



Original Article



Transvaginal Ultrasound: Current Practices and Barriers in Pakistani Sonographers

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ABSTRACT

Transvaginal ultrasound (TVUS) is an important diagnostic medium in the evaluation of female pelvic pathology because it can be performed without invasiveness, is real-time, and has diagnostic accuracy. Its use in low and middle-income countries, particularly in gynecological practice, has significant difficulties regardless of the international suggestions to use it regularly. **Objective:** To explore the current practices, perceived barriers, and influential factors associated with the routine implementation of TVUS among Pakistani sonographers. **Methods:** This cross-sectional descriptive survey was conducted among 162 accredited sonographers across Pakistan using a 35-item structured questionnaire. Data on demographic characteristics, clinical experience, confidence levels, protocol adherence, and perceived barriers were collected. Data were analyzed using descriptive statistics and chi-square tests. **Results:** The findings revealed strong patient preference for female sonographers across all regions, with statistically significant differences based on practice location ($p < 0.001$). Adherence to standardized TVUS protocols was highest in public hospitals and among practitioners with over 15 years of experience ($p < 0.001$). Key barriers included cultural taboos, inadequate training, limited institutional support, and legal/ethical concerns, particularly in rural and semi-urban areas. Practitioners' confidence was positively associated with years of experience. **Conclusion:** The study highlights critical gaps in training, infrastructure, and cultural acceptability that hinder effective TVUS utilization in Pakistan. Targeted interventions such as gender-sensitive training, protocol standardization, and policy-level reforms are essential to bridge these gaps and enhance the delivery of equitable, high-quality gynecological care.

INTRODUCTION

The transvaginal ultrasound (TVUS) is widely considered the first-line imaging modality for the assessment of the female pelvis due to its dynamic functions, high-resolution images, and non-ionizing radiation [1]. With the growth in the dependence on pelvic imaging, TVUS has demonstrated itself to be a significant diagnostic tool for the assessment of various gynecological conditions, such as endometriosis, ovarian cysts, and early pregnancy difficulties. While laparoscopy has traditionally been regarded as the diagnostic gold standard, it remains

invasive, carries surgical risk, and is resource-intensive, especially in low- and middle-income countries. Thus, the European Society of Human Reproduction and Embryology (ESHRE) has recommended transvaginal ultrasound (TVUS) as the first-line diagnostic tool for various gynecological conditions, owing to its accessibility and diagnostic accuracy. Given the diagnostic utility and effectiveness of TVUS, the British Medical Ultrasound Society also advocates that the procedure should be accessible to all eligible patients to provide equitable and high-standard



care [2]. Although the attitude of patients towards TVUS has been studied in numerous studies, revealing a variety of reactions across different clinical setups and cultural backgrounds, there is a significant gap in the literature regarding the perspective of sonographers about transvaginal ultrasound (TVUS)[3, 4]. This gap is especially relevant, as the successful implementation of TVUS is required beyond the acceptance by the patient, but also the training, technical confidence and attitudes of the healthcare professionals involved [5-7]. The broader application of Transvaginal Sonography (TVUS) in low-resource countries like Pakistan is a big challenge. These include the insufficiency of training and ergonomic capacity of the sonographers, the cultural ideologies that shape the attitude of the patients, the unavailability of the medical equipment in question, and the infrastructures and insufficient healthcare funding. In addition to that, the problem associated with the working conditions of the TVUS use, ergonomic load, and inability to cope with technically complex cases are discussed [8]. Moreover, the successful collaboration with the sonographers would help to recognize the barriers to the TVUS implementation that may improve the clinical guidelines and policy formulation, and might make a significant contribution to the facilitation of patient care, women's health, and healthcare system sustainability [9-11]. Moreover, to efficiently tackle the challenges on a larger scale, it is necessary to adopt an all-inclusive approach, which should be aimed at raising the awareness about the procedure by means of education, offering the comprehensive training to sonographers, addressing the cultural beliefs and stigmas, making the necessary medical equipment accessible, optimizing the overall healthcare system, and enhancing the finances to implement and support the programs.

Transvaginal ultrasound (TVUS) is a vital, non-invasive diagnostic tool for female pelvic health, yet its adoption in Pakistan faces multiple challenges, including cultural sensitivities, limited training opportunities, inadequate institutional support, and inconsistent adherence to standardized protocols, particularly in rural and semi-urban areas. Despite its recognized clinical utility, there is a notable lack of research exploring Pakistani sonographers' perspectives, confidence, and barriers in routine TVUS practice, highlighting a gap in understanding the professional, institutional, and socio-cultural factors affecting its implementation. This study aims to investigate the current practices, perceived barriers, and influential factors associated with TVUS utilization among Pakistani sonographers to inform targeted interventions, training programs, and policy reforms that can enhance equitable and high-quality gynecological imaging services.

METHODS

This cross-sectional descriptive survey was conducted among 162 accredited sonographers across Pakistan. Ethical approval was obtained from the research ethics committee of Green International University, Lahore, Pakistan (Ref. No. 25-10). The study was conducted at Green International University in Lahore, Pakistan, from August 2024 to August 2025. The survey instrument consisted of 35 questions, which were created in accordance with the literature and professional advice. The questionnaire was divided into five parts: demographic variables; clinical practice; training; self-perceived confidence to undertake transvaginal ultrasound (TVUS); perceived barriers and facilitators to routine TVUS use; and reporting and referral practices. The questionnaire was subject to the review of three sonographers who achieved the face and content validity of the questionnaire. The alpha of Cronbach was not determined because of time and resource limitations. The feedback allowed minor corrections to improve language clarity and structure. The data from pilot testing by three experienced sonographers was not added to the final results of the study. The first page of the survey included a participant information sheet, and informed consent was obtained from each sonographer before the data collection. Participants were recruited through convenience sampling. Recruitment strategies included the dissemination of the survey via professional social media groups for sonographers and radiologists, as well as poster advertisements in ultrasound departments across various hospitals in Pakistan. A convenience sampling technique was used, which may limit the generalizability of the findings. The minimum required sample size was estimated using Cohen's guidelines for chi-square tests of association, assuming a medium effect size ($w=0.25$), a significance level of 0.05, and a power of 0.80. The calculation, performed using G*Power version 3.1.9.7, indicated that a minimum of 126 participants would be sufficient. To account for potential nonresponse and incomplete data, a target sample of 162 was selected [12]. This sample size also aligns with similar cross-sectional studies conducted among the radiologists and sonographers investigating the practices, training, and related barriers [13-14]. The inclusion criteria required participants to hold a minimum qualification, such as a Diploma, BS, MS, MBBS with ultrasound certification, or FCPS in Radiology. Participants aged 18 years or older who were involved in performing gynecological ultrasound procedures in Pakistan were included in the study. Individuals not meeting the age criteria and those affiliated with the field were excluded. Data were analyzed using IBM SPSS Statistics version 26.0. Categorical and demographic

variables were summarized using frequencies and percentages, while continuous variables were reported as means and standard deviations. Inferential analyses included chi-square tests and logistic regression to examine associations between variables, with a significance level set at $p < 0.05$.

RESULTS

A total of 162 responses were included in the final analysis. Categorical and demographic data are reported as frequencies and percentages in Table 1. The majority of respondents were female (103, 63.6%), with most in the 25–34 age group (78, 48.1%). Over half of the participants, 107 (66%), were single. Regarding education, 101 (62.3%) held a Bachelor's degree in Radiography or Ultrasound, 26 (16%) an FCPS in Radiology, and 25 (15.4%) an MBBS.

Table 1: Demographic Characteristics of the Study Sample (N = 162)

Variables	Categories	n (%)
Gender	Male	59 (36.4%)
	Female	103 (63.6%)
Age (years)	18–24	12 (7.4%)
	25–34	78 (48.1%)
	35–44	51 (31.5%)
	45–54	21 (13.0%)
Marital Status	Single	107 (66.0%)
	Married	55 (34.0%)
Qualification	Bachelor's in Radiography/Ultrasound	101 (62.3%)
	Diploma in Medical Sonography	10 (6.2%)
	FCPS Radiology	26 (16.0%)
	MBBS	25 (15.4%)
Employment Status	Full-time	88 (54.3%)
	Part-time	46 (28.4%)
	Temporary/Locum	28 (17.3%)
Professional Role	Sonographer	128 (79.0%)*
	Radiologist	26 (16.0%)
	Trainee	8 (4.9%)
Years of Experience	< 2 years	11 (6.8%)
	2–5 years	15 (9.3%)
	6–10 years	25 (15.4%)
	11–15 years	53 (32.7%)
	> 15 years	58 (35.8%)
Type of Facility	Private Diagnostic Center	25 (15.4%)
	Public Hospital	83 (51.2%)
	Teaching Hospital	31 (19.1%)
	OB-GYN Specialty Clinic	23 (14.2%)
Location of Practice	Urban	52 (31.5%)
	Semi-Urban	39 (24.1%)
	Rural	72 (44.4%)

In terms of employment, 54.3% were working full-time, and most participants (69%) identified their role as a sonographer. Nearly 68.5% of the sample had more than 10 years of professional experience. More than half were

employed in public hospitals (51.2%), and 44.4% reported practicing in rural areas. To explore the gender preference perception among patients receiving TVUS, the chi-square test was used, depending on the location of practice of the respondents. The results showed that the relationship between the practice location and perceived gender preference was statistically significant ($\chi^2=32.64, p < 0.001$). The analysis also showed that in urban regions, 90.4% of practitioners said that patients favored female sonographers, and 3.8% did not favor, but 5.8% were uncertain. In the semi-urban locations, 100% of the respondents were found to prefer female practitioners. Equally, 97.2% of the participants in the rural setting expressed that a patient prefers female sonographers, where 2.8% responded that such a patient has no preference (Table 2).

Table 2: Perceived Gender Preference for TVUS by Practice Location (N=162)

Variables	Practice Location	No Preference, n (%)	Not Sure, n (%)	Yes, Prefer Female, n (%)	χ^2
Perceived Gender Preference for TVUS	Urban	2 (3.8%)	3 (5.8%)	47 (90.4%)	32.64***
	Semi-Urban	0 (0%)	0 (0%)	39 (100%)	
	Rural	2 (2.8%)	0 (0%)	70 (97.2%)	

*** $p < .001$

Use of standard protocols in TVUS doing between various types of facilities and the years of experience were also investigated. The findings revealed that the use of standardized protocols in public hospitals was the most adhered to, as 74.7% of the respondents confirmed that they used it, and only 4.3% expressed that they did not use the protocols. Conversely, the percentage of those in private diagnostic centers who had standardized protocol usage was 36% as compared to 32.3 and 34.8% in teaching hospitals and OB-GYN specialty clinics, respectively. In terms of years of experience, the largest percentage of protocol usage belonged to professionals who have over 15 years of experience (67.2%), then to those with experience between 11–15 years (60.4%). On the other hand, respondents with less than 5 years' experience exhibited significantly low standardized protocol adherence, with only 36.4% of the respondents with less than 2 years and 26.7% with 2–5 years having low standardized protocol adherence. The chi-square test showed that the facility type ($\chi^2=52.27$) and years of experience ($\chi^2=47.07$) had a significant relationship with the protocol use ($p < 0.001$ for both) (Table 3).

Table 3: Use of Standardized TVUS Protocols by Facility Type and by Years of Sonography Experience (N = 162)

Variables	Categories	Yes, n (%)	Maybe, n (%)	No, n (%)	Not Aware, n (%)	χ ²
Use of Standardized TVUS Protocols	Private Diagnostic Centre	9 (36.0%)	11 (44.0%)	2 (8.0%)	3 (12.0%)	52.27*
	Public Hospital	62 (74.7%)	11 (13.3%)	4 (4.8%)	6 (7.2%)	
	Teaching Hospital	10 (32.3%)	2 (6.5%)	13 (41.9%)	6 (19.4%)	
	OB-GYN Specialty Clinic	8 (34.8%)	5 (21.7%)	5 (21.7%)	5 (21.7%)	
Years of Experience	> 15 years	41 (67.2%)	12 (19.7%)	3 (4.9%)	5 (8.2%)	47.07*
	11-15 years	4 (36.4%)	1 (9.1%)	2 (18.2%)	4 (36.4%)	
	6-10 years	4 (26.7%)	3 (20.0%)	3 (20.0%)	5 (33.3%)	
	2-5 years	9 (36.0%)	8 (32.0%)	5 (20.0%)	3 (12.0%)	
	< 2 years	32 (60.4%)	17 (32.1%)	2 (3.8%)	2 (3.8%)	

***p<0.001

A logistic regression was performed to identify predictors of confidence and protocol adherence in performing TVUS. The analysis revealed that sonographers with six or more years of experience were over four times more likely to demonstrate confidence and adherence (AOR=4.13, 95% CI: 1.85–9.21). Employment in public or teaching hospitals was also a significant predictor (AOR=3.29, 95% CI: 1.47–7.38). The use of standardized protocols showed a strong association with improved confidence (AOR=2.86, 95% CI: 1.22–6.69). Additionally, training availability (AOR=3.71, p=0.003) and lower gender-based barriers (AOR=2.42, p=0.047) were independently associated with positive practice behaviors (Table 4).

Table 4: Logistic Regression Analysis of Factors Associated with Confidence and Protocol Adherence in Performing TVUS

Predictor Variables	β Coefficient	Adjusted OR	95% CI (Lower–Upper)	p-value
≥6 Years of Experience	1.42	4.13	1.85 – 9.21	0.001
Public/Teaching Hospital (vs Private/Clinic)	1.19	3.29	1.47 – 7.38	0.004
Use of Standardized Protocols (Yes)	1.05	2.86	1.22 – 6.69	0.014
Low Gender-Based Barrier (vs High)	0.88	2.42	1.01 – 5.79	0.047
Training Availability (Yes)	1.31	3.71	1.56 – 8.85	0.003
Constant	-2.07	–	–	0.009

The most commonly reported barriers that hinder Sonographer from performing TVUS are illustrated in Figure 1. These included cultural sensitivities and patient consent issues, lack of training opportunities, inadequate institutional support, and legal/ethical concerns. Such barriers appeared to be more pronounced in rural and semi-urban areas (Figure 1).

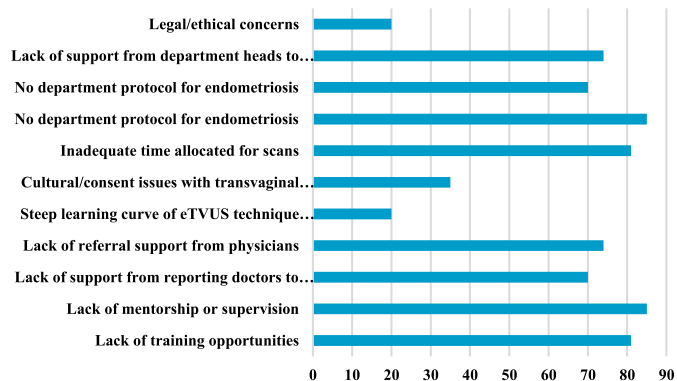


Figure 1: Barriers That Limit the Sonographer's Ability to Perform TVUS (N=162)

Sonographer confidence in performing TVUS was found to be closely linked with their years of professional experience. Confidence levels increased substantially with more years of practice. Those with over 15 years of experience reported the highest confidence, whereas those with less than 5 years of experience displayed lower levels of self-reported competence in performing the procedure (Figure 2).

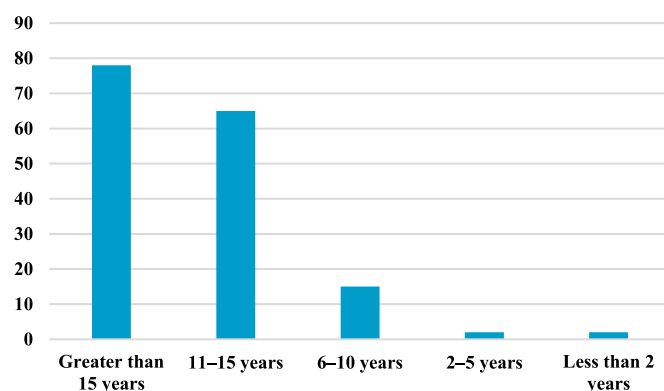


Figure 2: Confidence in Performing TVUS by Years of Experience (N=162)

DISCUSSION

The current study was the first to investigate these issues that Pakistani sonographers commonly encounter when learning and implementing TVUS in routine practice. One significant conclusion made based on the results of this

study is that there is a high preference for female sonographers by the patients, across all demographic areas, including urban, semi-urban, and rural areas. This observation is corroborated by the literature both in South Asia and the Middle Eastern countries, where gender dynamics in the healthcare relationship have been significantly affected by the cultural and religious understanding, specifically in gynecological or intimate examinations [15, 16]. Similar results are provided in a study carried out in Lahore, Pakistan, raising high refusal rates of TVUS when provided by a male sonographer, similar to the present study [17, 18]. The significant correlation between the location of practice and gender preference of patients indicates the deep sense of cultural values present in rural and conservative areas of Pakistan. Female patients, in such settings, tend to avoid male medical practitioners because of the modesty norms, family and societal norms, and religious expectations [19]. This underscores that there is a need of skilled female sonographers, especially in the underserved rural settings. In terms of adherence to the standardized TVUS procedures, the analysis suggested that public hospitals are generally more compliant with the standardized TVUS protocols than the private centers and specialty clinics. This may be attributed to the presence of enhanced governance by the institutions, quality assurance systems, and continuing education policies that are commonly present in government facilities [16]. On the other hand, the variability in the protocol compliance in the private sector may represent an absence of a regulatory process and standardized training protocols, which was also mentioned in one of the recent audits of radiological facilities in Punjab [20]. Years of experience on the job were also discovered to have a substantial influence on the attitude towards adherence to protocol and confidence of sonographer in performing the TVUS. This observation confirms the available evidence that the clinical skills in ultrasound are enhanced with time and subsequent exposure, along with the supervision and training of the skills. A regional study suggested that senior radiologists were observed as more consistent and guideline-compliant with regard to scanning practices in comparison with junior employees or technicians [21, 22]. Similarly, the association between experience and confidence demonstrated by this study reflects similar tendencies in sonography teaching programs explained in a study conducted in Southeast Asia, indicating that organized formal training and mentorship have not only a positive effect on the practical abilities of the practitioner but also improve their self-efficacy [23]. The results of the logistic regression analysis emphasize that professional experience, institutional support, and structured training are significant factors to consider to increase confidence and compliance with TVUS protocols. The sonographers

who had an experience of ≥ 6 years were more than four times more expected to show competent practice (AOR=4.13), a finding that corresponded with past reports that clinical seniority increases procedural confidence and guideline adherence. Working in state or teaching hospitals (AOR=3.29) also indicates the contribution of the resource availability and supervision to the improvement of the practice standards, as the prior studies have shown. The adherence was much better with the use of standardized protocols (AOR=2.86), which proves that formal guidelines can decrease the variability of ultrasound practice [24]. Further, the availability of training (AOR=3.71) and decreased gender-related barriers (AOR=2.42) demonstrate the significance of the equitable accessibility and conducive conditions in promoting professional competence. Taken together, these findings highlight the importance of specific training, institutional support, and reduction of social obstacles as the key to enhancing TVUS performance. Notably, the research also established several barriers to quality delivery of the TVUS practice, particularly in semi-urban and rural locations. Some of the key concerns in this respect are cultural taboos, lack of training opportunities, gaps in the institution, and the absence of the consent of patient. Such outcomes are consistent with the case in Pakistan, which was described in previous research, pointing to the deficiency of gynecological ultrasound education in general sonography programs and the absence of workshops or simulation training to learn the invasive procedures [25]. The issue of legal and ethical consequences in the practice of (TVUS) shows that the problem requires national guidelines that are standardized to protect both patients and professionals. One of the reviews notes that a lack of training in the field of ultrasound, and in particular in low and middle-income countries, can give rise to both ethical and clinical issues [26]. The research is among one of the earliest studies in Pakistan conducted to investigate the professional, institutional, and cultural determinants affecting the application of transvaginal ultrasound (TVUS) by sonographers and radiologists. The inclusion of various practitioners working in different healthcare settings, including public, private, and teaching institutions, contributes to the generalizability of the results in the local context.

However, there are a number of limitations that need to be acknowledged. External validity is restricted due to the convenience sampling method, and lack of formal power analysis also limits the accuracy of the inferential findings. Self-reported data can also be subject to recall or social desirability bias, while the cross-sectional research design does not allow making causal inferences. Future research needs to consider employing probability-based sampling and multi-center data collection to enhance

representativeness. The longitudinal or mixed-method approach may also be used to investigate the effect of training, gender sensitivity, as well as institutional policy reforms on practice behaviors over time. Moreover, the development and validation of standardized national guidelines and training programs in TVUS may reinforce the competence of the practitioners as well as patient trust.

CONCLUSION

This study identified major cultural, institutional, and training-related barriers that limit the adoption of TVUS in Pakistan. Confidence and protocol adherence were higher among experienced practitioners and those in public hospitals. The use of convenience sampling restricts external validity and should be considered when interpreting the results. Addressing these barriers is essential to improve the equity and quality of the transvaginal ultrasound practices across diverse healthcare settings.

Authors' Contribution

Conceptualization: SAG, SMYF

Methodology: SMYF, MU, ZH, SK, SA, MIUH

Formal analysis: SMYF, MU

Writing and Drafting: SAG, SMYF, MU, ZH, SK, SA, MIUH

Review and Editing: SAG, SMYF, MU, ZH, SK, SA, MIUH

All authors approved the final manuscript and take responsibility for the integrity of the work.

Conflicts of Interest

The authors declare no conflict of interest.

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REFERENCES

- [1] Daniilidis A, Grigoriadis G, Dalakoura D, D'Alterio MN, Angioni S, Roman H. Transvaginal Ultrasound in the Diagnosis and Assessment of Endometriosis-An Overview: How, Why, and When. *Diagnostics*. 2022 Nov; 12(12): 2912. doi: 10.3390/diagnostics12122912.
- [2] Becker CM, Bokor A, Heikinheimo O, Horne A. ESHRE Guideline: Endometriosis. *Human Reproduction Open*. 2022. doi: 10.1093/hropen/hoac009.
- [3] Okeji MC, Agwuna KK, Ihudiebube-Splendor CN, Izge IY, Ekuma KK, Emeter JO et al. Transvaginal Sonography: Perception and Attitude of Nigerian Women. *BMC Women's Health*. 2017 Jul; 17(1): 54. doi: 10.1186/s12905-017-0413-z.
- [4] Chinene B, Mudadi LS, Gonde L. Awareness, willingness, and perceptions of transvaginal ultrasound among African women: A narrative review and recommendations for increased utilization. *Journal of Medical Imaging and Radiation Sciences*. 2025 Dec; 56(6): 102109. doi: 10.1016/j.jmir.2025.102109.
- [5] Mwiinga FB, Mwiza T, Banda EM. Knowledge And Perspectives of Health Care Providers Towards Clients with Substance Abuse at Solwezi General Hospital in Solwezi District. *Medical Journal of Zambia*. 2021; 48(4): 406-14. doi: 10.55320/mjz.48.4.71.
- [6] Moustafa S, Rosen E, Goodman L. Patient and Provider Satisfaction with Saline Ultrasound Versus Office Hysteroscopy for Uterine Cavity Evaluation before In Vitro Fertilization: A Randomized Controlled Trial. *Journal Of Assisted Reproduction and Genetics*. 2021 Mar; 38(3): 627-34. doi: 10.1007/s10815-021-02065-9.
- [7] Shah S, Bellows BA, Adedipe AA, Totten JE, Backlund BH, Sajed D. Perceived Barriers in the Use of Ultrasound in Developing Countries. *Critical Ultrasound Journal*. 2015 Dec; 7(1): 11. doi: 10.1186/s13089-015-0028-2.
- [8] Thoirs K, Deed K, Childs J. Transvaginal Sonography: Sonographer Reflections on Patient Experience Using a Critical Incident Technique. *Sonography*. 2017 Jun; 4(2): 55-62. doi: 10.1002/sono.12104.
- [9] Van Der Westhuizen L, Naidoo K, Casmod Y, Mdletshe S. A Qualitative Approach to Understanding the Effects of a Caring Relationship Between the Sonographer and Patient. *Journal Of Medical Imaging and Radiation Sciences*. 2020 Dec; 51(4): S53-8. doi: 10.1016/j.jmir.2020.07.005.
- [10] Chinene B, Mutandiro L, Mushosho E, Khumbula L, Zanga A, Banhwa J et al. The Role of Radiographers in the Provision of Diagnostic Medical Ultrasound Services in Zimbabwe: Past, Present, and Way Forward: Radiographer Roles in Ultrasound. *Medical Journal of Zambia*. 2023; 50(3): 273-81. doi: 10.55320/mjz.50.3.424.
- [11] Van Elburg D, Meyer T, Martell K, Quirk S, Banerjee R, Phan T, Fenster A, Roumeliotis M. Clinical implementation of 3D transvaginal ultrasound for intraoperative guidance of needle implant in template interstitial gynecologic high-dose-rate brachytherapy. *Brachytherapy*. 2023 Nov; 22(6): 790-9.
- [12] Alsaedi HI, Krsoom AM, Alshoabi SA, Alsharif WM. Investigation Study of Ultrasound Practitioners' Awareness About Artefacts of Hepatobiliary Imaging in Almadinah Almunawwarah. *Pakistan Journal of Medical Sciences*. 2022 Jul; 38(6): 1526. doi: 10.12669/pjms.38.6.5084.

- [13] Abuzaid MM, Aldahes AS, Elshami W, Hamd ZY, Pedersen MV. Exploring motivational drivers and barriers to sonographers' research engagement in Arab countries. *Radiography*. 2025 Mar 1;31(2):10290-5.
- [14] Tahir MJ, Jamil H, Jabbar R, Qureshi MK, Zeeshan MH, Ullah I et al. Radiology as a Career Among Medical Students of Pakistan: A Cross-Sectional Study. *Medicine*. 2024 May; 103(20): e38156. doi: 10.1097/MD.00000000000038156.
- [15] El Ansari W, El-Ansari K, Arafa M. Breaking the Silence-Systematic Review of the Socio-Cultural Underpinnings of Men's Sexual and Reproductive Health in the Middle East and North Africa (MENA): A Handful Of Taboos?. *Arab Journal of Urology*. 2025 Jan; 23(1): 16-32. doi: 10.1080/20905998.2024.2387511.
- [16] Nasir LS, Al-Qutob R. Gender and Health. In *Caring for Arab Patients*. 2018 Dec; 27-59). CRC Press. doi: 10.1201/9781315365411-3
- [17] Riaz B, Sherwani NZ, Inam SH, Rafiq MY, Tanveer S, Arif A et al. Physician Gender Preference Amongst Females Attending Obstetrics/Gynecology Clinics. *Cureus*. 2021 May; 13(5): e15028. doi: 10.7759/cureus.15028.
- [18] Habib SS, Jamal WZ, Zaidi SM, Siddiqui JU, Khan HM, Creswell J et al. Barriers to Access to Healthcare Services for Rural Women – Applying a Gender Lens on TB in a Rural District of Sindh, Pakistan. *International Journal of Environmental Research and Public Health*. 2021 Sep; 18(19): 10102. doi: 10.3390/ijerph181910102.
- [19] Raza A, Jauhar J, Abdul Rahim NF, Memon U, Matloob S. Unveiling the Obstacles Encountered by Women Doctors in the Pakistani Healthcare System: A Qualitative Investigation. *PLOS ONE*. 2023 Oct; 18(10): e0288527. doi: 10.1371/journal.pone.0288527.
- [20] Mushtaq A, Bansal P. Evaluating MRI Safety Compliance in Punjab: Awareness, Adherence to Guidelines, and Institutional Preparedness. *The Quintessential*. 2025 Apr; 77-83.
- [21] Zhang J, Luo S, Yuan L, Jin Y, Liu D. Knowledge, Attitudes, and Practices of Intrauterine Adhesion Prevention Among Healthcare Providers and Patients: A Cross-Sectional Study in Western China. *BMC Medical Education*. 2025 May; 25(1): 684. doi: 10.1186/s12909-025-07273-w.
- [22] Chinene B, Matika W, Mushosho EY, Mutandiro LC. A Qualitative Exploration of Sonographers' Views Toward Transvaginal Ultrasound in Zimbabwe: A Barriers and Solutions Approach. *Radiography*. 2025 Mar; 31(2): 102883. doi: 10.1016/j.radi.2025.01.018.
- [23] Bohrer MB, Rodgers DL. Improving Confidence in Performing Clinical Procedures Through Peer-Driven Training Sessions for Preclinical Medical Students. *MedEdPORTAL*. 2025 Aug; 21: 11542. doi: 10.15766/mep_2374-8265.11542.
- [24] White BR, Ho DY, Rogers LS, Natarajan SS. A Standardized Imaging Protocol Improves Quality and Reduces Practice Variability in Echocardiographic Assessment of Ventricular Function by First-Year Pediatric Cardiology Fellows. *Echocardiography*. 2019 Aug; 36(8): 1515-23. doi: 10.1111/echo.14441.
- [25] Akhtar W, Ali A, Aslam M. Clinical Radiology Research in Pakistan: From Evidence to Practice. *Journal Of the Pakistan Medical Association*. 2009; 59(8): 544.
- [26] Viner AC, Okolo ID, Norman JE, Stock SJ, Reynolds RM. Training in Ultrasound to Determine Gestational Age in Low-And Middle-Income Countries: A Systematic Review. *Frontiers In Global Women's Health*. 2022 Mar; 3: 854198. doi: 10.3389/fgwh.2022.854198.