

Saudi nurses' caring attributes, professional self-concept, and technological influences: A structural equation modeling study



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ABSTRACT

This study aimed to examine how caring attributes influence nurses' professional self-concept and their perceptions of technological influence in the Saudi Arabian healthcare context. A cross-sectional correlational design was used. Data were collected from 248 Saudi nurses using the Caring Attributes, Professional Self-Concept, and Technological Influences (CAPSTI) scale. Structural equation modeling (SEM) with WarpPLS was applied to analyze the relationships among the variables. The results showed that caring attributes had a significant positive effect on professional self-concept ($\beta = 0.23$, $p < .01$) and a significant negative relationship with technological influence ($\beta = -0.38$, $p < .01$). Caring attributes accounted for 6% of the variance in professional self-concept and 15% of the variance in technological influence. In conclusion, caring attributes remain an important part of nurses' professional identity; however, challenges exist between caring values and technology-focused practice environments. These findings suggest the need for culturally appropriate strategies that combine caring principles with technological skills in Saudi nursing practice.

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1. Introduction

Caring has long been recognized as a foundational element of nursing practice, underpinning holistic, patient-centered care and professional identity formation. In contemporary healthcare systems, nurses are expected not only to demonstrate caring behaviors but also to navigate increasingly complex technological environments (Labrague et al., 2017; Warshawski et al., 2018). While technological advancements have improved efficiency and clinical outcomes, they have also

raised concerns about the potential erosion of relational and humanistic aspects of care (Vrbnjak et al., 2017).

Caring is influenced by nurses' values, attitudes, and interpretations of patient experiences and is expressed through interpersonal relationships, communication, and ethical engagement. Studies have consistently demonstrated that caring behaviors are associated with enhanced professional self-concept, job satisfaction, and perceived quality of nursing care (Edvardsson et al., 2017). However, competing demands such as workload intensity, documentation requirements, and technology-mediated care may challenge nurses' ability to sustain caring relationships (Goncalves et al., 2016; Jiang et al., 2015).

Within the Kingdom of Saudi Arabia, nursing practice is situated at the intersection of rapid healthcare modernization and deeply rooted cultural and religious values. Saudi nursing care is shaped by

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Islamic ethics emphasizing compassion, responsibility, and service, while simultaneously adapting to technologically advanced healthcare infrastructures. Despite this unique context, limited empirical research has examined how caring attributes interact with professional self-concept and technological influences among Saudi nurses. This study addresses this gap by examining these relationships using a validated cross-cultural instrument.

Caring is widely acknowledged as a core professional value in nursing; however, it remains a complex and multidimensional construct (Jiang et al., 2015). Previous research has explored caring through theoretical, practical, and pedagogical lenses, leading to the development of several measurement instruments. Among these, the Caring Attributes, Professional Self-Concept, and Technological Influences (CAPSTI) scale has been applied across multiple cultural contexts (Edvardsson et al., 2017; Goncalves et al., 2016; Labrague et al., 2017; Maniago and Albougami, 2020; Vrbnjak et al., 2017; Warshawski et al., 2018).

Although international studies have examined the interplay between caring, professional self-concept, and technology, findings remain inconsistent, particularly regarding the role of technology in caring practice. Some studies suggest that technology enhances caring by supporting clinical decision-making, while others report that high technological demands may detract from relational care. In Saudi Arabia, where healthcare systems are rapidly advancing under national modernization initiatives, understanding this dynamic is particularly important.

This study contributes theoretically by situating caring attributes within a culturally specific context, thereby extending existing caring frameworks. Rather than replicating prior findings, the study explores how caring attributes function within Saudi nurses' professional identity amid technologically intensive practice environments.

The objective of this study is to determine the effect of caring attributes on nurses' professional self-concept and perceived technological influence in Saudi Arabia.

2. Methodology

A cross-sectional correlational design was employed to examine relationships among caring attributes, professional self-concept, and technological influence. This study was conducted in private and government hospitals in major cities in Saudi Arabia. The main inclusion criterion is that the hospital must have at least 200-bed capacity or more to ensure more representative samples from nurses.

The study was conducted in selected government and private hospitals across major cities in Saudi Arabia. Eligible participants were Saudi-registered nurses with at least one year of clinical experience and a minimum diploma-level qualification. A total of 248 nurses participated in the study.

We used the caring instrument developed by Arthur et al. (1999) to compare caring items with responses related to professional self-concept and technological influences. The conceptual-theoretical basis of the study was informed by the empirical work of Watson and Lea (1997) and the conceptual and multidimensional construct development of Wolf et al. (1994). Also, theoretical, practical, and pedagogical perspectives were generated from such works from the general nursing caring literature, such as Watson (1988).

The Caring Attributes, Professional Self-Concept, and Technological Influences scale (CAPSTI) was developed through a pilot study using a convenience sample of nurses from Hong Kong, Beijing, and Macau. The themes and language that emerged from this sample were reviewed for content validity by a sample of experts. Specific items emerged from a combination of sources: the literature, the sample, and the experts. The instrument was administered to an additional sample of 100 nurses in Hong Kong to establish reliability and validity. A Cronbach's alpha of greater than 0.7 was found for each of the instrument's four parts (Arthur et al., 1999). The instrument consists of 7 demographic items in part 1, 30 items in the Professional Self-Concept of Nurses (PSCNI) in part 2, 14 items for technological influences in part 3, and 60 items related to caring in part 4. The CAPSTI has demonstrated cross-national validation across culturally diverse nursing populations, supporting its conceptual universality while allowing for culturally specific interpretation within the Saudi Arabian context.

Each of the four parts of the instrument uses a Likert scale, on which a high ranking indicates a positive attitude or belief. Individual scores and group scores were obtained for the components of the PSCNI (professional practice, satisfaction, and communication), technological influences (TIQ and TIS), and caring attributes (including theoretical, practical, and pedagogical perspectives).

The approval was secured according to the hospital's protocol included in this study, before the actual data collection. Signed informed consent was secured from all the respondents before they participated in the study.

A pilot test was conducted before the actual data collection to establish the adapted questionnaire's reliability in the survey. The questionnaire was formatted as an online survey using the purchased version of SurveyMonkey. Potential participants have the option of previewing the survey before choosing to participate. Once they clicked on the survey link in [surveymonkey.com](https://www.surveymonkey.com) provided in the email letter of invitation, the participants were directed to the questionnaire; the survey also clarified that submitting the completed document indicated consent. Nurses who accessed the survey link were provided with the study's purpose before clicking in their responses. This page also highlights the anonymity that is maintained by the site. When the respondents completed the survey, they clicked the "Submit" button to forward the survey. Informed

consent was also provided to each identified and eligible participant. After providing the necessary information, access to the web-based design survey using the purchased version of SurveyMonkey was given to the participant, which further shows (1) Letter to the Participant, (2) Packet Information, (3) Consent Information, and (4) Questionnaires.

Structural equation modeling using WarpPLS software was employed to test hypothesized relationships. Formative measurement models were evaluated using indicator weights, variance inflation factors, and model fit indices.

3. Results

3.1. Convergent validity

Table 1 presents the convergent validity statistics of the nurses' Caring Attributes, Professional Image, and Technological Influence.

In Table 1, the variables were formative wherein the caring attributes, specifically the Theoretical Perspective obtain an indicator weight of 0.521 (SE: 0.058, p-value of 0.000) with variance inflation factor (VIF) of 1.019, Practical Perspectives with an indicator weight of 0.614 (SE: 0.057, p-value of 0.000) with VIF of 1.029, and the Pedagogical Perspectives with an indicator weight of 0.440 (SE: 0.059, p-value of 0.000) with VIF of 1.011. For the Professional Image, specifically, the Professional Practice obtain an indicator weight of 0.620 (SE: -0.057, p-value of 0.000) with VIF of 1.057 while the Professional Communication attain an indicator weight of 0.623 (SE: 0.057, p-value of 0.000) with VIF 1.058, and lastly the Professional Satisfaction with an indicator weight of 0.179 (SE: 0.62, p-value of 0.002) with VIF of 1.002.

Finally, the Technological Influence specifically the Specialized Care, obtain an indicator weight of 0.307 (SE: 0.060, p-value of 0.000) with VIF of 1.059, the Out-Patient Care with indicator weight of 0.478 (SE: 0.059, p-value of 0.000) with VIF of 1.231, the Acute Care which obtains an indicator weight of 0.308 (SE: 0.060, p-value of 0.000) with VIF of 1.082, the Critical Care with indicator weight of -0.173 (SE: 0.062, p-value of 0.003) with VIF of 1.020, and lastly, the General In-Patient care with an indicator weight of -0.413 (SE: 0.059, p-value of 0.000) with VIF of 1.137.

According to Kock (2020), indicator weight is appropriate for a formative latent variable. The formative indicators should be statistically significant ($p < 0.05$) and VIF < 2.5 . AVE or average variance extracted, and Cronbach's alpha are irrelevant for formative latent variables; hence, they are not presented.

3.2. Discriminant validity

Table 2 shows the discriminant validity statistics of the Nurses' Caring Attributes, Professional Image, and Technological Influence. The values in the

diagonal are the square roots of the Average Variance Extraction (AVE) of the variables. The values in the off-diagonal are correlations among the variables. To have a discriminant validity, the square roots of the AVE of the variables should be greater than the correlation coefficients, wherein the Caring Attributes (0.629), Professional Image (0.644), and Technological Influence (0.569) obtain a higher score diagonally than the values inside Table 2.

Table 1: Convergent validity statistics of the nurses' caring attributes, professional image, and technological influence

Variable	Indicator weight	SE	p-value	VIF
CarAttri				
Theoretical perspectives	0.521	0.058	0.000	1.019
Practical perspectives	0.614	0.057	0.000	1.029
Pedagogical perspectives	0.440	0.059	0.000	1.011
P-Image				
Professional practice	0.620	0.057	0.000	1.057
Professional communication	0.623	0.057	0.000	1.058
Professional satisfaction	0.179	0.062	0.002	1.002
TechInflu				
SPeCare	0.307	0.060	0.000	1.059
OPCare	0.478	0.059	0.000	1.231
ACare	0.308	0.060	0.000	1.082
CriCare	-0.173	0.062	0.003	1.020
GIPCare	-0.413	0.059	0.000	1.137

Latent variable type: Formative; SE: Standard error; CarAttri: Caring attribute; P-Image: Professional image; TechInflu: Technological influence; SPeCare: Specialized care; OPCare: Out-patient care; ACare: Acute care; CriCare: Critical care; GIPCare: General in-patient care

Table 2: Discriminant validity statistics of the nurses' caring attributes, professional image, and technological influence

	CarAttri	P-Image	TechInflu
CarAttri	0.629		
P-Image	0.222	0.644	
TechInflu	-0.328	-0.327	0.569

3.3. PLS-path model of nurses' caring attributes, professional image, and technological influence

Results revealed that Caring Attributes and Professional Image are significantly and positively related to Professional Image ($\beta = 0.23, p \leq 0.01$) with an effect size of large (0.055) (Table 3); hence, Caring Attributes play a significant role in the professional image of Saudi Nurses.

In terms of the relationship between Caring Attributes and Technological Influence, the results showed that it is significantly and negatively correlated ($\beta = -0.38, p \leq 0.01$), having an effect size of large (0.147); therefore, caring attributes do not contribute to the technological influences among Saudi Nurses.

The R-squared (R^2) or the coefficient of determination was also presented in Fig. 1. Based on the Structural Model, the R^2 of 0.06 indicates only a 6% effect in terms of the relationship between the variables of caring attributes and the professional image. The R^2 of 0.15 indicates a 15% effect between the caring attributes and the technological influence among Saudi Nurses.

3.4. Model fit and quality indices

Table 4 presents the five model fit quality indices, namely the Average path coefficient (APC), the Average R-squared (ARS), Average adjusted R-squared (AARS), Average block VIF (AVIF), and the

Tenenhaus GoF (GoF). According to Kock (2020), APC, ARS, and AARS must be significant, wherein the result of the p-value to be obtained must be less than 0.05. As shown, the p-value of APC, ARS, and AARS in Table 4 is less than 0.05; therefore, the model results satisfied the criteria for model fit.

Table 3: Effects of caring attributes on technological influence and professional image

Hypotheses	Path coefficient (β)	SE	P-value	f ²	Remark
CarAttri → P-Image	0.235	0.061	<0.001	0.055	Effect is significant
CarAttri → TechInflu	-0.383	0.060	<0.001	0.147	Effect is significant

f²: Effect size; 0.02: Small; 0.15: Medium; 0.35: Large

Table 4: Model fit and quality indices

	Value	P-value	Criteria	Remark
Average path coefficient (APC)	0.309	0.000	P should be less than .05	Ok. Statistically significant
Average R-squared (ARS)	0.101	0.027	P should be less than .05	Ok. Statistically significant
Average adjusted R-squared (AARS)	0.097	0.030	P should be less than .05	Ok. Statistically significant
Average block VIF (AVIF)	1.164		Acceptable if <= 5; ideally <= 3.3	Ideal
Tenenhaus GoF (GoF)	0.195		Small >= 0.1, medium >= 0.25, large >= 0.36	Large

Regarding AVIF, the index is acceptable if it must be less than or equal to 5 and ideally less than 3.3 (Kock, 2020). In Table 4, results revealed an AVIF score of 1.1641 therefore, the model is considered ideal. Lastly, the Tenenhaus GoF (GoF), the coefficient must fall on the following threshold: small >= 0.1, medium >= 0.25, and large >= 0.36 (Kock, 2020). With the Tenenhaus GoF (GoF) = 0.195, this indicates that the above structural equation model (Fig. 1) is large; likewise, it is highly acceptable.

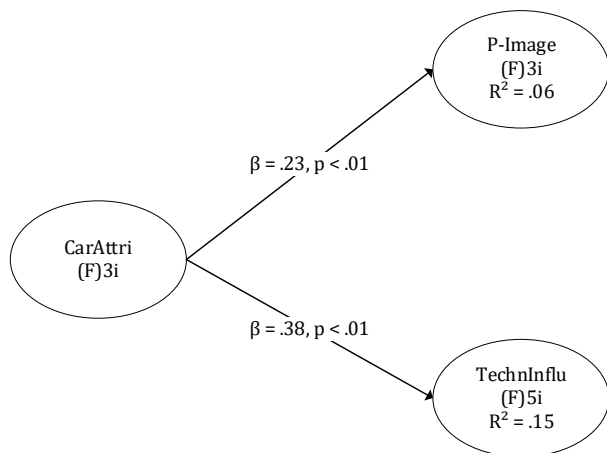


Fig. 1: The structural equations model of caring attributes as a moderator of professional image and technological influence among Saudi nurses

4. Discussion

As part of the present study results, the analysis of the convergent and discriminant validity of the instrument used is reported. The study's main aim, which is to determine how caring attributes affect nurses' professional self-image and technological influence in Saudi Arabia, is discussed. The coefficient of determination, model fit, and quality indices are also presented.

Based on the findings, the convergent validity statistics of the CAPSTI are statistically significant. This means that the indicator variables of each latent

variable converge and are correlated with each other. For caring attributes, the theoretical, practical, and pedagogical perspectives determine the intended caring attributes. In like manner, the professional practice, communication, and satisfaction converge to define the professional image. SPeCare, OPCare, ACare, CriCare, and GIPCare all determine the technological influence.

The discriminant validity of the scale is also statistically significant. It shows that the different constructs in the scale captured the phenomena that are being studied. It means that the caring attribute, the professional image, and the technological influence are not correlated and distinct from each other.

The present study found that caring attributes are significant and positively related to the professional image. This means that the development of caring attributes goes hand in hand with professional self-concept. Caring attributes in CAPSTI include three dimensions: meaning of caring, what is done when caring, and how caring is learned and taught. On the other hand, professional self-concept includes three dimensions: skill, leadership, flexibility, satisfaction, and communication (Arthur et al., 1999).

Considering the dimensions of professional self-concept, it can be deduced that these dimensions are being practiced during the caring process with the patient. For instance, it was found that the Turkish nurses have high scores in professional competence, attitude, and skills subscales of PSCI. Professional competence includes self-evaluation of professional qualifications, including knowledge and skills in nursing. Expert nursing practice is a critical attribute of the caring process (Finfgeld-Connert, 2008). This means that improvement in the professional self-concept will also cause improvement in the caring attributes and vice versa. The findings indicate that caring attributes contribute meaningfully to nurses' professional self-concept, reinforcing the centrality of caring in professional identity formation. This

aligns with international literature emphasizing the relational foundations of nursing professionalism.

Another finding of the present study is that caring is significantly and negatively correlated with technological influence. This signifies that a high score in caring attributes means a low score in technological influence. This finding is similar to the findings of Arthur et al. (2001). It was found that those who have the lowest technological influence have the highest caring mean in the subscale caring advocacy. Conversely, in the same study, opposite findings were found in other subscales of caring, including caring communication and caring involvement. The group with the lowest technological influence recorded the lowest mean for caring, and the strongest technological influence recorded the highest mean score for caring. The negative association between caring attributes and technological influence suggests a perceived tension between relational caring values and technologically mediated practice. In the Saudi context, this may reflect concerns that technology prioritizes efficiency over interpersonal engagement. Cultural expectations rooted in Islamic ethics may further amplify the perceived importance of relational presence in care delivery. This finding may be interpreted through the lens of role strain theory and value incongruence, wherein nurses experience tension between relational caring roles and task-oriented, technology-driven demands within contemporary healthcare systems.

Contrary to the present study's findings, it was also found that caring attributes and technology influence are positively associated (Bagherian et al., 2017). This implies the need for further study to clarify the association between the two variables and their factors.

The R-squared (R^2) or the coefficient of caring attribute and personal image is .06, which means that 6% of the professional image is predicted by the caring attributes. This also means 94% variation in the professional image that cannot be explained or predicted by the caring attributes. On the other hand, the R^2 of caring attributes and the technological influence is 0.15, which means that 15% of the technological influence is predicted by the caring attributes. Consequently, 85% variation is not predicted by caring attributes. A big percentage of the variations between the variables are unexplained. The modest explanatory power of the model highlights the complexity of professional self-concept and technological engagement, which are likely shaped by organizational culture, leadership, workload, and digital readiness. Future studies should incorporate these factors to enhance explanatory strength.

This study is limited to Saudi nurses as respondents during the data collection. Despite the exclusiveness within the Kingdom of Saudi Arabia, the study offers more generalizable findings that represent the local nurses. The use of a web-based survey was another limitation that may have affected the questionnaire's distribution due to time and

work-related constraints, as the majority of nurses were assigned the middle crisis during the pandemic.

Many studies explored the ubiquitousness of caring in various professions, including nursing. Scholars worldwide continued to contribute to the caring discourse in defining, clarifying, and integrating this concept into practice, education, and research. Evidently, caring has been described along with its antecedents, attributes, processes, and outcomes using different approaches. In the multicultural environment, caring may have been influenced by many contextualized and understood. For instance, in Saudi Arabia, caring may be anchored in a Muslim perspective where local nurses may also have been influenced by the culture within or by the colleagues having different backgrounds, educational preparation, race, or ethnicity.

On the other hand, the technological advancements also posed another challenge because they demand nurses to immerse themselves in a challenging environment in which their current practice may be impacted. For this reason, the nurses' professional image may require a critical explication to understand how nurses provide their care in an ever-changing landscape of the healthcare system and to understand their societal roles and responsibilities in achieving quality patient outcomes. This study is exceptional and one-of-a-kind, conducted in the Middle Eastern countries that offer new insight into caring attributes, professional image, and technological influences. Undeniably, the Kingdom of Saudi Arabia has been considered a hub of technological innovation where international and local nurses meet to share ideas and learn from each other. Local nurses, in the end, will continue to serve as role models within the Muslim context, but are more willing to learn and widen their perspectives in a multicultural workplace.

5. Conclusion

The convergent and discriminant validity of the instrument used in the study is found to be statistically significant. The latent variable's indicator variables converge together, and the latent variables are distinct from each other. The caring attribute is also significant and positively related to professional image, but negatively correlated with technological influence. This shows that nurses' development of caring attributes will also develop their professional self-concept, but not their technological influence. However, the latter finding needs to be studied further because some literature findings are contrary to it. The effects of caring attributes on technological influence and professional image, and the model fit and quality indices are also statistically significant.

Notably, this study is among the first to empirically examine the relationships between caring attributes, professional self-concept, and technological influence within the Saudi Arabian nursing context. This study underscores the

enduring importance of caring attributes in shaping nurses' professional self-concept while revealing persistent tensions with technological influence. By contextualizing caring within the Saudi healthcare environment, the study extends caring theory and offers direction for practice, education, and future research.

List of abbreviations

AARS	Average adjusted R-squared
ACare	Acute care
APC	Average path coefficient
ARS	Average R-squared
AVE	Average variance extracted
AVIF	Average block variance inflation factor
CAPSTI	Caring attributes, professional self-concept, and technological influences
CarAttri	Caring attributes
CriCare	Critical care
GIPCare	General in-patient care
GoF	Goodness of fit
OPCare	Out-patient care
P-Image	Professional image
PSCNI	Professional self-concept of nurses index
SE	Standard error
SEM	Structural equation modeling
SPeCare	Specialized care
TechInflu	Technological influence
TIQ	Technological influence questionnaire
TIS	Technological influence scale
VIF	Variance inflation factor

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Compliance with ethical standards

Ethical considerations

Ethical approval was obtained from the relevant institutional review board (IRB Log Number: 19-123E). Participants were informed of their right to withdraw at any time without penalty.

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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