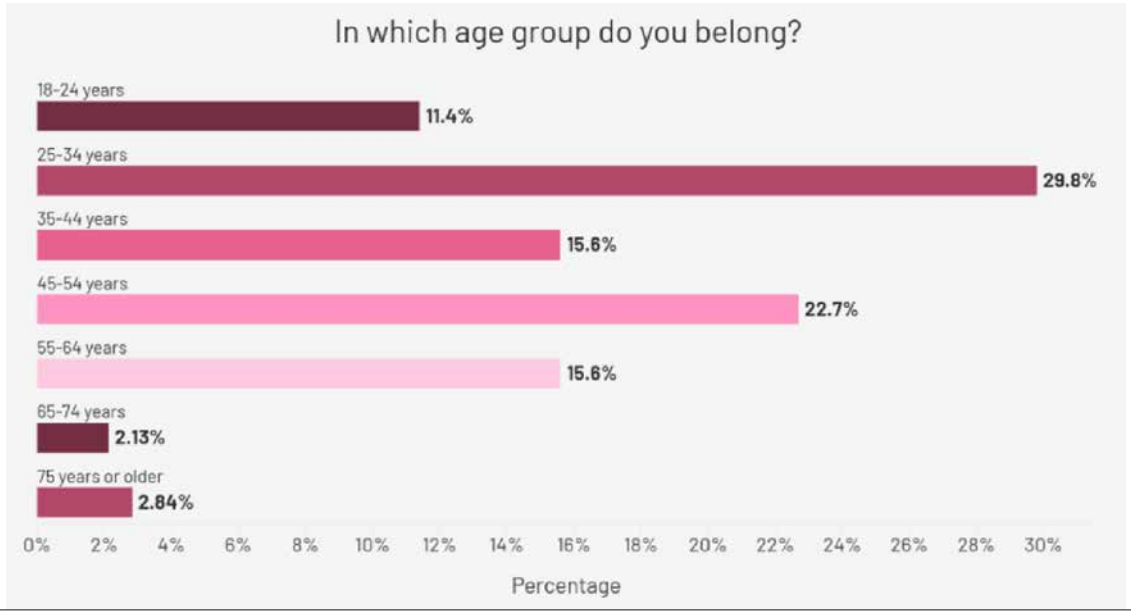



**Fig. 3.** Gender distribution of the participants.

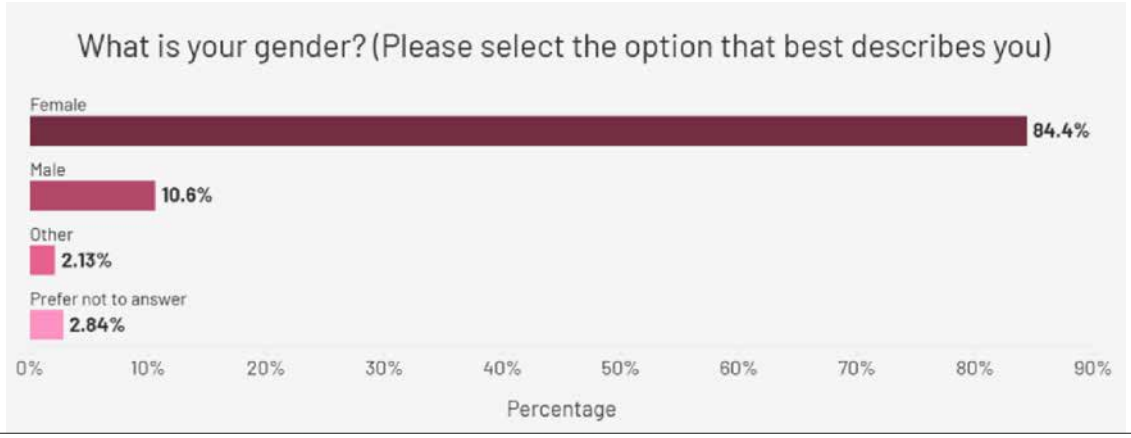
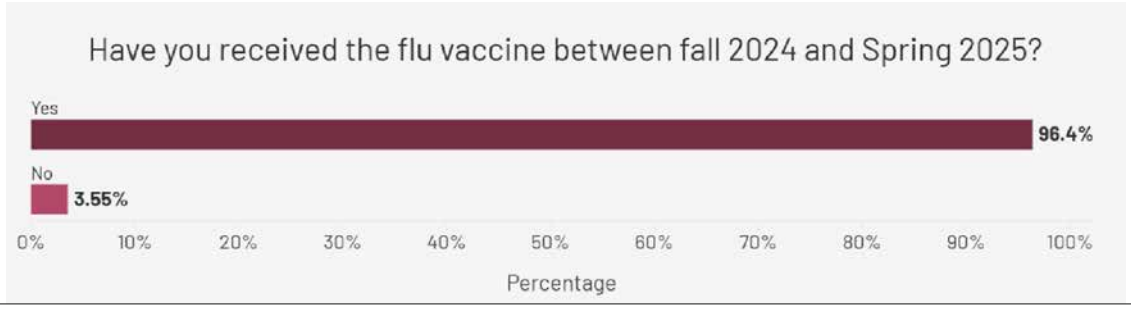



**Fig. 4.** Vaccination status of participants.




to participants, the most important factor influencing their recommendation of influenza vaccination to patients was clinical guidelines and recommendations (n = 89, 63.12%). This was followed by the patient's age and health status (n=80 participants, 56.7%). The least influential factor was the availability of vaccine stock in the clinic (n=49, 34.75%).

### 3. Level of comfort when discussing influenza vaccination with patients

Figure 7 shows the level of comfort reported by participants when discussing influenza vaccination with patients. Most participants reported feeling very comfortable discussing influenza vaccination with patients (n=56, 39.7%), followed by somewhat comfortable (n=35, 24.8%).

**Fig. 5.** Frequency of discussing influenza vaccination with patients.

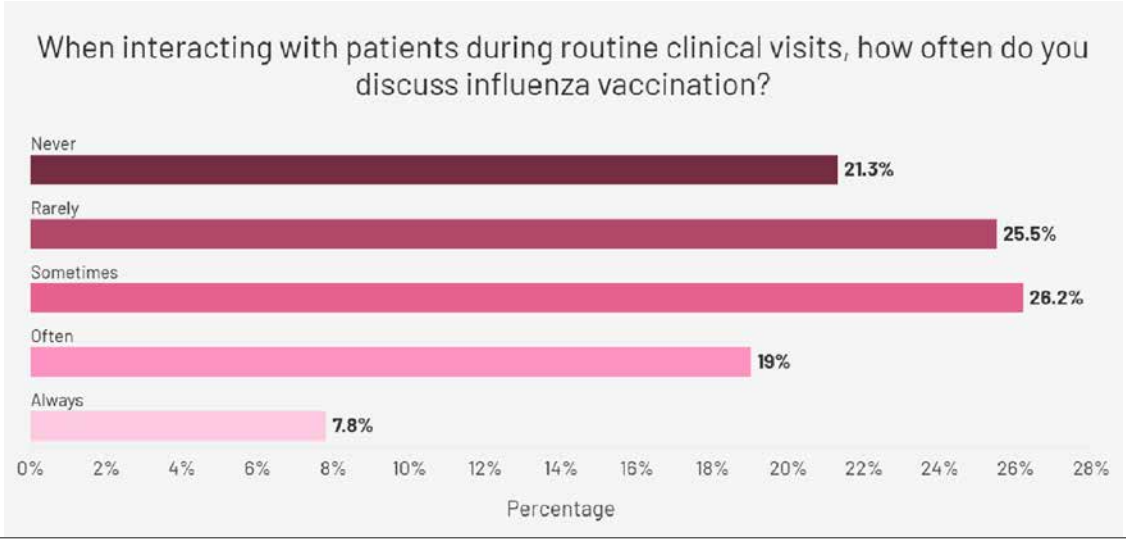



**Fig. 6.** Factors influencing decisions to recommend influenza vaccination to patients.

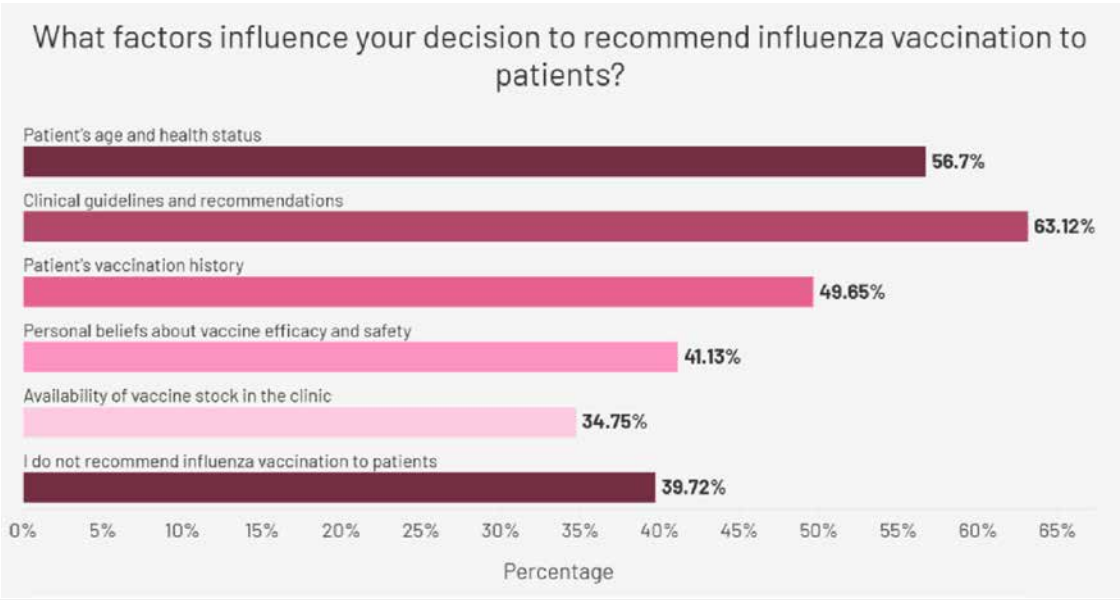
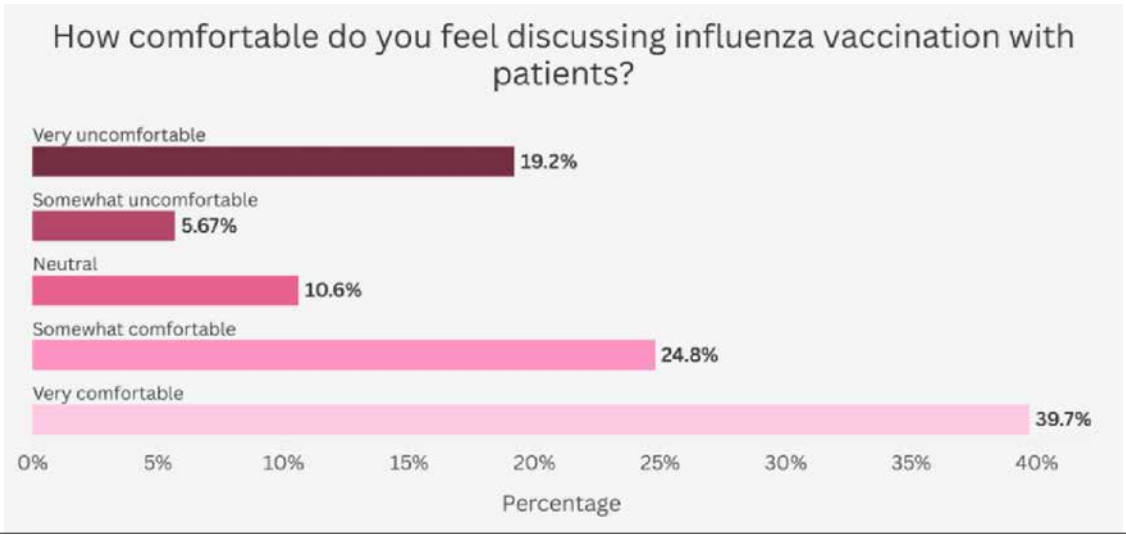



**Fig. 7.** Level of comfort when discussing influenza vaccination with patients.



**Tab. I.** Scores of the MoVac-flu scale and subscales.

| | Mean | SD | Min | Max | Lower 95% CI | Upper 95% CI |
|---|---|---|---|---|---|---|
| MoVac score | 5.31 | 1.43 | 1.00 | 7.00 | 5.07 | 5.55 |
| MoVac Value score | 5.43 | 1.61 | 1.00 | 7.00 | 5.16 | 5.70 |
| MoVac Impact score | 5.34 | 1.52 | 1.00 | 7.00 | 5.09 | 5.59 |
| MoVac Knowledge score | 5.74 | 1.43 | 1.00 | 7.00 | 5.50 | 5.97 |
| MoVac Autonomy score | 4.01 | 2.55 | 1.00 | 7.00 | 3.58 | 4.43 |

SD: Standard deviation, CI: Confidence Interval

**Tab. II.** Scores of the MovAd-flu scale and subscales.

| | Mean | SD | Min | Max | Lower 95% CI | Upper 95% CI |
|---|---|---|---|---|---|---|
| MovAd score | 4.77 | 1.27 | 1.00 | 7.00 | 4.56 | 4.98 |
| MovAd Value score | 4.68 | 1.71 | 1.00 | 7.00 | 4.40 | 4.97 |
| MovAd Impact score | 4.35 | 1.50 | 1.00 | 7.00 | 4.10 | 4.60 |
| MovAd Knowledge score | 5.19 | 1.28 | 1.00 | 7.00 | 4.98 | 5.40 |
| MovAd Autonomy score | 4.90 | 1.60 | 1.00 | 7.00 | 4.63 | 5.17 |

SD: Standard deviation, CI: Confidence Interval

**Tab. III.** Kendall's Tau and p-value.

| Scale | Kendall's Tau | *p-value* |
|---|---|---|
| MoVac-flu | 0.1632 | 0.01177* |
| MovAd-flu | 0.3043 | 2.644e-06*** |

Signif. codes: 0'***' 0.001'**' 0.01'*' 0.05'.' 0.1'' 1

**Tab. IV.** Linear regression model results.

| Scale | Kendall's Tau | *p-value* |
|---|---|---|
| MoVac-flu | 0.1632 | 0.039* |
| MovAd-flu | 0.26794 | 0.000108*** |

Signif. codes: 0'***' 0.001'**' 0.01'*' 0.05'.' 0.1'' 1

## C. Calculation of MoVac and MoVad scores

Table I shows the MoVac-flu scale and subscale scores out of a maximum score of 7. The average MoVac score among participants was 5.31 (SD=1.43). Within subscales, the knowledge subscale had the highest score (mean=5.74, SD=1.43). In contrast, the autonomy subscale had the lowest score (mean=4.01, SD=2.55).
Table II shows the MoVac-flu scale and subscale scores out of a maximum score of 7. The average MovAd score calculated for the study population was 4.7 (SD=1.27). The knowledge subscale had the highest score (mean=5.19, SD=1.28). The impact subscale had the lowest score (mean=4.35, SD=1.5).

## D. Kendall's Tau Correlation between the comfort level in discussing influenza vaccination and MoVac and MovAd scores

### 1. Correlation with MoVac score

Table III shows that Kendall's Tau was determined to be 0.1632, reflecting a weak positive correlation between the comfort level in discussing influenza vaccination and the MoVac score (p-value: 0.01177), indicating that this correlation is statistically significant at p<0.05.

### 2. Correlation with MovAd score

Table III shows that Tau was determined to be 0.3043, reflecting a moderate positive correlation between the comfort level in discussing influenza vaccination and the MovAd score (*p-value*=2.644e-06) indicating that this correlation is highly statistically significant at $p<0.05$.

## E. Linear Regression between the comfort level in discussing influenza vaccination and MoVac and MovAd scores

### 1. MoVac score *vs*. the comfort level in discussing influenza vaccination

The linear regression model in Table IV reveals that the comfort level coefficient is 0.163, indicating that for each one-unit increase in the comfort level in discussing influenza vaccination, the MoVac score increases by 0.163 points (*p-value*=0.039), demonstrating statistical significance at $p<0.05$.
There is a weak positive but significant relationship between comfort in discussing vaccination and MoVac score. As comfort level increases, MoVac score tends to increase slightly.

### 2. MovAd score *vs*. the comfort level in discussing influenza vaccination

The linear regression model in Table IV reveals that the comfort level coefficient is 0.268, indicating that for each one-unit increase in the comfort level in discussing influenza vaccination, the MovAd score increases by 0.268 points (*p-value*=0.0001) demonstrating statistical significance at $p<0.05$.
There is a moderate positive and highly significant relationship between comfort in discussing vaccination and MovAd score. As the comfort level increases, MovAd score tends to increase more noticeably compared to MoVac score.

## Discussion

Further studies conducted across a broader and more diverse population throughout Europe have reinforced the validity of the MoVac-flu and MovAd-flu scales [14-16]. These findings not only confirmed the robustness of the scale but also highlighted its strong predictive capacity for influenza vaccine uptake. This expanded research demonstrated that the scale remains reliable and effective when applied to a wider population.

Since their development, the two scales have been utilized across numerous regions globally, including Europe, Eurasia, North Africa, and the Middle East [17]. Their adaptability has been demonstrated through translations into multiple languages [18] enabling their application not only among HCWs but also other diverse demographic groups, such as elderly populations, and university students [15, 18]. This widespread usage underscores their versatility and reliability as tools for understanding vaccination behaviors. Furthermore, their integration into varied cultural and professional contexts highlights their effectiveness in exploring different behaviors regarding influenza vaccine acceptance and advocacy on an international scale.

Since the onset of the COVID-19 pandemic, a new scale known as the MoVac-COVID19S was established, specifically tailored to assess acceptance of Covid-19 vaccines. This scale has been widely adopted in various research projects with the shared goal of understanding vaccine acceptance dynamics [19]. The MoVac-COVID19S Scale was derived from the MoVac-flu scale, maintaining the original 9-item structure while shifting its focus to the Covid-19 vaccine. The scale was implemented with diverse populations, primarily in Asian countries such as China, Taiwan, Indonesia, and Malaysia [19, 20], then in New Zealand [21]. The MoVac-COVID19S scale has eventually been proven as a good predictor for vaccination engagement among the general population.

This large implementation of MoVac and MovAd scales around the world provided critical insights into the optimal use of these scales within our study. It helped us determine the most effective approach for assessing influenza vaccine acceptance and advocacy behaviors among our target population. Although previous studies' methods and protocols varied, they all came to similar conclusions. The MoVac-flu and MovAd-flu scales were considered to be in line with the Cognitive Model of Empowerment (CME) [10, 21], which takes into account autonomy, knowledge, influence, and value. The internal consistency of both scales was good [18]. These MoVac-flu and MovAd scales aligned with other validated measures, such as the Multidimensional Health Locus of Control, reinforcing the importance of HCWs' beliefs in vaccine utility and personal responsibility in improving immunization rates [22].

It is important to note that there is a gap in research in exploring non-physician HCW attitudes and advocacy toward influenza vaccine within the United States. By assessing both the acceptance and advocacy of influenza vaccination among non-physician HCWs, our study explored factors influencing vaccine-related decision-making within this population. The findings from this research study can potentially strengthen workplace vaccination policies, enhance healthcare workers' engagement in vaccine advocacy and recommendation, and ultimately improve patient health outcomes.

Most participants in our study were female, accounting for 84.4% of the sample. This demographic distribution is consistent with this healthcare system workforce, where 73% of its employees identify as female [23]. This healthcare system data also shows that the most common certification among employees is Certified Nurse Assistant (CNA) representing 18% of total employees [24]. This aligns with our findings, as the study population's composition showed that medical and nursing assistants accounted for 24.1% of all participants, following registered nurses, who comprised 27.7% of the total sample.

Our findings show that 96.4% of the total participants have received the influenza vaccine during the 2024-25 respiratory virus season. Influenza vaccination is mandatory for all health providers working at this healthcare system, unless they have medical contraindications or a religious exemption [25].

Our study found that discussions about influenza vaccination among HCW varied significantly. While 26.2% of participants reported occasionally addressing the topic with their patients, 25.5% admitted to discussing it rarely, and 21.3% stated that they never brought it up [26]. These findings suggest that even though HCWs might support recommending the vaccine, they do not necessarily engage in conversations about it with their patients. Additionally, this trend of not discussing the influenza vaccine often can be attributed to the diverse roles within our healthcare population. In certain specialized departments, discussing influenza vaccination may not be a routine part of patient interactions, which likely explains why most respondents either rarely or never engage in these conversations. This insight emphasizes the need to address communication gaps in vaccine advocacy efforts.

Moreover, our study revealed that multiple factors influenced recommendation behaviors toward influenza vaccination. 63.12% of participants mentioned clinical guidelines and recommendations as the major factor to influence their decision to recommend influenza vaccination to their patients. These findings align with previous research, which highlighted the influential role of supervisors and institutional leaders in promoting vaccination [27, 28]. Furthermore, studies showed that individuals who obtain vaccination information from official health sources are more likely to get vaccinated and consequently advocate for the vaccine [29]. Additionally, patients age and health status emerged as significant factors influencing HCWs' decisions to recommend the influenza vaccine. In our study, 56.7%

of participants identified this as a primary reason for their recommendations.

Regarding the level of comfort of discussing influenza vaccination with their patients, almost 40% (39.7%) of HCWs reported being very comfortable, while 24.8% stated being somewhat comfortable. Prior research has yielded different findings on this topic. While some HCWs felt comfortable discussing influenza vaccination, as they believed in its efficacy and positive impact on patient health, others experienced discomfort due to misconceptions about the vaccine's safety or effectiveness [30, 31]. The variation of the comfort levels of HCWs in discussing the influenza vaccine is attributed to risk perception [10] or discomfort due to skepticism or misinformation [15]. Thus, even though most of our population received the influenza vaccine, this does not necessarily reflect on their comfort level to advocate for it. Therefore, examining the correlation between the level of comfort of discussing the influenza vaccine and MoVac and MovAd scores provides stronger evidence for the connection between the comfort level and acceptance and advocacy behavior.

Our findings have shown that the average MoVac-flu score of non-physician HCWs was 5.31 (SD=1.43) which is above the mid-point of 4, suggesting a strong acceptance of the influenza vaccine. The knowledge subscale showed the highest score, averaging 5.74 (SD=1.43). This suggests that non-physician HCWs feel confident in their understanding of the influenza vaccine. Conversely, the autonomy subscale had the lowest score, recorded at 4.01, with considerable variation among participants (SD=2.55). This discrepancy can be attributed to the HCW influenza vaccine mandate [25, 32].

The average MovAd score for non-physician HCWs was 4.7 (SD=1.27), indicating a positive attitude toward advocating for the influenza vaccine. However, this score is lower than the MoVac score (MoVac=5.74). These findings support our earlier assertion that accepting the influenza vaccine does not necessarily equate to being motivated to advocate for it. Similarly, a Greek study reported comparable results, with a MovAd score of 4.7 (SD=1.2), further validating our interpretations [15]. Similar to the MoVac score, the knowledge subscale of the MovAd score had the highest score, calculated at 5.19 (SD=1.28). This confirms that non-physician HCWs feel confident in their ability to answer questions and offer advice about the influenza vaccine. On the other hand, the impact subscale of the score was the lowest among all assessed aspects, with a value of 4.35 (SD=1.5). This reflects that even though non physician HCWs believe in their ability to advocate for the influenza vaccine; they are less confident in the impact that vaccine advocacy can have on the general population. A previous study reported comparable results, with the impact score calculated at 4.5 (SD=1.3) [15]. On the other hand, another study conducted in multiples countries in Europe have found a better impact score (5.67, SD=1.2) suggesting that HCW believed that their advocacy for the influenza vaccine can have a great impact [14]. These discrepancies may be attributed to differences in the study populations. While the European study covered all healthcare professionals, including physicians, our research specifically examined non-physician HCWs. The inclusion of physicians in the population could suggest that they have greater confidence in the influence of their recommendations on patient decisions and consequently a greater impact score. In fact, the National Foundation for Infectious Diseases surveys indicate that 51% of patients who have received or plan to receive an influenza vaccine cite their doctor's recommendation as a key motivating factor [27].

Our findings demonstrated that there is a positive significant correlation between the comfort level in discussing influenza vaccination with patients and MoVac and MovAd scores. The linear regression model indicates that for each one-unit increase in the comfort level in discussing influenza vaccination, the MoVac score increases by 0.163 points ($p$=0.039) and the MovAd score increases by 0.268 points ($p$=0.0001). Thus, the comfort level in discussing influenza vaccination is considered a significant predictor for vaccination acceptance and advocacy. Previous research has identified various predictors of vaccination behavior. For example, demographic factors such as country of origin and age have been shown to be significant indicators [14]. Additionally, behavioral aspects like risk perception have proven to be strong predictors of vaccination behavior [10]. Analyzing the relationship between the comfort level in discussing the influenza vaccine and the MoVac and MovAd scores can illustrate the extent to which feeling confident and at ease with vaccination discussions predicts its acceptance among non-physician HCWs, as well as their willingness to advocate for it.

## Strengths and limitations

### Sample Size and Representativeness

Our study included 141 participants from various healthcare facilities. While this exceeds the threshold recommended by Green's rule for regression models (N≥104 + k, with k=1 predictor; minimum 105 participants) [33], challenges remain in determining representativeness. Available resources categorize nonphysician HCWs collectively as "staff members" without specifying the total number in direct patient contact or their distribution across hospitals, clinics, and other settings [23]. Nevertheless, the sample size is sufficient for meaningful statistical analyses and enhances the study's power to detect smaller effects.

### Study Design and Sampling Methods

Participants were recruited through purposive sampling, which may not fully represent the broader healthcare workforce. Voluntary participation could have led to overrepresentation of HCWs supportive of vaccination, while those with negative views may have opted out.

Reliance on selfreported behaviors introduces potential recall and social desirability biases. Moreover, the crosssectional design captures data at a single point in time, limiting causal inference. Future longitudinal or experimental studies could provide deeper insights into vaccine advocacy and acceptance.

### Variability and Novelty

Because influenza vaccination is mandated for all healthcare providers in our study setting, MoVacflu scores could not be used to predict uptake due to limited variability in vaccination behavior [16]. Similarly, restricted gender variability prevented assessment of gender as a predictor. This limitation redirected focus toward behavioral factors, such as comfort in discussing vaccination, which showed meaningful associations with MoVac and MoVad scores. A notable strength is that this study represents one of the first applications of these scales among nonphysician HCWs, contributing novel insights despite limited comparability with prior research.

## Conclusion

By establishing a foundational exploration of advocacy attitudes and recommendation behaviors among non-physician HCWs our research serves as a valuable starting point for future studies to build upon.

Overall, both acceptance and advocacy levels were found to be good, reflecting positive attitudes toward vaccination and active engagement in promoting it. However, two specific dimensions showed only moderate outcomes. The autonomy subscale, which measures the extent to which HCWs feel free to choose vaccination, and the impact subscale, which reflects the perceived influence of their advocacy efforts. These areas represent important targets for intervention.

Evidence based strategies should therefore focus on strengthening HCWs' sense of autonomy and enhancing the perceived impact of their recommendations. Tailored workplace policies and institutional support have previously doubled vaccination rates among HCWs [34]. By reinforcing these aspects, interventions can improve both HCWs' confidence and their effectiveness in vaccine advocacy.

Finally, by situating nonphysician HCWs at the center of vaccine advocacy, the findings of our study could support broader public health initiatives aimed at reducing the burden of respiratory diseases on a global level, increasing seasonal influenza vaccination rates, and enhancing preparedness for future respiratory virus threats.

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## Conflict of interest statement

There are no conflicts of interest of a financial, personal, or any other nature that could have influenced or biased the conduct of this study. This study did not receive any funding, and no external sources were involved in the study design, data acquisition, analysis, interpretation, or writing of the manuscript.

## Author's contributions

OS: Led the preparation and submission of the IRB proposal, and coordinated revisions based on reviewer feedback. He developed the survey tool, facilitated discussions with co-authors regarding edits, and conducted pilot testing. He managed participant coordination and oversaw data collection, including cleaning and analysis. In addition, he drafted the manuscript. LV: Supervised the IRB submission process, contributed to testing and refining the survey tool, and guided the manuscript writing. She provided critical revisions throughout the drafting process. ZW: Oversaw the development of the IRB proposal, participated in testing and refining the survey tool, and supported data collection efforts in collaboration with partners and health facilities. She also contributed to manuscript review and provided substantive edits.

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