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The knowledge of nurses, skills, and personal attributes for providing competent health education practice, and its influencing factors: a cross-sectional study in Saudi Arabia

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ABSTRACT

Background: Nurses play a key role in delivering health education in hospital and community settings; however, their competence is influenced by various personal and institutional factors. *Objective*: The objective of this study was to evaluate the knowledge, skills, and personal attributes of hospital nurses concerning health education competence in Saudi Arabia, as well as to investigate the related socio-demographic and occupational factors. *Methods*: This cross-sectional study included 450 clinical nurses from public and private healthcare institutions in Saudi Arabia. Nurses' health education competence was assessed using the Nurse Health Education Competence Instrument (I-CEpSE), which measures knowledge, skills, and personal attributes. Descriptive statistics, Spearman correlations, and multiple linear regression analyses were performed to examine associations with socio-demographic, professional, and training factors. *Results*: The study included 450 nurses (median age 38 years; 58.2% male), with 70.9% receiving formal health education training. Median scores were 69 for knowledge, 79 for skills, and 27 for attitude. *Conclusion*: Nurses demonstrated strong practical skills but showed gaps in theoretical knowledge and attitudes. Health education competence is influenced by factors such as age, experience, clinical setting, and training. These findings highlight the need for targeted educational interventions and organizational support, particularly in high-acuity settings such as ICUs.

Keywords: health education, nursing competence, knowledge, skills, attitudes, patient education, Saudi Arabia, cross-sectional study

1. INTRODUCTION

Nurses play a vital role in delivering health education in both acute and community settings, contributing to improved patient outcomes and enhanced health care delivery (Pueyo-Garrigues et al., 2019; Shi et al., 2021; Weiss et al., 2021a). Hospital

nurses play an important role in routine health education activities because they have direct patient contact and are the most accessible medical professionals in this setting (See et al., 2020). Importantly, hospitalization provides a window of opportunity to encourage lifestyle changes, given the abundance of educational opportunities it offers.

Additionally, studies show that while in the hospital, the majority of patients are either considering or have already decided to change at least one aspect of their lifestyle (Pellet et al., 2020). Additionally, patient education is one of the three nursing care procedures that is missed, according to Lelorain et al., (2019) and See et al., (2020).

Health education seeks to improve knowledge, skills, attitudes, and beliefs related to health needs and behaviors. It also accounts for internal and external factors that influence the health of individuals and groups, supporting a positive health paradigm. The previously mentioned concept analysis served as the foundation for the competency context in this study (Pueyo-Garrigues et al., 2019).

The research emphasizes how important it is for nurses to understand common health concerns, life changes, and lifestyles and health (Mashhad University of Medical Sciences et al., 2016a; Hwang et al., 2018); health education and the role nurses play in education (Whitehead, 2018; Pueyo-Garrigues et al., 2019); and pedagogical tools and methods, including learning types, educational process planning stages, behavior modification theories, and community and material resources (Mashhad University of Medical Sciences et al., 2016b; Whitehead, 2018).

Furthermore, it is essential to possess personal and social abilities that facilitate effective health communication and the growth of a nurse-patient relationship, as well as educational skills that assist the educational process (Kemppainen et al., 2013; Pueyo-Garrigues et al., 2019). Nursing research highlights that recognition of nurses and appreciation of their role as health educators are essential for effective health education delivery. The effectiveness of nurses in health education depends on their positive attitudes toward fostering a learning environment, their perceived competence in performing educational tasks, and their professional motivation (Hwang et al., 2018).

Health education is difficult, as improving the health of individuals' behaviors is a complicated undertaking (Ghorbani et al., 2014; Kang et al., 2020). Particularly in hospitals with physician-centered settings, brief patient stays, high workloads, and ambiguous rules for promoting competency in health education practice, nurses who carry out health education interventions receive little recognition (Hwang et al., 2018; Kang et al., 2020; See et al., 2020).

Furthermore, a lack of skills, knowledge, desire, and self-confidence may have a detrimental effect on the quality of education provided by nurses, as these elements are necessary for effective health education practice (Lelorain et al., 2019). As a result, professional competency in health education practice has not received the recognition it deserves (Hwang et al., 2018; Pellet et al., 2020). Most clinical nurses recognize that health education training is essential.

Interventions to improve nurses' educational competency in health should be tailored to individual learning needs and characteristics, while considering organizational support (Soto et al., 2018). Even though nurses play a key role in hospitals, their educational needs and the things that affect their ability to teach health effectively have not been fully studied. As far as we know, no research has looked into how nurses' skills, knowledge, and personal characteristics can help improve health education (See et al., 2020).

There has been little research on how nurses' educational needs change based on things like their work unit and previous training. Additionally, the connections between these characteristics and nurses' self-efficacy for effective health education practice have not been previously investigated. Thus, the primary goal of this study was to investigate the knowledge, abilities, and character traits of hospital nurses regarding health education competency. The second step is to determine which perceived circumstances affect its performance. Third, to investigate the relationships between the various areas of health education competency and the socio-demographic, occupational, and self-efficacy characteristics of nurses.

2. MATERIALS AND METHODS

Study design

This cross-sectional study was conducted in Saudi Arabia.

Participants

A convenience sample of 450 clinical nurses was recruited from a range of clinical departments, including hospital wards, critical care units, outpatient clinics, hemodialysis, and perioperative units, across two public and private hospitals in Saudi Arabia. Nurses were eligible if their main clinical duties involved providing health education.

Sample Size

According to Price et al., (2005), to optimize sample representativeness, the required sample size for this cross-sectional study was calculated to ensure a 95% confidence level and a 5% margin of error, assuming a 50% response distribution. The study aimed to recruit at least 450 nurses to compensate for potential nonresponse or missing data. Ultimately, 450 clinical nurses from public and private hospitals in Saudi Arabia participated, providing sufficient statistical power for the intended analyses.

Data collection

The researcher approached potential participants in their clinical settings and explained the study. Those who agreed provided written informed consent and completed the questionnaire, which the researcher collected while addressing any questions.

Measures

Competence evaluation assesses a person's knowledge, skills, attitudes, and values to ascertain their capacity to function effectively and professionally. According to this definition, health education competency is the set of skills, knowledge, attitudes, and values required to carry out a planned teaching and Learning process that emphasizes a fair and negotiated partnership focused on the needs of patients to empower and assist the individual in promoting lifestyle changes that promote positive health outcomes (Pueyo-Garrigues et al., 2021).

The Nurse Health Education Competence Instrument, sometimes called Instrumento Competencia de Educacion para la Saluddel professional de Enfermería (I-CEpSE), was used to assess nurses' learning requirements in connection to knowledge, abilities, and personal traits for health education (Pueyo-Garrigues et al., 2021).

The I-CEpSE consists of a multidimensional inventory with four self-reported scales:

A) Demographic data for work-related and demographic traits, such as age, sex, education level, present department of employment, and years of experience in that department

B) The 23-item cognitive domain scale, which looks at educational resources and methods, health education, and specialized knowledge about health and its determinants. Respondents rated each item on a five-point Likert scale, with 1 being minimal knowledge and 5 being excellent knowledge. The overall scale's Cronbach's alpha coefficient was 0.95, whereas the corresponding values for the aforementioned subscales were 0.81, 0.88, and 0.95 (Pueyo-Garrigues et al., 2021).

C) The psychomotor domain scale examines nurses' individual social and academic abilities and consists of 26 items that are rated on a five-point Likert-type scale (1 being entirely disagree and 5 being completely agree). Higher scores reflect stronger practice abilities in health education. For the entire scale, the Cronbach's alpha coefficients were 0.95, and for each of the aforementioned subscales, they were 0.88 and 0.95 (Pueyo-Garrigues et al., 2021).

D) Using a five-point Likert-type scale (1 being completely disagree and 5 being completely agree), the attitudinal and affective domain scale consists of nine items that evaluate the personal attributes of nurses related to health education practice, such as their intention, attitudes, and confidence for aspects of the practice (e.g., fostering a learning environment or encouraging the commitment of patients to change their behavior). Passive voice misuse. 0.90 was the Cronbach's alpha (Pueyo-Garrigues et al., 2021).

Data analysis

Continuous variables are presented as median (IQR), while categorical variables are presented as frequencies and percentages (n, %). The study examined how demographic and occupational characteristics influenced ratings of knowledge, skills, personal qualities, and self-efficacy. The correlation analyses of spearman examined the relationships between I-CEpSE scores, age, years of experience, sex, education level, health education training, and work department. Finally, multiple linear regression analyses were examined for personal and professional characteristics as potential confounders. Statistical significance was defined at the 5% level ($p < 0.05$).

3. RESULTS

Socio-demographic, Professional, Training Characteristics, and Health Education Competence Scores of the Study Participants (n = 450)

The 450 participating nurses' professional and demographic traits are shown in Table 1. The middle 50% of the population ranged from around 32.5 to 43.5 years old, with a median age of 38 years (IQR = 11). There were 188 (41.8%) females and 262 (58.2%) men in the sample.

In terms of education, 58 nurses (12.9%) had a postgraduate degree, 173 (38.4%) had a bachelor's degree, and 219 nurses (48.7%) had a nursing diploma. Most participants worked in intensive care units (161, 35.8%) and hospital wards (185, 41.1%), with outpatient clinics (94, 20.9%) and other departments (10, 2.2%) following closely behind. Five years of professional experience was the median (IQR = 5). Most nurses (319, 70.9%) reported receiving formal health education training, whereas 131 (29.1%) reported no such training. At baseline, the median scores were 69 (IQR = 9) for overall knowledge, 79 (IQR = 8) for total abilities, and 27 (IQR = 4) for total attitude.

Table 1. Demographics of study participants (n = 450)

Variables		**Values)**
Age, years, median (IQR)		38 (11)
Gender, n (%)	Male Female	262 (58.2) 188 (41.8)
Highest level of education, n (%)	Nursing diploma Bachelor's degree Postgraduate degree	219 (48.7) 173 (38.4) 58 (12.9)
Current clinical department, n (%)	Hospital ward Intensive care unit Outpatient clinic Other	185 (41.1) 161 (35.8) 94 (20.9) 10 (2.2)
Years of experience, median (IQR)		5 (5)
Have you received any formal training in health education?	Yes No	319 (70.9) 131 (29.1)
Total knowledge score, median (IQR)		69 (9)
Total skills score, median (IQR)		79 (8)
Total attitude score, median (IQR)		27 (4)

Note: n = sample number, IQR = interquartile range.

Associations Between Socio-demographic, Professional, and Training Factors and Health Education Competence Domains

The relationships between the three categories of health education competency and demographic and employment-related characteristics are shown in Table 2. Knowledge (rho = -0.319), abilities (rho = -0.212), and attitude (rho = -0.192, all $p < 0.001$) all significantly correlated negatively with age. Years of experience, on the other hand, showed strong positive associations with knowledge, abilities, and attitude (rho = 0.331, 0.290, and 0.300, respectively, all $p < 0.001$).

Male nurses (n = 262) exhibited superior median scores compared to female nurses in knowledge (71.5 vs. 66), skills (81 vs. 77), and attitude (28 vs. 26); these disparities were statistically significant (all $p < 0.001$), signifying a substantial association between gender and all domains. The knowledge scores of postgraduate and certificate holders were higher (71) than those of bachelor's degree holders (67, $p < 0.001$), indicating that educational level was also relevant.

Competency domains were significantly associated with the clinical department. Outpatient nurses demonstrated higher knowledge (71.5) and attitude (28) scores than ICU nurses, who had the lowest attitude score (26; $p = 0.04$).

Formal health education training was associated with higher knowledge (70 vs. 67; $p < 0.001$) and skills scores (79 vs. 78; $p < 0.001$), whereas attitude scores were identical (27) in both trained and untrained groups. Furthermore, knowledge, abilities, and attitude showed strong positive correlations with each other (rho = 0.604–0.636; all $p < 0.001$).

Table 2. Total scores are associated with demographics.

Variable	**Total knowledge**	**Total skills**	**Total attitude**
Age	-0.319-	-0.212-	-0.192-
p value	<0.001[S]	<0.001[S]	<0.001[S]

Gender			
Male	71.5 (7)	81 (9)	28 (4)
Female	66 (8)	77 (5.75)	26 (3)
p value	<0.001*	<0.001*	<0.001*
Highest level of education			
Nursing diploma	71 (11)	79 (9)	28 (4)
Bachelor's degree	67 (7)	78 (7.5)	27 (3)
Postgraduate degree	71 (5.25)	80 (6.25)	28 (3)
p value	<0.001^{K}	0.001^{K}	<0.001^{K}
Current clinical department			
Hospital ward	68 (7.5)	79 (10)	27 (5)
Intensive care unit	68 (11)	78 (7)	26 (4)
Outpatient clinic	71.5 (7)	79.5 (6)	28 (3.25)
Other	79 (44.25)	94 (51.75)	27.5 (17.25)
p value	<0.001^{K}	<0.001^{K}	0.04^{K}
Years of experience	0.331	0.290	0.300
p value	<0.001^{S}	<0.001^{S}	<0.001^{S}
Have you received any formal training in health education?			
Yes	70 (9)	79 (10)	27 (5)
No	67 (6)	78 (6)	27 (2)
p value	<0.001*	<0.001*	<0.001*
Total knowledge	1	0.604	0.620
p value	-	<0.001^{S}	<0.001^{S}
Total skills	0.604	1	0.636
p value	<0.001^{S}	-	<0.001^{S}
Total attitude	0.620	0.636	1
p value	<0.001^{S}	<0.001^{S}	-

Note: Values are shown with median (IQR)

Mann-Whitney Test *, Kruskal-Wallis Test ^{K}, Spearman's rho coefficient ^{S}

Multiple Linear Regression Analysis of Independent Predictors of Health Education Competence Domains

Table 3 presents the results of the multiple linear regression analysis examining independent factors associated with nurses' health education competency. The model accounted for 76.3% of the variation in the Total Knowledge domain (adjusted R2 = 0.759, $p < 0.001$). Age had a significant negative correlation ($\beta = -0.097$, $p = 0.003$), whereas the present clinical department ($\beta = 1.102$, $p < 0.001$) and years of experience in the current department ($\beta = 0.183$, $p = 0.009$) were significant positive predictors. Knowledge was also strongly positively predicted by total skills ($\beta = 0.434$, $p < 0.001$) and overall attitude ($\beta = 0.863$, $p < 0.001$).

The model accounted for 76.3% of the variation in the Total Skills domain (adjusted R2 = 0.758, $p < 0.001$). Only total knowledge ($\beta = 1.170$, $p < 0.001$) and total attitude ($\beta = 0.553$, $p < 0.001$) remained significant positive predictors, but demographic and work-related factors did not.

The model accounted for 73.6% of the variation in the Total Attitude domain (adjusted R2 = 0.732, $p < 0.001$). There was a substantial negative correlation between attitude ratings and current clinical department ($\beta = -0.392$, $p = 0.004$) and formal health education training ($\beta = -0.600$, $p = 0.019$).

Strong positive predictors were total skills ($\beta = 0.183$, $p < 0.001$) and total knowledge ($\beta = 0.173$, $p < 0.001$). Significant positive correlations were observed among knowledge, abilities, and attitude across the three domains. In the multivariate analysis, most demographic variables were no longer statistically significant.

Table 3: Multiple linear regression analysis of factors affecting total scores

Variates	β	SE	β′	t value	*p* values	95% CI	
						Lower	Upper
Total Knowledge							
Constant	10.806	2.614		4.135	<0.001	5.669	15.942
Age (years)	-0.097-	0.033	-0.082-	-2.946-	0.003	-0.162-	-0.032-
Sex	0.362	0.598	0.018	0.606	0.545	-0.813-	1.538
Highest educational qualification	0.124	0.381	0.009	0.324	0.746	-0.626-	0.873
Current clinical department	1.102	0.301	0.091	3.666	<0.001	0.511	1.693
Years of experience in the current department	0.183	0.070	0.073	2.613	0.009	0.045	0.320
Have you received any formal training in health education?	0.788	0.571	0.036	1.379	0.169	-0.335-	1.911
Total Skills	0.434	0.037	0.490	11.802	<0.001	0.362	0.506
Total Attitude	0.863	0.098	0.366	8.783	<0.001	0.670	1.056
R^2=0.763, After adjustment R^2 = 0.759; F = 177.548, p < 0.001							
Total Skills							
Constant	5.941	2.996		1.983	0.048	0.054	11.828
Age (years)	0.072	0.037	0.054	1.924	0.055	-0.002-	0.146
Sex	-0.479-	0.675	-0.021-	-0.709-	0.479	-1.806-	0.848
Highest educational qualification	0.304	0.431	0.019	0.707	0.480	-0.542-	1.151
Current clinical department	0.393	0.344	0.029	1.142	0.254	-0.283-	1.069
Years of experience in the current department	-0.137-	0.079	-0.049-	-1.729-	0.085	-0.293-	0.019
Have you received any formal training in health education?	0.429	0.647	0.017	0.663	0.508	-0.842-	1.699
Total Knowledge	1.170	0.107	0.439	10.974	<0.001	0.960	1.379
Total Attitude	0.553	0.047	0.490	11.802	<0.001	0.461	0.646
R^2=0.763, After adjustment R^2 = 0.758; F = 177.212, p < 0.001							
Total Attitude							
Constant	2.551	1.185		2.153	0.032	0.222	4.881
Age (years)	-0.010-	0.015	-0.020-	-0.673-	0.501	-0.039-	0.019
Sex	-.100-	0.267	-0.012-	-0.374-	0.709	-0.626-	0.426
Highest educational qualification	-0.194-	0.170	-0.032-	-1.138-	0.256	-0.529-	0.141
Current clinical department	-0.392-	0.135	-0.077-	-2.903-	0.004	-0.658-	-0.127-
Years of experience in the current department	0.047	0.031	0.044	1.484	0.138	-0.015-	0.109
Have you received any formal training in health education?	-0.600-	0.255	-0.064-	-2.359-	0.019	-1.101-	-0.100-
Total Knowledge	0.173	0.020	0.407	8.783	<0.001	0.134	0.211
Total Skills	0.183	0.017	0.488	10.974	<0.001	0.151	0.216
R^2=0.736, After adjustment R^2 = 0.732; F = 153.981, p < 0.001							

Note: β = Regression coefficient; SE = Standard errors; β'=Standardized regression coefficient; 95%*CI* = 95% confidence interval

4. DISCUSSION

The goal of this cross-sectional study was to find out what nurses know, how well they can do things, and how they feel about health education competency. It also wanted to find out what personal and institutional factors affect these competencies. The study was conducted among clinical nurses working in governmental and private healthcare facilities in Saudi Arabia.

In terms of demographics, the median age of nurses in the current study was 38 years, which is marginally lower than the mean age (about 41 years) recorded in comparable studies. Furthermore, the present sample included a higher proportion of male nurses (58.2%) compared with previous studies, which reported more balanced gender distributions or minimal gender differences (Fukada, 2018; Pueyo-Garrigues et al., 2019).

The distribution of educational levels differed from prior studies, which often reported a higher proportion of nurses holding diplomas. In the present study, 48.7% of nurses held a diploma, 38.4% a bachelor's degree, and 12.9% a postgraduate degree. Additionally, while previous research indicated that most nurses had not received formal health education training (e.g., 13.6%), a substantially higher proportion of nurses in the current study had received such training (70.9%). Variations in training exposure and demographic factors likely contributed to the observed differences in competency outcomes (Pueyo-Garrigues et al., 2019).

In terms of professional experience, nurses in the other study had an average of 9.5 years in their current clinical unit, indicating a more seasoned workforce, while nurses in our study had a median of 5 years of total experience. The percentage of nurses with formal health education training was similarly larger among our participants (70.9%), whereas the other study focused mostly on differences based on past teaching without mentioning the proportion (Bergh et al., 2014; Pueyo-Garrigues et al., 2021).

The median scores for knowledge, skills, and attitude were 69, 79, and 27, respectively. These findings are consistent with other research showing that nurses often exhibit high levels of social and personal skills, including active listening and interpersonal skills, as well as sufficient knowledge. According to both sets of data, nurses often have positive character traits and the general abilities needed for patient engagement (Nesari et al., 2019; Menichetti et al., 2024).

Nurses received the highest scores in our research for abilities (median = 79), knowledge (median = 69), and attitude (median = 27). Similarly, another study reported that, overall, nurses' skills and social/personal competencies exceeded their cognitive knowledge in health education, particularly regarding instructional strategies and the application of health promotion principles (Mashhad University of Medical Sciences et al., 2016b). This finding aligns with prior research indicating that nurses frequently exhibit strong social and interpersonal skills while lacking in practical and educational knowledge (Pueyo-Garrigues et al., 2021).

Nonetheless, disparities were noted in the association between age and aptitude or disposition (Fereidouni et al., 2019). While previous studies found positive or non-significant correlations between age and skills and personal attributes, the current study found negative correlations between age and all domains. Institutional and contextual factors may influence how age and experience translate into practical competence (Lin et al., 2020).

Both studies showed a steady negative link between age and knowledge. This suggests that older nurses may have less theoretical health education, possibly because of differences in nursing education across generations. The former study found a positive association between age and abilities and a non-significant relationship with personal qualities. Still, the current study found a negative correlation between age and all categories. Such discrepancies may result from variations in workplace mentorship, opportunities for continuing professional development, or social norms (Eloranta et al., 2016; Weiss et al., 2021b).

Studies also differed in how important professional experience was. Experience in the current department remained a significant predictor of knowledge in multivariate models, and total years of experience were positively associated with knowledge, skills, and attitude in this study. On the other hand, the comparison analysis discovered very minor positive associations with skills and traits, and no significant link between experience and knowledge. This disparity may result from differences in sample composition, institutional support, or the assessment of experience (Ghorbani et al., 2014; Svavarsdóttir et al., 2015).

Experience in the present department emerged as a predictor of knowledge in multivariate analysis, and years of professional experience showed positive connections with all domains in the current study. In this study, formal health education training was associated with higher knowledge and skills, while years of professional experience were positively associated with knowledge, abilities, and attitude. Similarly, another study found that higher competence across all domains was significantly predicted by participation in training or seminars within the previous 12 months, providing patient education, and recognizing the importance of health education, which bolsters the idea that formal training and active participation improve the competency of nurses (Khazhymurat et al., 2023).

There was some variation in gender and educational attainment. While previous studies reported minimal gender differences and higher knowledge scores among nurses with a bachelor's degree or higher, the present study found that male nurses scored higher across all domains and that nurses with diplomas or postgraduate degrees achieved higher knowledge scores than those with a bachelor's degree. These variations suggest that the impact of gender and formal education on competence might differ due to regional educational systems, cultural factors, and expectations related to clinical roles (See et al., 2020; Khazhymurat et al., 2023).

In all the trials, formal health education was positively linked to higher levels of knowledge and skills, underscoring the significant role that structured training must play in improving competency. However, whereas the effectiveness of formal educational experience was captured through a major difference in attitude scores, the relationship comparisons revealed positive correlations across all domains in the Comparison Study, but negative relationships between formal education and attitude were revealed through analyses in this Study. This unexpected finding may reflect either interactions among the predictors of the reported regression coefficients or self-critical evaluative perceptions held by those with qualified nurse status (Hwang et al., 2018; Lelorain et al., 2019).

Both studies reported that greater years of work experience positively influenced abilities and attitudes, supporting the notion that exposure to clinical settings enhances practical competence. Similar to other research showing that younger or less experienced nurses typically have better cognitive scores, our study found a negative correlation between age and knowledge, abilities, and attitude (Pueyo-Garrigues et al., 2021).

Training and educational attainment showed both convergence and divergence. While greater education and prior training were typically associated with higher competence ratings across all areas in the other study, diploma and postgraduate holders in our study scored higher in knowledge than bachelor's degree holders. Variations in curriculum and circumstance may affect how formal education affects particular competency outcomes (Rahmati Sharghi et al., 2015).

The earlier research showed that training programs led to improved attitudes and enhanced skills, yet our multivariate analysis revealed an unexpected negative association between formal education and students' attitude scores. The existing gap between these two groups probably results from their distinct training experiences, and their individual ability to assess their skills, and their workplace backing for health education activities (Rahmati Sharghi et al., 2015; Pueyo-Garrigues et al., 2021).

In both investigations, in line with the findings of another study, which found that nurses in high-acuity or specialized units frequently have lower competence because of patient complexity and the priority of acute care over educational tasks, outpatient nurses in our study had higher knowledge and attitude scores, while intensive care unit nurses had lower attitude scores (Rahmati Sharghi et al., 2015; Pueyo-Garrigues et al., 2021).

Research studies consistently demonstrate that medical units create an impact on nurses who work in acute care units because these nurses show lower competency levels and poor attitude scores. The research results demonstrate how medical staff must handle obstacles when they try to deliver healthcare training in hospitals that treat numerous critical cases because these units restrict their time availability for educational activities (Fukada, 2018; Torkshavand et al., 2020).

The substantial positive intercorrelations among knowledge, skills, and attitudes/personal traits in both studies confirm the multifaceted and interconnected nature of health education competency. However, compared to the comparative study (R^2 = 28–49%), the regression models in the current study explained a larger percentage of variance (R^2 = 73–76%). This is due to methodological differences, such as the inclusion of inter-domain predictors and strong intercorrelations among competence domains (Fukada, 2018; Torkshavand et al., 2020).

There are several differences observed. In our study, male nurses scored higher than female nurses across all domains, whereas the other study, which had a predominantly female sample, found no gender differences. Additionally, formal training was unexpectedly negatively associated with attitude ratings in our multivariate analysis, in contrast to the previous study, which reported a positive effect of training on attitudes (Rahmati Sharghi et al., 2015; Pueyo-Garrigues et al., 2021).

The two research studies establish that people develop their skills through actual work experience and hands-on learning activities while educational programs provide essential support and personal traits together with abilities tend to surpass theoretical understanding. The way nurses learn health education skills depends on various factors which include their gender and their training background and the specific clinical environments they work in and the organizational structures of their workplaces (Rahmati Sharghi et al., 2015; Pueyo-Garrigues et al., 2021).

The current research together with earlier studies demonstrate that formal health education programs consistently enhance learning outcomes and practical abilities which proves their vital role in developing professional skills. The research findings indicate negative links between formal training and attitude scores during multivariate analysis which contradicts previous studies that found positive relationships between all domains. The research results showed an unexpected pattern which might stem from connections between other regression model variables or from self-assessment tendencies that nurses with qualifications tend to exhibit (Eloranta et al., 2016; Weiss et al., 2021b).

The clinical department similarly influenced competence in all studies. Because of the high acuity care needs and the lack of organized health education opportunities, nurses in critical care units showed worse attitude and personal attribute ratings. Outpatient

nurses achieved superior knowledge and attitude scores which align with earlier studies that show clinical environments determine how nurses deliver health education services (Ghorbani et al., 2014; Svavarsdóttir et al., 2015).

The study revealed different patterns between gender and age and education level when it came to abilities and the unexpected negative connection between formal training and attitude which showed how institutional and environmental aspects affected the results. Our research indicates that clinical environments need particular training programs and health education integration into educational programs and institutional backing to enhance nurses' professional development in knowledge acquisition and skill enhancement and attitude transformation (Ghorbani et al., 2014; Svavarsdóttir et al., 2015).

Notwithstanding the advantages of this study, several drawbacks should be noted. First, the cross-sectional design captures associations at a single point in time, preventing the establishment of causal relationships between the identified factors and health education competency. Second, the research used a convenience sample which gathered participants from particular sites and organizations, but this sampling method prevents the results from applying to all Saudi nurses and nurses working abroad. Third, competence was assessed using the self-report I-CEpSE tool. Although self-reports are validated, they are vulnerable to social desirability bias, which can lead participants to overestimate their skills.

This bias may partly explain the unexpectedly negative relationship between attitude and training, where trained nurses self-report more accurately and modestly. The research failed to study multiple important factors which might influence the outcomes. The research fails to investigate two vital factors which could affect its results.

Healthcare organizations need to establish continuing health education as their top priority because this training approach supports balanced competence development through its dual focus on knowledge and attitude learning. Nurses working in high-acuity settings, such as intensive care units, need tailored educational support because their clinical duties prevent them from receiving structured training. Competency-based health education modules should be with nursing courses, with an emphasis on both cognitive and practical abilities.

Furthermore, especially for younger or less experienced nurses, peer-learning opportunities and mentorship programs may improve the transfer of information into practice. Future research needs to use interventional studies and longitudinal designs to explore how gender and attitude outcomes evolve through their respective development processes and to determine how training, experience, and departmental environment affect competence development.

5. CONCLUSION

The research shows that nurse health education abilities exist as a complex system which emerges from the combination of hospital and personal elements that affect their performance. Nurses show excellent hands-on abilities, but they need to improve their theoretical knowledge and develop better attitudes when they work in intense medical areas like intensive care units. The contradictory findings about gender and education and the negative correlation between formal education and attitudes show that organizational environment together with community elements strongly affect these results.

Research reveals that health education programs need to develop unique approaches which focus on environments instead of using standard methods. Nurses will succeed in their health educator duties when educational programs receive improvement and when their workplaces offer strong backing and create environments which support patient education efforts. Healthcare delivery needs patient empowerment to achieve better patient results while healthcare quality enhancement and improved health knowledge become possible.

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Authors' Contributions

Adel Jamaan Alzahrani contributed to study conceptualization, study design, and supervision of the research process.

Ahmed Abdullah Alghamdi contributed to study design, data collection, statistical analysis, interpretation of data, and drafting of the manuscript.

Ahamed Mohammed Alghamdi contributed to data collection, data management, and manuscript revision.

Mohammed Abaid Alharbi contributed to methodology development, data interpretation, and critical revision of the manuscript for important intellectual content.
Abdullah Tareq Alhemiary contributed to data analysis, manuscript editing, and final approval of the version to be published.
All authors read and approved the final manuscript and agree to be accountable for all aspects of the work.

Informed consent
Written & Oral informed consent was obtained from individual participants included in the study.

Ethical approval
The study was done in conformity with ethical guidelines. Participation was entirely voluntary, and all respondents provided informed consent. The participants' anonymity and confidentiality were ensured, and the data obtained were utilized purely for the study. The ethical guidelines for Human Subjects are followed in the study.

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Conflict of interest
The authors declare that they have no conflicts of interest, competing financial interests or personal relationships that could have influenced the work reported in this paper.

Data and materials availability
All data associated with this work are present in the paper.

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