

eHealth Literacy and Professional Attitudes as Predictors of Influenza Vaccination and Recommendation Among Spanish Primary-Care Nurses

Abstract

Background: Influenza vaccination among Spanish Healthcare Workers (HCWs) remains below the 75.00% benchmark. Primary-care nurses are both recipients and gatekeepers, yet the roles of digital competence and professional attitudes remain unclear. We examined how eHealth literacy (eHL) and professional attitudes predict influenza vaccination uptake and recommendation among Spanish primary-care nurses. **Materials and Methods:** We conducted a nationwide cross-sectional online survey (November 2024 to March 2025) of 526 primary-care nurses. Instruments included the Questionnaire on Professional Attitudes Toward Official Influenza Vaccination (CAPSVA), and the eHealth Literacy Scale (eHEALS). The statistical analysis was performed using Jamovi version 2.4. **Results:** Vaccination coverage was 89.40% ($n = 470$). Higher eHEALS, CVF, and IIO scores were independently associated with vaccination (adjusted OR per point = 1.07, 1.46, and 1.32, respectively). These factors, together with recent training and online information seeking, explained 26.90% of the variance in recommendation strength. Online information seeking mediated 16.00% of the association between eHL and vaccination. **Conclusions:** Digital skills and favorable professional attitudes, rather than sociodemographic or incentives, appear to drive both vaccination and advocacy among Spanish primary-care nurses. Interventions combining eHealth-literacy training with evidence-based education and supportive workplaces may further boost coverage.

Keywords: Health literacy, influenza vaccines, nursing staff, primary health care, vaccination coverage

Introduction

Seasonal influenza remains a major public health concern, generating high morbidity, mortality, and healthcare costs worldwide.^[1,2] Despite longstanding recommendations, coverage remains below the 75% benchmark in many countries, including Spain, leaving vulnerable groups unprotected and increasing strain on primary-care services.^[3,4] In this context, primary-care nurses are both vaccine recipients and key influencers, whose personal decisions and recommendations impact patients, families, and colleagues.

Motivations for influenza vaccination, such as self-protection, safeguarding others, and adherence to professional norms, are well documented.^[5,6] Recent evidence on influenza-COVID-19 coinfection and excess mortality further underscores vaccination's importance.^[7] However, vaccine hesitancy persists, driven by concerns about vaccine safety and efficacy,^[8,9] the spread of online

misinformation,^[10-12] and skepticism toward health authorities.^[13] In today's digital landscape, where the quality of information varies greatly,^[14] such narratives spread easily.

Health literacy (HL) refers to the ability to access, understand, and apply health information, which is essential for informed decision-making and for resisting misinformation.^[15,16] eHealth Literacy (eHL) extends this competence to digital contexts, enabling nurses to evaluate online information critically and translate evidence into effective patient counseling. Although the COVID-19 pandemic increased the demand for credible information, little is known about how eHL influences Spanish primary-care nurses' vaccination behaviors and their willingness to recommend vaccination.

This cross-sectional study addresses that gap by analyzing how eHealth literacy and the three dimensions of the Spanish

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Questionnaire on Professional Attitudes Toward Official Influenza Vaccination CAPSVA: i) Vaccine Characteristics and Training, ii) Peer Influence and Organizational Support, and iii) Sensitivity to Incentives/Penalties, relate to influenza vaccine uptake and recommendation. It also explores national coverage, tests independent effects of eHealth literacy, and evaluates whether online information-seeking mediates the literacy uptake relationship.

Materials and Methods

We conducted a nationwide cross-sectional survey between November 2024 and March 2025, following the STROBE checklist.

Eligible participants, in this study, were registered nurses working in public or private primary care centers. They were eligible if they had ≥ 6 months of continuous practice and provided electronic informed consent. Nurses from hospitals, those in nonclinical roles, or with $>20.00\%$ missing data were excluded. Participants were recruited through convenience and snowball sampling. Assuming 50.00% prevalence, 95.00% confidence, and 5.00% precision, the required sample size was 385. A total of 526 valid responses were obtained, exceeding the target and increasing power for multivariable analyses.

Data were collected using a two-section questionnaire. The first section gathered sociodemographic information: gender, age, region, years in practice, prior influenza vaccination, recent formal training, and whether online searches had influenced vaccination opinions. The second section included two validated instruments. The CAPSVA questionnaire^[4] assesses professional attitudes towards official influenza vaccination, with 16 items across three dimensions: Vaccine Characteristics and Training (CVF), Peer Influence and Organizational Support (IIO), and Sensitivity to Incentives/Penalties (SPS); internal consistency was $\alpha = 0.81$. The C-eHEALS^[17] measures perceived ability to use the Internet for health information using an 8-item, 5-point Likert scale (range, 8-40); reliability was high (KMO = 0.914; $\alpha = 0.933$). Higher scores reflect greater eHealth literacy.

Furthermore, the data were collected via an online survey using snowball sampling through social media. One response per device/IP was allowed. Participation was voluntary and anonymous, with informed consent obtained digitally. Control questions ensured data quality by identifying random or inconsistent responses. Participants were encouraged to answer honestly.

Analyses were conducted using Jamovi 2.4. Shapiro-Wilk tested normality; data were summarized as mean (SD), median [IQR], or n (%). Group comparisons used Pearson's χ^2 or Fisher's exact test for categorical variables and t tests (with Welch correction) or Mann-Whitney U for continuous variables. Spearman's rho examined associations between eHEALS and CAPSVA scores.

A three-block hierarchical logistic regression identified predictors of vaccination; model fit was assessed with the Hosmer-Lemeshow test and AUC. Linear regression analyzed recommendation scores. Mediation was tested via Jamovi's medmod module (4,000 bootstraps). Significance was set at $p < 0.050$.

Ethical considerations

The study was approved by the Universidad Alfonso X El Sabio Ethics Committee (Ref. 2023_02/169). Participation was voluntary. Data collection complied with the General Data Protection Regulation (GDPR) and the Declaration of Helsinki. Anonymized data are available upon reasonable request.

Results

A total of 526 primary-care nurses (72.40% women) completed the survey. The mean (SD) age of participants was 45.1 (10.10) years, and 46.10% had ≥ 15 years of experience. Overall, 89.4% ($n = 470$) were vaccinated against influenza. The mean (SD) eHealth-literacy score was 31.00 ± 5.50 . CAPSVA scores were, total = 2.80 ± 0.77 ; CVF = 2.92; IIO = 3.02; SPS = 2.12. Vaccinated nurses showed significantly higher eHEALS, CVF, and IIO scores than nonvaccinated peers ($p < 0.001$), while SPS and demographic variables showed no significant association with vaccination status [Table 1].

In relation to the independent predictor of vaccination, the hierarchical logistic regression confirmed that professional attitudes and digital competence significantly predicted influenza vaccination [Table 2]. Adding CAPSVA subscales improved model fit ($\Delta\chi^2 = 24.30$; $p < 0.001$), and including eHealth literacy (eHEALS) yielded the best model (Hosmer-Lemeshow $\chi^2 = 4.75$; $P = 0.71$; AUC = 0.78). Each eHEALS point increased vaccination odds by 7 % (aOR = 1.07). Higher CVF (aOR = 1.46) and IIO (aOR = 1.32) were also independent facilitators; SPS and sociodemographic factors were not.

Regarding vaccine recommendation strength, linear regression explained 28.00 % of the variance (adjusted $R^2 = 0.269$). CVF, IIO, eHEALS, recent training, and online information-seeking were all significant positive predictors. Female participants showed a modest negative effect. Residuals showed homoscedasticity and no multicollinearity [Table 2].

Finally, online information searching partially conveyed the influence of eHealth literacy on vaccination status [Table 3]. Nurses with higher eHEALS scores were more likely to engage in regular online searches for vaccine information (path a: OR = 1.05; 95% CI: 1.02-1.08; $p = 0.001$). Such searches, in turn, increased the odds of being vaccinated (path b: OR = 1.25; 95% CI: 1.01-1.55; $P = 0.038$). The indirect effect ($\beta = 0.011$; bias-corrected 95% CI: 0.002-0.025) accounted for

16.00 % of the total association (Sobel $z = 2.11$; $p = 0.035$). After inclusion of the mediator, the direct path from eHEALS to vaccination lost conventional significance (path c' : OR = 1.05; $p = 0.054$), indicating partial mediation [Table 3].

Discussion

This nationwide survey of Spanish primary-care nurses revealed three key findings. First, influenza vaccination uptake reached 89.00%, significantly higher than

Table 1: Sample profile, vaccination coverage, and bivariate associations

Variable	Total n (%)	Mean (SD)	Vaccinated (%)	Not vaccinated (%)	Statistics; p ; effect size
Age (years)	-	45.10±10.20	45.40±10.10	42.70±10.90	($t=1.90$; $p=0.058$; $d=0.27$)
Gender					
Female	381 (72.40%)		344 (73.20%)	37 (66.10)	($\chi^2=0.94$; $p=0.333$; $V=0.04$)
Male	145 (27.60%)		126 (26.80%)	19 (33.90)	
Professional experience					
<15 years	283 (53.90%)		248 (52.80%)	35 (62.50)	($\chi^2=1.54$; $p=0.215$; $V=0.05$)
≥15 years	243 (46.10%)		222 (47.20%)	21 (37.50)	
Change of opinion following internet search					
Yes	169 (32.10%)		154 (32.80%)	15 (26.80)	($\chi^2=0.57$; $p=0.451$; $V=0.06$)
No	357 (67.90%)		316 (67.20%)	41 (73.20)	
Formal training last 12 months					
Yes	150 (28.50%)		139 (29.60%)	11 (19.60)	($\chi^2=1.96$; $p=0.162$; $V=0.06$)
No	376 (71.50%)		331 (70.40%)	45 (80.40)	
eHEALS	-	30.98±5.54	31.30±5.44	28.39±5.87	($t=3.53$; $p<0.001$; $d=0.50$)
CAPSVA total	-	2.80±0.77	2.86±0.74	2.30±0.82	($t=4.88$; $p<0.001$; $d=0.7$)
CVF	-	2.85±0.78	2.99±0.78	2.28±0.83	($t=5.49$; $p<0.001$; $d=0.78$)
IIO	-	3.02±0.83	3.08±0.83	2.40±0.88	($t=5.01$; $p<0.001$; $d=0.71$)
SPS	-	2.12±1.00	2.14±1.00	1.93±1.02	($t=1.32$; $p=0.189$; $d=0.19$)

Notes. Continuous data are Mean (SD) or Median [IQR]; categorical data are n (%). Group comparisons used t test with Welch's correction, Mann–Whitney U , and χ^2 test, as appropriate. Abbreviations: IV: Influenza Vaccination; eHEALS: eHealth Literacy Scale; CAPSVA: Questionnaire on Professional Attitudes Toward Official Influenza Vaccination; CVF: Vaccine Characteristics and Training; IIO: Peer Influence and Organizational Support; SPS: Sensitivity to Incentives/Penalties

Table 2: Predictors of influenza vaccination uptake (logistic) and recommendation intensity (linear) in Spanish primary-care nurses

Predictor	Influenza vaccination (logistic regression)		Recommendation intensity (linear regression)	
	OR (95% CI)	P	β / B (Std β)	P
Age (per year)	1.02 (0.98–1.07)	0.368	0.004 (0.05)	0.183
Female sex	1.35 (0.70–2.59)	0.367	0.152 (0.10)	0.009
≥15 yrs practice	1.21 (0.66–2.23)	0.542	0.067 (0.04)	0.21
Formal training	1.78 (0.83–3.83)	0.139	0.118 (0.07)	0.039
Online search (yes)	-	-	0.104 (0.07)	0.042
CVF (per point)	1.46 (1.12–1.91)	0.005	0.306 (0.32)	<0.001
IIO (per point)	1.32 (1.02–1.70)	0.033	0.284 (0.28)	<0.001
SPS (per point)	1.05 (0.90–1.24)	0.548	0.051 (0.06)	0.09
eHEALS (per point)	1.07 (1.02–1.13)	0.01	0.018 (0.10)	0.025
Model diagnostics				

(Logistic) Hosmer–Lemeshow $\chi^2=4.75$; $P=0.71$; AUC=0.78. (Linear) Adjusted $R^2=0.269$; Breusch–Pagan $\chi^2=4.12$; $P=0.128$; max VIF=1.7

Table 3: Bootstrap mediation model (eHEALS → on-line search → vaccination)

Path	β	SE	z	P	OR	Lower 95 %	Upper 95 %
Path a (eHEALS → Search)	0.049	0.015	3.30	0.001	1.05	1.02	1.08
Path b (Search → Vaccination)	0.221	0.107	2.07	0.038	1.25	1.01	1.55
Path c Total (eHEALS → Vaccination)	0.067	0.024	2.79	0.005	1.07	1.02	1.13
Path c' Direct	0.047	0.024	1.93	0.054	1.05	1.00	1.11
Indirect effect (ab)	0.011	-	2.11	0.035	-	-	-

Indirect effect estimated via 4000 bias-corrected bootstrap samples; proportion mediated 16%

the national healthcare worker average (66%) and surpassing the 75.00% benchmark set by Spanish health authorities.^[18] Second, eHealth literacy and two CAPSVA domains, Vaccine Characteristics and Training (CVF) and Peer Influence and Organizational Support (IIO), were independent, mutually reinforcing predictors of vaccination and recommendation strength. Third, online information-seeking partially mediated the link between eHealth literacy and uptake, suggesting a behavioral pathway by which digital skills support immunization.

The strong association between CVF and uptake supports previous evidence that vaccine knowledge drives acceptance among healthcare professionals.^[5,6] IIO also aligns with findings that peer norms and institutional culture shape vaccination behavior.^[19] Our results further show that Sensitivity to Incentives/Penalties (SPS) had a negligible impact, consistent with studies where financial or punitive strategies failed to shift entrenched beliefs.^[20]

Each additional point on the eHEALS increased vaccination odds by 7%, corroborating systematic reviews linking health literacy to vaccination intentions.^[21,22] Even after adjusting for CVF and IIO, eHealth literacy retained borderline significance, indicating its unique cognitive contribution. Sixteen percent of its total effect was mediated through online information-seeking, a pattern also observed in COVID-19 vaccination studies.^[23]

While high uptake may reflect self-selection bias, this aligns with evidence that nurses vaccinate at higher rates than other groups^[20] and that COVID-19 increased risk awareness among frontline staff.^[24]

These results support interventions combining digital literacy training with evidence-based education and supportive organizational culture. Incentives appear ineffective, suggesting that investment should prioritize educational and culture-based strategies. Demographic factors showed no significant association with uptake, highlighting the central role of cognitive-attitudinal variables.^[23]

This study has several limitations that should be acknowledged. First, its cross-sectional design prevents establishing causal relationships between variables. Second, the use of nonprobability convenience sampling may limit the generalizability of the findings to the broader population of primary-care nurses. Fourth, although validated instruments were used, the online data collection method could have introduced variability in participant interpretation or attention. Finally, the findings are specific to Spanish primary-care nurses, which may limit their applicability to other healthcare contexts.

Conclusion

Among Spanish primary-care nurses, influenza vaccine uptake and recommendation are mainly influenced by three

factors: eHealth literacy, confidence in vaccine science and training, and supportive peer and organizational norms. Regular online information-seeking partially mediates the link between digital competence and vaccination, making it a valuable behavioral target. Once these attitudinal factors are accounted for, sociodemographics and incentives appear less relevant.

These results support the need for professional training programs, led by healthcare institutions, nursing associations, and public health authorities, that combine digital literacy and evidence-based vaccine education within supportive work environments. Despite limitations of a cross-sectional design and self-selection bias, the study provides a rationale to prioritize educational and cultural strategies over incentives. Future longitudinal studies should specifically examine how trust in national health authorities, exposure to online misinformation, and digital health literacy interact over time to influence both influenza vaccination uptake and recommendation behaviours among primary-care nurses.

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Conflicting interest

Nothing to declare.

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