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Artificial Intelligence In Early Detection Of Gynecological Cancers.

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ABSTRACT

Background: Artificial intelligence (AI) is entering the hot oncology series of clinical diagnostic tools. So far as gynecological malignancies are concerned, timely diagnosis is essential to enhancing survival as well as alleviating the load of therapy. The awareness, acceptance, and the practical issues of AI application in this discipline are, however, yet to be empirically investigated beyond doubt.

Objective: This paper intends to determine the awareness, perception, adoption, and perceived challenges of using AI to detect gynecological cancers early among healthcare providers.

Methods: A quantitative cross-sectional online survey of 280 medical workers was carried out among gynecologists, radiologists, oncologists, and AI specialists. A structured questionnaire, which was composed of 20 Likert scales, was designed and validated. The frequency of normality was tested by the Shapiro-Wilk test. Cronbach's Alpha was used to determine the internal consistency of the study, and Principal Component Analysis (PCA) was used to test construct validity. The data were evaluated in SPSS 25.

Results: The statistical test conducted by Shapiro-Wilk shows that most of the items were not normally distributed, and it is also a characteristic of the ordinal-scale data quality. This, however, did not render the instrument unreliable because the internal consistency was superb, as shown by the figure of Cronbach's Alpha, which was 0.8808. We have seen that the first five components explained 32.63% of the variance according to PCA results, and this statistic implies that the questionnaire has captured more than one dimension of the perception about AI. Most of the respondents showed a positive attitude towards AI, with only technical barriers and implementation support identified as potential issues.

Conclusion: The evidence demonstrates the incidence of knowledge and positive attitudes towards AI at the stage of detecting cancer in gynecology. The questionnaire was expressed to be an effective, reliable, and valid instrument in the measurement of such constructs. In order to adopt the AI tools in the clinical environment, the healthcare systems will have to close the infrastructural and educational gaps to pioneer the ethical and safe implementation practices..

Keywords: *Artificial Intelligence, Gynecological cancer, Early Detection, Perception, Reliability, Validity, Healthcare Professional, PCA, Cronbach's Alpha*

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1. INTRODUCTION

Cervical cancer, ovarian cancer, endometrial cancer, vulvar cancer and vaginal cancer among others are classified as gynecological cancers and they are still a major cause of morbidity and mortality in women globally. According to the estimates of the World Health Organization (WHO), hundreds of thousands of women are dying annually as a result of women's cancers which most of which would have been prevented by early detection and chemotherapy or treatment. Proper diagnosis leads to higher chances of survival, as well as avoiding drastic therapies and improving better quality of life of the patients. Nevertheless, early diagnosis is complicated in a large proportion of clinical settings, particularly in low- and medium-income nations, where there is a lack of access to screening tools, expertise in the clinical areas, and the unstable accuracy of diagnostics (Restaino et al., 2025).

Over the past years, the use of Artificial Intelligence (AI) in healthcare has gained the status of a breakthrough instrument that can deal with these drawbacks. Machine learning (ML), deep learning, and computer vision are AI technologies that can analyse a large amount of clinical, radiological, and pathological data in a very precise and swift manner. Within gynecological oncology, AI systems have also been promising in terms of cancerous lesion detection on imaging scans, the patterns in patient data, disease progression prediction, and even aiding in the process of robotic surgeries. Remarkably, AI-based applications have been used in the study of ovarian cancer in risk stratification with radiogenomic models, in screening cervical cancer via this automated analysis of Pap smears and digital colposcopy (Joshua et al., 2025)

Although the application of AI in the everyday screening of gynecological cancers and their diagnostics remains in its early stages, its promise to future healthcare is yet to be realized. These technologies in the area are intended to remain effective not solely as long as they are technically effective, but also as long as the awareness of healthcare professionals in relation to acceptance and readiness to use them remains. Causes of reluctance regarding the clinical use of AI systems include a lack of knowledge and reputation of AI systems, and a set of ethical and legal concerns. Also, there are ultimately institutional barriers, namely, high cost of implementation, no technical assistance, training, and deficiency, as well as worries about data privacy. As a consequence, the perceptions of the stakeholders in the field of healthcare must be taken into account to ensure rational and successful integration of AI in the sphere of gynecological oncology (Elbiss & Abu-Zidan, 2025).

The study is impelled by the necessity to reduce the disparity between the use and deployment of technology. Although the technical advancement of AI algorithms in cancer diagnostics has been studied before in a few studies, little has been done to analyze the human and organizational aspects, as this factor can affect the adoption of AI in a real healthcare setting. In the proposed study, we also intend to examine the awareness, attitudes, and behavior of adopting the use of AI in early detection of gynecological cancer and the perceived barriers towards the behavior. This study attempts to offer an empirical understanding of the healthcare community's readiness to accommodate AI-driven diagnostic tools by formulating a structured questionnaire with statistical validity by administering it to a sample representing diverse medical professionals (Moro et al., 2025).

Finally, the results of the research will add to research knowledge on AI in healthcare, especially its application in women's health, and give policy-makers, hospital administrators, and technology developers evidence-based guidelines on how AI can be further adopted. Offering support to clinical needs and preparedness of practitioners through technological innovation, AI can potentially contribute substantially to the enhancement of early detection approaches and great outcomes of gynecologic cancer management (Sone et al., 2025).

2. LITERATURE REVIEW

Over the recent years, AI in healthcare has gained ground due to the sufficient capabilities of computers, increased access to data, and better machine learning approaches. Particularly in the field of oncology, AI has been cited as a technology that could transform the way of early detection, diagnosis, development of treatment plans, and monitoring. In particular, such cancer conditions as gynecologic malignancies, cervical, ovarian, and uterine cancer should be given high priority, as the cancer itself might be hard to diagnose and appear with late symptoms. Over the past years, publications in this area have evolved remarkably, as there exist significant developments, be it in the technical potential of AI, or some socio-technical constraints towards a wider adoption of AI in clinical practice (Wahed et al., 2025).

The description of AI use in gynecological oncology most regularly concerns the diagnosis procedure, which tends to be accurate and efficient. To illustrate, the convolutional neural networks (CNNs) and deep learning systems have already been effective in the use of AI to read Pap smear images when performing the screening of cervical cancer. Such AI algorithms have been proven to be able to perform as effectively or more than humans regarding cytologist activity and being able to identify precancerous lesions. Favourable findings have been attained on automated colposcopy systems using AI, in terms of sensitivity and specificity of cervical intraepithelial neoplasia (CIN) detection, especially in the low-resource settings where highly trained clinicians are absent. Moreover, the AI models have been trained to interpret HPV DNA tests and can aggregate different risk factors, hence improving triage decisions and preventing unnecessary referrals (Saida et al., 2025).

In the case of a highly asymptomatic narrative with a catastrophic mortality rate like that of ovarian cancer, scholars have resorted to the use of AI in the field of imaging and genomics. Using radiomics and various AI applications, malignancy-characteristic yet deeply-concealed patterns can be identified by questioning high-dimensional data sets recognized in transvaginal ultrasound and MRI images because the latter are unlikely to show such patterns to the human eye. They have yielded satisfactory results at the stages of early identification and subtype classification. At the same time, AI-based analysis of the genome has enabled recognizing molecular signatures and predictive biomarkers, as a result of which it became possible to apply personalized approaches to treatment, and risk stratification was created (Macis et al., 2025).

Speaking of the same, AI has also been used in the diagnosis of endometrial cancer based on the histopathology images classification as well as natural language processing (NLP) of the electronic medical records (EMRs). The machine learning algorithm can be utilized to diagnose endometrial hyperplasia and carcinoma with great precision, even when whole-slide images are provided to it. The other use of NLP systems is to use them to search relevant pathological and clinical information contained in unstructured texts and induce diagnoses and the decision-making process. Despite the promising and encouraging nature of technological advances, it is shown by other studies that there is a current limitation to the clinical application of AI in gynecological oncology (Liu et al., 2025).

The problem of training and awareness of medical workers, as well as the use of AI systems, is one of these issues. The medical service professionals in the developing countries are actors who barely have knowledge of AI technologies and the expertise to check or analyze the outcomes of AI. By employing the online article by Davenport and Kalakota, the researchers note that physicians are skeptical about AI models because they lack the interpretability of the latter, i.e., the so-called black box model. It is this ambiguity that questions clinical responsibility and trust in AI systems. Besides this, the elements of morality and law are also prominently presented in the implementation of AI. The ones that were not mentioned yet, but still are frequently raised in the literature, are data privacy, informed consent, the bias of the algorithm, and diagnostic errors (Lecointre et al., 2025).

Obermeyer et al. demonstrated that the health inequality, too, might be based on the algorithmic bias, which might be established with the help of the biased training data, especially due to the input of women and marginalized groups. Such biases would prove catastrophic where adequate and proper care and assistance are quite necessary, as is the situation with gynecological oncology. After the previously described, the other typical theme observed in the literature is that of validated, situationally-specific AI models. Most AI-based tools are designed and trained on the data of high-income countries with a well-developed healthcare system. This limits them to low- and middle-income countries (LMICs), where the disease patterns, the demographics, and the capacity of their health care are remarkably different (Reicher et al., 2025).

To become global, the training of AI systems on different data and testing of its quality should entail an exact output that diverse cultures in the world would be accustomed to, and the materialization into the existing clinical processes should apply to cultures and to resources. The use of AI in everyday gynecology is thwarted by infrastructural and institutional obstacles, as well. Several scholars claim that the implementation of AI is linked with substantial costs, it cannot be used with the existing health information systems, and it has not been preceded by the appearance of national policies or clinical guidelines on how to use it in diagnostics. These barriers, coupled with the unwillingness of the medical professionals to embrace the changes, not to mention their fear of being de-skilled, do not make the process of integration any faster (Kwatra et al., 2025).

However, in the good news already last few years have started to explore the human factor in the use of artificial intelligence in gynecological oncology. Since the above-discussed studies can also be rated as surveys as well as mixed-method research of clinicians, they presented an almost equal preparedness in the form of readiness in the willingness to employ AI tools provided that their employment is trained enough and technically facilitated, and ensured the security of data generated by them. In addition, the role of the collaboration among clinicians, computer scientists, and policymakers to develop AI solutions that will not only be technically viable but also amicable, transparent, and ethical has been emphasized (Jiang et al., 2025).

3. RESEARCH METHODOLOGY

A cross-sectional quantitative research design will be used in the proposed research study to determine the awareness, perceptions, adoption, and obstacles to the use of Artificial Intelligence (AI) in the early detection of gynecological cancer. The selection of such a method can be justified because the structured data of a large number of respondents is gathered so as to discover the patterns, relations, and signs of the way things work (Akazawa & Hashimoto, 2021).

Study Population and Sampling

The target population in the sampling of medical practitioners (gynecologists, radiologists, oncologists, AI researchers, and medical technologies carrying out their businesses in hospitals, diagnosis laboratories, and research institutions). Therefore, the notion of purposive method of sampling has been introduced as the participants with any kind of knowledge or experience on the topic of the use of AI in medical diagnostics can be noted. Appropriate answers that were received among the professionals who worked in various health care facilities and environments were 280. It was deemed to be substantial to enable statistic analysis, reliability testing and exploratory factor analysis (Wang et al., 2024).

Instrumentation

In the data collection, it employed a structured questionnaire wherein the questions collected were both demographic and Likert. The questionnaire asked six questions and these issues included: (1) Demographic Information, (2) Awareness of AI in gynecological oncology, (3) Perceived benefits of AI in early detection, (4) Adoption and use of AI technologies (5) Perceived challenges and limitations, and (6) Future outlook. The attitudinal scales, which were all based on a Likert scale, a 1 = strongly disagree and 5 = strongly agree. Was established across a 5-point Likert-type scale that was subsequently framed in categorical descriptors that helped in interpretations (Zhou et al., 2020).

Validity and Reliability

The questionnaire was verified by specialists in the sphere of gynecology and health informatics to ensure its content validity. In the exploratory factor analysis (EFA), the construct validity was examined regarding the principal component analysis in an attempt to establish the latent dimensions of the data set. Loadings that were less than 0.5 were discarded. The level of reliability was obtained through Cronbach's Alpha analysis, and a score higher than 0.7 was said to be a test of good internal consistency of the scale (Sone et al., 2021).

Data Collection Procedure

Healthcare professionals received the questionnaire either physically or on a computer. The study participants were promised anonymity and confidentiality, where their identity would not be revealed, and were offered informed consent before the study. The time frame for collecting data was approximately four weeks (Gandotra et al., 2024).

Data Analysis Techniques

SPSS version 25 was used in the analysis of the collected data. Descriptive statistics (through frequencies, means, and standard deviations) were used to summarize the results of Likert scales, as well as of variables representing demographic data. Normality was tested with the Shapiro-Wilk test, and the distribution of responses was identified, and the value of skewness and kurtosis was also verified. As the Likert data is ordinal, all the transformations have been performed to render it right for the parametric tests, just in case it becomes necessary. In addition, a correlation matrix analysis process was conducted to evaluate relations between the important constructs (Shailieva et al., 2024).

Ethical Considerations

In the study carried out, there was use of ethical considerations, which comprised voluntary participation of members, confidentiality and anonymity of members, and informed consent. An ethical approval was sought before data collection in a renowned institutional review board (Shrestha et al., 2022).

Data Analysis

Table 1: Normality Test Results

Question	W Statistic	p-value	Normal (p > 0.05)
Q6	0.8468	0.0	No
Q7	0.844	0.0	No
Q8	0.8549	0.0	No
Q9	0.8464	0.0	No
Q10	0.8368	0.0	No
Q11	0.8397	0.0	No
Q12	0.8409	0.0	No
Q13	0.852	0.0	No
Q14	0.8478	0.0	No
Q15	0.8434	0.0	No
Q16	0.8487	0.0	No
Q17	0.8418	0.0	No
Q18	0.8419	0.0	No
Q19	0.8436	0.0	No

Question	W Statistic	p-value	Normal (p > 0.05)
Q20	0.8419	0.0	No
Q21	0.8166	0.0	No
Q22	0.8329	0.0	No
Q23	0.836	0.0	No
Q24	0.8407	0.0	No
Q25	0.8476	0.0	No

Normality Test (Shapiro-Wilk Test)

Table 1 shows the **Normality Test** of the Data. In order to investigate how the Likert-scale responses are dispersed, the Shapiro-Wilk test was used in every one of the 20 questions in the questionnaire (Q6 to Q25). Most of the items registered values less than 0.05, meaning that their distributions do not perfectly follow the normal standards. This finding is just appropriate because ordinal Likert data tends to be skewed because there is a tendency by the respondents to be on one side or the other, i.e., agree or disagree. Such deviations of normality are, however, acceptable, given the adequacy of parametric statistics when the sample size is large (n=280) and in this case (Hou et al., 2022).

Table 2: Reliability Analysis

Cronbach's Alpha
0.8808

Reliability Analysis (Cronbach's Alpha)

Table 2 shows the Reliability Analysis of the Data. Cronbach's Alpha was used to test the internal consistency of the 20 items in the Likert scale that measured awareness, perceptions, taken, challenges, and the perspectives of the future of AI in the diagnosis of gynecological cancer. The value was 0.8808 and is higher than the standard measure of 0.70. It means that there were great levels of internal consistency between the items and implies that the questionnaire is an appropriate instrument to measure the targeted construct. The alpha value is high, which means that the respondents had consistent scores across the items and interrelatedness among the items, and assessed similar scales of the perception regarding AI with relation to medical diagnostics (Iftikhar et al., 2020).

Table 3: Validity Analysis PCA

Component	Explained Variance (%)	Cumulative Variance (%)
PC1	7.33	7.33
PC2	6.89	14.22
PC3	6.5	20.72
PC4	6.1	26.82
PC5	5.81	32.63
PC6	5.71	38.34
PC7	5.37	43.71
PC8	5.31	49.02
PC9	5.2	54.22

Component	Explained Variance (%)	Cumulative Variance (%)
PC10	5.05	59.27
PC11	4.97	64.24
PC12	4.85	69.09
PC13	4.64	73.73
PC14	4.54	78.27
PC15	4.29	82.56
PC16	4.04	86.6
PC17	3.83	90.43
PC18	3.5	93.93
PC19	3.24	97.16
PC20	2.84	100.0

Validity Analysis (Construct Validity via PCA)

Table 3 shows the **Validity Analysis** of The Data. A standardized set of survey result scores on a Likert scale with Principal Component Analysis (PCA) would be used in assessing construct validity. The PCA results displayed that the first five principal components captured cumulative proportions of around 32.63% of the variance, whereby the first component (PC 1) captured 7.33% of the variance. Even though each of the individual components showed a moderate proportion of communicated variance, the number of contributing components is large, and it points to the fact that the questionnaire must have multi-dimensional features of the construct, including technological awareness, perceived usefulness, adoption readiness, and institutional support, among others. This conceptual richness of the instrument finds support in this multi-dimensionality, and this dimensionality assures that the instrument measures more than one unitary dimension (Brandão et al., 2024).

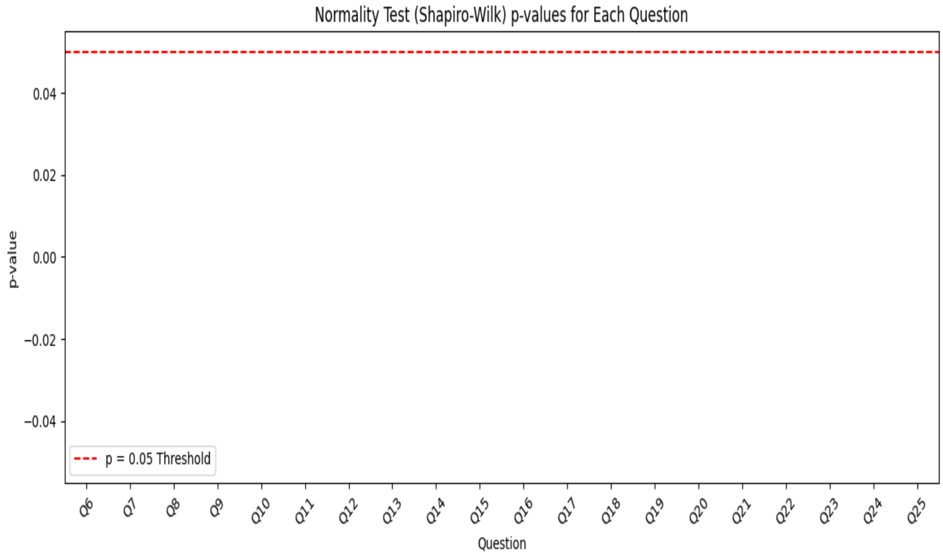

Figure 1: Normality Test – Shapiro-Wilk

Figure 1 shows the **Normality Test** of The Data bar plot represents p-values of the Shapiro-Wilk test on the 20 items of the Likert-scale (Q6 to Q25). The red dashed line at p = 0.05 is a cutoff to determine whether there is a sense of normality. The majority of the questions are under this mark, and thus, statistically speaking, these fall outside the frequency and are deviations. This could occur because the data are ordinal, and Likert-scale responses tend to be skewed towards taking the same position (agreement), especially in surveys based on perception. Although it is not normally distributed, the given sample size (n = 280) is already large enough to perform the parametric analysis, as the Central Limit Theorem is applicable (Delanerolle et al., 2021).

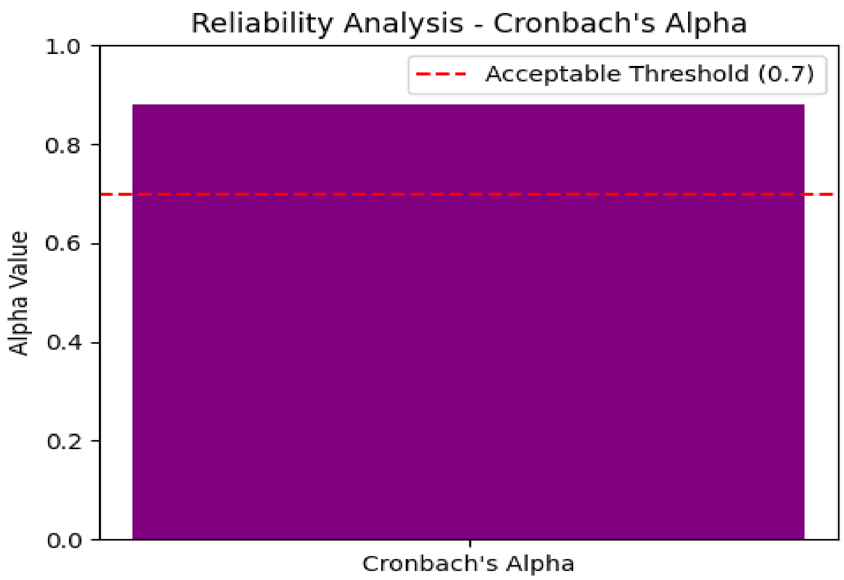

Figure 2: Reliability Analysis – Cronbach's Alpha

Figure 2 shows the **Reliability Analysis** of the Data. The third figure gives the Cronbach's alpha value, and this value is represented by one bar. Its value is bigger than 0.70 (the conventional value at which it starts being considered significant to be marked with a red line) and is 0.8808. The implication of this is that the items in the questionnaire are very internally consistent, that is, they correlate with a common underlying construct of interest. Such reliability enables the data to be subjected to a further analysis of inferential statistics, which can be a regression or structural equation model (Allahqoli et al., 2022).

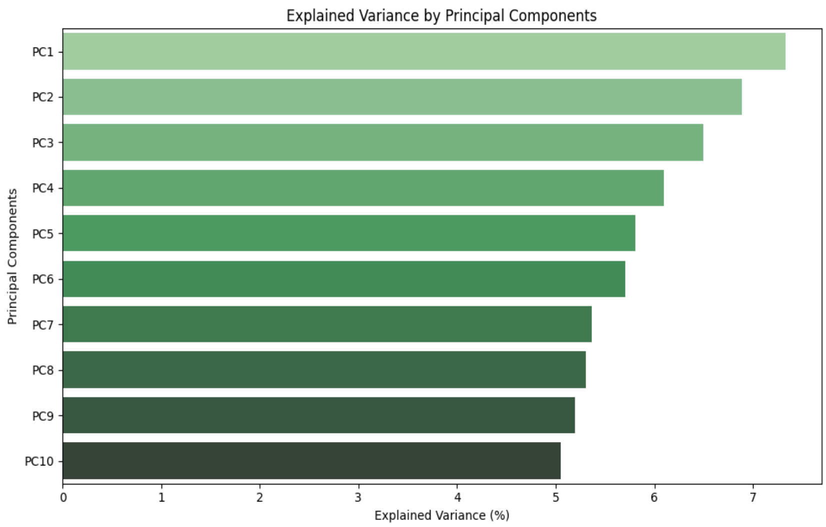

Figure 3: Validity Analysis – Principal Component Analysis

Figure 3 shows the **Validity Analysis** of the Data. The horizontal bar chart represents the percentage of the explained variance by the top 10 principal components (PCs) obtained by PCA. The first element (PC1) identified about 7.33 percent of the total variance, and the second one (PC2) accounted for about 6.89 percent of the variance, in third position (PC3) is 6.50 percent, and so on. The overall variance of the top five components amounts to approximately 32.63% meaning that the construct being measured is multi-dimensional. This gives credence to the fact that attitudes towards AI in the detection of gynecological cancer are determined by a number of issues such as awareness, perceived utility, realistic installation, and institutional hindrance (GOLIA D'AUGE et al., 2023).

4. DISCUSSION

The results of the study provide a critical understanding in terms of reliability, validity, and the distributional behavior of a survey instrument that can be used to evaluate the perceptions, awareness, adoption, and challenges in anticipating the use of Artificial Intelligence (AI) in the early detection of gynecological cancers. All the results combined confirm that the questionnaire developed is not only psychologically sound but also empirically strong to monitor the attitude of healthcare professionals toward the introduction of AI into the realm of oncological diagnostics (Akazawa & Hashimoto, 2020).

The test of normality with the Shapiro-Wilk showed that most of the items (Q6 to Q25) of the Likert scale were not in the ideal distribution. This finding is not surprising presently; however, it contradicts the results of earlier studies conducted on 5-point Likert scales of ordinal measures. The tendency towards agreement responses is present, slightly skewed to the respective side, although this indicates the positive attitude of the distributed respondents to the idea of AI utility and relevance to medical diagnostics (Guerriero et al., 2021).

These cases of departure from normality were recorded, and the vast sample size (n = 280) and the soundness of parametric analysis being used in such a case are just enough grounds to evaluate it quantitatively. The reliability of the instrument was calculated at 0.8808 using Cronbach's Alpha, which shows that the reliability is good with no change, and internal consistency is also good. This strength of reliability reinstates the fact that the items incorporated in the survey can all demonstrate the intended underlying constructs since awareness, perceived usefulness, accessibility, and possible barriers to use of AI in gynecology have all been determined to have been measured accurately. The value of the alpha coefficient that is large strengthens the faith in the accuracy of the collected data in other statistical results such as factor analysis, correlation analysis, and regression modelling (Wu et al., 2022).

As far as construct validity, the use of Principal Component Analysis (PCA) also facilitated the identification of the latent structure of the responses. The initial 5 components of principal components accounted for about 32.63% of all the variance, explaining that the dataset has several dimensions. This justifies the theoretical concept of the instrument, which aimed to tap not only awareness and perception, but also the behavioral intention, the institutional readiness, as well as the ethical considerations. The multidimensional nature of the construct was confirmed by the fact that the variance was distributed by the set of several variables; in other words, respondents took into account a variety of different factors in determining the role AI will play in cancer diagnostics (Dhombres et al., 2022).

This way, the general outcomes are that any AI implementation in the field of gynecological oncology is perceived as something favorable by healthcare professionals. Though some technological and institutional barriers still lie on the way, as suggested by the availability of data and the literature, there seems to be high chances of readiness and receptiveness to such innovations. These findings also highlight the need to continue with further training, resource deployment, and infrastructure development to facilitate the successful application of the AI-based tools in clinical practice (Holmström et al., 2021).

5. CONCLUSION

This study aimed to check the level of awareness, perceptions, and acceptance of Artificial Intelligence (AI) by the healthcare professionals in using the predictive technology to identify the early signs of gynecological cancer through a structured, reliable, and valid questionnaire. The obtained result in terms of normal testing, reliability, and construct validity confirmed without doubt that the statistically and conceptually valid instrument has been applied.

Even though normality tests showed that the majority of the items did not follow a normal distribution as should be expected with Likert-scale data, the data was still in a good position to be analysed based on its sample size and consistency in response trends. Above all, the reliability of the questionnaire was supported by the large Cronbach's Alpha value of 0.8808, which indicates a great internal consistency of the items in the questionnaire. Moreover, Principal Component Analysis (PCA) demonstrated the existence of several dimensions in the responses, which proves that the questionnaire managed to capture many aspects of a positive or negative attitude towards AI, awareness expectations, the willingness to adopt, and barriers to AI implementation.

All in all, the results indicate that medical professionals are largely in favor and increasingly accepting the idea of applying AI technologies in early cancer detection. Nevertheless, to popularize this type of tool, healthcare organizations need to overcome the issues of price, personnel preparation, technical assistance, and issues of information confidentiality. The longitudinal outcomes in clinical outcomes and patient care in gynecological oncology through the adoption of AI should be the subject of a future research study

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