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Knowledge of rheumatoid factor in the diagnosis of rheumatoid arthritis: a survey of family physicians in Punjab, Pakistan

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Abstract

Rheumatoid arthritis (RA) is a chronic autoimmune inflammatory disease that requires timely diagnosis and intervention. As frontline healthcare providers, family physicians must have a clear understanding of the diagnostic utility of rheumatoid factor (RF) and its limitations to ensure early recognition and appropriate referral of RA patients. This descriptive cross-sectional study was conducted over three months to assess the knowledge of family physicians in Punjab, Pakistan, regarding the diagnostic role and interpretation of RF in RA. Stratified random sampling was used, and a structured questionnaire was distributed to 300 physicians, with responses collected via Google Forms. The questionnaire evaluated demographic variables and knowledge of RA diagnostic criteria, RF specificity, and related clinical interpretation. The knowledge scores were classified as good (≥ 75%), moderate (50–74%), or poor (< 50%). Data analysis was performed via SPSS version 24, with chi-square tests used to examine associations ($p < 0.05$). The results revealed that only 27.76% of the participants demonstrated good knowledge. Most respondents had moderate (50.95%) or poor (21.29%) knowledge. Significant associations were observed between knowledge level and factors such as physician age, graduation cohort, experience, type of medical college, involvement in RA patient care, and private practice ($p < 0.05$). This study revealed significant gaps in family physicians' knowledge regarding RF's diagnostic value in RA. Targeted educational interventions and updated clinical training are essential to improve early RA detection, enhance referral practices, and improve patient outcomes at the primary care level.

Keywords

Rheumatoid factor; Rheumatoid arthritis; Knowledge, attitudes, practice; Primary health care; Family physicians

1. Introduction

Rheumatoid arthritis (RA) is a chronic autoimmune inflammatory disorder that primarily affects synovial joints and is characterized by persistent inflammation, progressive joint destruction, and systemic complications, including cardiovascular, pulmonary, and hematologic involvement [1]. Globally, RA has an estimated annual incidence of 3 per 10,000 individuals and a prevalence of approximately 1%, with peak onset between 35 and 50 years of age and a higher prevalence in females [2]. If not diagnosed and treated early, RA can lead to irreversible joint damage, deformities, and significant disability, negatively impacting quality of life and socioeconomic well-being [3,4].

Early diagnosis and the initiation of disease-modifying antirheumatic drugs (DMARDs) are crucial for preventing long-term joint damage [5]. However, diagnosing RA, especially in its early stages, can be difficult because of the nonspecific nature of early symptoms and variable laboratory results [6]. Rheumatoid factor (RF) is an autoan-

tibody directed against the Fc portion of immunoglobulin G (IgG) and has traditionally been used as a key serological marker for RA. However, RF has limitations in diagnostic specificity, as it may be elevated in other autoimmune diseases (e.g., systemic lupus erythematosus, Sjögren's syndrome), infections (e.g., hepatitis C, tuberculosis), chronic lung conditions, and even in up to 4% of healthy people, especially elderly individuals [7]. In contrast, anti-cyclic citrullinated peptide (anti-CCP) antibodies are more specific for RA and have a stronger ability to predict erosive disease [8]. Despite their usefulness, both RF and anti-CCP can be negative in patients with seronegative RA, which makes clinical judgment even more important when they are being diagnosed [9].

To address diagnostic ambiguity and standardize classification, the American College of Rheumatology (ACR) and the European League Against Rheumatism (EULAR) introduced revised RA classification criteria in 2010. These criteria highlight a combination of joint involvement, serological markers (RF and anti-CCP), acute-phase reactants (CRP and ESR), and symptom duration. A score of ≥ 6/10 indicates definite RA [10]. In addition to its diagnostic role, RF also has prognostic significance. High titers of RF are linked to more aggressive disease, increased radiographic progression, extra-articular manifestations, and poorer overall outcomes [11,12,13]. Therefore, accurate interpretation of RF results is essential not only for diagnosis but also for long-term disease management.

In the healthcare system of Pakistan, family physicians serve as the first point of contact for most patients. Their role is central in identifying RA early, ordering relevant diagnostic tests, initiating appropriate patient counseling, and making timely referrals to rheumatologists [14]. However, studies have shown that knowledge gaps among primary care physicians regarding serological markers, especially RF, contribute to delayed diagnoses and inappropriate test utilization, leading to misdiagnosis or missed opportunities for early treatment [15].

Despite the widespread use of RF in clinical practice, limited data exist on the knowledge and clinical reasoning of family physicians in Pakistan regarding its appropriate use, interpretation, and limitations [16]. Understanding these knowledge gaps is critical for improving early diagnosis, referral patterns, and, ultimately, patient outcomes. This study aimed to assess the diagnostic utility and limitations of RF in the treatment of RA among family physicians in Punjab, Pakistan. Specifically, it evaluates the understanding of RA classification criteria, the specificity and prognostic relevance of RF, and factors influencing test interpretation and diagnostic decision-making in primary care.

2. Methodology

2.1. Study design

This was a descriptive, cross-sectional study conducted over a three-month period from February to April 2025.

2.2. Ethical approval

Ethical approval for this study was obtained from the Institutional Review Board of FMH College of Medicine & Dentistry, Lahore (No. FMH-30/09/2024-IRB-1488). Informed consent was obtained from all participants prior to their inclusion in the study, and the confidentiality of the data was maintained throughout the research process.

2.3. Study setting

The study was conducted across primary healthcare settings in Punjab, Pakistan, and targeted family physicians working in both the public and private sectors. Physicians

were recruited from urban and rural areas spanning the 16 administrative districts of Punjab. The study was carried out under the supervision of the Department of Family Medicine, Fatima Memorial Hospital, Lahore, Pakistan.

2.4. Inclusion and exclusion criteria

The inclusion criteria for the study were MBBS-qualified physicians who were actively practicing in primary healthcare facilities, such as basic health units (BHUs), rural health centers (RHCs), and private general practice clinics. Physicians who graduated from foreign institutions or held postgraduate qualifications in internal medicine or rheumatology, as well as those working exclusively in secondary or tertiary care hospitals, were excluded.

2.5. Sample size and sampling technique

A sample size of 233 was calculated via the OpenEpi sample size calculator, assuming a 99.99% confidence level, 5% margin of error, and an estimated knowledge proportion of 4%, on the basis of a previous study that reported that only 4% of primary care physicians felt very confident in diagnosing early RA [17]. To account for potential nonresponses and incomplete data, a total of 300 questionnaires were distributed. The sampling frame was constructed using physician lists provided by the Health and Population Department of the Government of Punjab for public sector facilities, as well as lists from the Association of Family Physicians of Pakistan for private sector clinics. Stratified sampling was used, dividing the physicians into three strata: public, private, and NGO/not-for-profit sectors. The participants were then randomly selected from each stratum to ensure representation across all healthcare sectors.

2.6. Data collection tool

Data were collected via a structured, self-administered questionnaire distributed digitally via Google Forms. The questionnaire was developed on the basis of current clinical guidelines and literature and was reviewed by academic experts in rheumatology and family medicine [18,19,20]. A pilot test was conducted with 15 family physicians to assess clarity and reliability, following which minor revisions were made for comprehensibility.

2.7. Study measures

The questionnaire consisted of two main sections. The first section collected demographic information, including age [≤ 35 years (young), 36–45 years (middle-aged), and ≥ 46 years (senior)], gender (male, female), ethnicity (Punjabi, Saraiki, Urdu-speaking, Balochi, Sindhi, and other), medical college of degree (public, private), year of graduation [recorded as year and later categorized as pre-COVID graduates (≤ 2019) and post-COVID graduates (≥ 2020)], years of clinical experience (1–10 years, >10–20 years, >20–30 years, >30 years), job sector (public, private, NGO/not-for-profit), private practice engagement (yes, no), average number of patients seen per day (1–50, 51–100, >100), and whether the physician routinely managed patients with RA.

The second section assessed physicians' knowledge about RA and the diagnostic utility of RF through multiple-choice questions, each containing one correct answer. The knowledge items covered key clinical concepts, including the nature of RA as a disease, components of the 2010 ACR/EULAR diagnostic criteria, the minimum score required for diagnosis, eligibility criteria for applying the classification system, the use and specificity of RF in diagnosis, the presence of RF in healthy individuals and other diseases, the most specific serological marker for RA, the possibility of RA diagnosis despite negative RF

and anti-CCP results, the biochemical composition of RF, and its prognostic implications. Each correct answer was scored as 1, whereas incorrect and "not sure" responses were scored as 0. A composite knowledge score was calculated for each participant, which was then categorized into three levels: good knowledge (≥75% correct responses), moderate knowledge (50–<75%), and poor knowledge (<50%) [21].

2.8. Data analysis

The data were entered and analyzed via IBM SPSS Statistics version 24 (IBM Corp., Armonk, NY, USA). Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize participant demographics and knowledge scores. Chi-square tests were applied to assess associations between categorical demographic variables (e.g., gender, job sector) and levels of knowledge. A p value of less than 0.05 was considered statistically significant for all inferential analyses.

3. Results

Table 1 shows that the majority of family physicians were female (58.56%), and most were 35 years of age or younger (45.25%), followed by those aged 36–45 years (33.84%) and senior physicians aged 46 years or above (20.91%). Ethnically, more than half identified as Punjabi (57.03%), whereas the rest belonged to the Urdu-speaking (19.77%), other (11.41%), Saraiki (6.08%), Sindhi (5.32%), and Balochi (0.38%) backgrounds. Slightly more participants had graduated from public medical colleges (52.47%) than from private colleges (47.53%), and a greater proportion were pre-COVID-19 graduates (63.12%) than were post-COVID-19 graduates (36.88%). In terms of experience, 45.25% had been practicing for 1–10 years, 33.84% for 11–20 years, and fewer had more than 20 years of experience. The majority worked in the private sector (59.32%), while 33.84% were in the public sector and 6.84% in NGO or not-for-profit settings. While 36.16% engaged in private practices in addition to their main job, most (60.84%) did not. Most physicians (86.31%) reported seeing 1–50 patients daily, and 75.67% of all respondents reported managing patients with RA in their clinical practice.

Table 1. Demographic and practice characteristics of family physicians (N = 263).

Variables		Frequency (%)
Age (in years)	≤ 35 (young)	119 (45.25)
	36–45 (middle-aged)	89 (33.84)
	≥ 46 (senior)	55 (20.91)
Gender	Male	109 (41.44)
	Female	154 (58.56)
Ethnicity	Punjabi	150 (57.03)
	Saraiki	16 (6.08)
	Urdu-speaking	52 (19.77)
	Balochi	1 (0.38)
	Sindhi	14 (5.32)
	Other	30 (11.41)
Type of medical college graduation	Public	138 (52.47)
	Private	125 (47.53)
Graduation cohort	Pre-COVID (≤ 2019)	166 (63.12)
	Post-COVID (≥ 2020)	97 (36.88)
Clinical experience	1–10 years	119 (45.25)
	> 10–20 years	89 (33.84)

Variables		Frequency (%)
	> 20–30 years	40 (15.21)
	> 30 years	15 (5.70)
Job sector	Public	89 (33.84)
	Private	156 (59.32)
	NGO/not-for-profit	18 (6.84)
Private practice engagement	Yes	103 (36.16)
	No	160 (60.84)
Daily patient volume	1–50	227 (86.31)
	51–100	26 (9.89)
	> 100	10 (3.80)
Manage rheumatoid arthritis	Yes	199 (75.67)
	No	64 (24.33)

Table 2 shows that 27.76% of the physicians demonstrated good knowledge (≥ 75%), 50.95% had moderate knowledge (50–74%), and 21.29% had poor knowledge (< 50%) regarding RA and RF.

Table 2. Knowledge scores and levels of rheumatoid factors in rheumatoid arthritis patients.

Variables		Frequency (%)
Knowledge level regarding rheumatoid arthritis and rheumatoid factor	Poor (< 50%)	56 (21.29)
	Moderate (50–74%)	134 (50.95)
	Good (≥ 75%)	73 (27.76)

Table 3 presents the associations between physician characteristics and knowledge levels regarding RA and RF. Among the physicians aged ≤ 35 years, 62.5% had poor knowledge, whereas only 16.1% of those aged ≥ 46 years had poor knowledge. Conversely, 27.4% of the senior physicians (≥ 46 years) had good knowledge, indicating a statistically significant association between age and knowledge level ($p = 0.032$). The type of medical college also showed a significant relationship; 62.5% of poor scorers graduated from private colleges, whereas 61.6% of good scorers were from public colleges ($p = 0.023$). Knowledge was significantly greater among pre-COVID-19 graduates ($p < 0.001$), with 76.7% of good scorers graduating in or before 2019. Similarly, those with greater clinical experience demonstrated better knowledge ($p = 0.029$), and those engaged in private practices had significantly higher scores ($p = 0.046$). Notably, 98.6% of the participants with good knowledge reported managing RA patients in practice, whereas 66.1% of the poor scorers did not ($p < 0.001$). No statistically significant associations were observed between knowledge level and gender, job sector, or patient volume.

Table 3. Associations between physician characteristics and knowledge level (N = 263).

Variables		Knowledge level regarding RA and RF			Chi-square Value	*p* Value
		Poor (< 50%) n = 56	Moderate (50–74%) n = 134	Good (≥ 75%) n = 73		
Age (in years)	≤ 35 (young)	35 (62.50)	57 (42.54)	27 (36.99)	10.566	0.032 **
	36–45 (middle-aged)	12 (21.43)	51 (38.06)	26 (35.62)		
	≥ 46 (senior)	9 (16.07)	26 (19.40)	20 (27.40)		
Gender	Female	33 (58.93)	84 (62.69)	37 (50.68)	2.809	0.246
	Male	23 (41.07)	50 (37.31)	36 (49.32)		

Variables		Knowledge level regarding RA and RF			Chi-square Value	*p* Value
		Poor (< 50%) n = 56	Moderate (50–74%) n = 134	Good (≥ 75%) n = 73		
Type of medical college graduation	Private	35 (62.50)	62 (46.27)	28 (38.36)	7.581	0.023 **
	Public	21 (37.50)	72 (53.73)	45 (61.64)		
Graduation cohort	Pre-COVID (≤ 2019)	24 (42.86)	86 (64.18)	56 (76.71)	15.735	< 0.001 **
	Post-COVID (≥ 2020)	32 (57.14)	48 (35.82)	17 (23.29)		
Clinical experience	1–10 years	36 (64.29)	58 (43.28)	25 (34.25)	14.023	0.029 **
	> 10–20 years	11 (19.64)	50 (37.31)	28 (38.36)		
	> 20–30 years	6 (10.71)	18 (13.43)	16 (21.92)		
	> 30 years	3 (5.36)	8 (5.97)	4 (5.48)		
Job sector	Private	18 (32.14)	46 (34.33)	25 (34.25)	0.584	0.965
	Public	35 (62.50)	79 (58.96)	42 (57.53)		
	NGO/not-for-profit	3 (5.36)	9 (6.72)	6 (8.22)		
Private practice engagement	No	42 (75.00)	75 (55.97)	43 (58.90)	6.161	0.046 **
	Yes	14 (25.00)	59 (44.03)	30 (41.10)		
Daily patient volume	1–50	50 (89.29)	117 (87.31)	60 (82.19)	3.066	0.547
	51–100	3 (5.36)	13 (9.70)	10 (13.70)		
	> 100	3 (5.36)	4 (2.99)	3 (4.11)		
Manage rheumatoid arthritis	No	37 (66.07)	26 (19.40)	1 (1.37)	75.658	< 0.001 **
	Yes	19 (33.93)	108 (80.60)	72 (98.63)		

* RA = rheumatoid arthritis; RF = rheumatoid factor. ** Significant value ($p < 0.05$).

4. Discussion

This study revealed that a substantial proportion of the physicians reported only moderate or poor knowledge, indicating a gap in the understanding of the diagnostic criteria and serological markers used in clinical evaluation. Statistically significant associations were observed between knowledge levels and multiple demographic and professional characteristics. Younger physicians and those who graduated after the onset of the COVID-19 pandemic tended to have lower knowledge levels, while better knowledge was associated with increasing age and greater clinical experience. Graduates from public sector medical colleges demonstrated higher knowledge scores than those from private institutions did. Additionally, physicians engaged in private practice and those actively managing patients with RA were more likely to possess greater diagnostic knowledge. No significant associations were observed with sex, job sector, or daily patient volume.

These findings are consistent with those of previous studies; a Nigerian study revealed that a majority of general practitioners lacked awareness of the diagnostic role of RF and its limitations, reflecting a similar deficiency in knowledge [22]. Saudi Arabia reported widespread misconceptions about the specificity of RF for the treatment of RA among primary care physicians [23]. Similarly, studies have highlighted poor to moderate levels of knowledge regarding RA diagnostic criteria and the correct interpretation of RF and anti-CCP antibodies [8,24]. Our study revealed that older physicians, public medical college graduates, and those with more than ten years of experience were more likely to have higher knowledge scores. These trends mirror findings from studies in India and Bangladesh, where structured training and clinical exposure in public institutions were associated with better diagnostic proficiency in autoimmune conditions [25,26]. A study by Alzahrani et al. also concluded that clinical experience significantly improved the diagnostic accuracy for RA in general practice [27].

Another noteworthy finding was the significantly lower knowledge scores among physicians who graduated during or after the COVID-19 pandemic. This aligns with evi-

dence suggesting that medical training during the pandemic, which relied heavily on virtual learning, may have compromised clinical exposure and diagnostic reasoning development [28,29]. Graduates from public medical colleges outperform those from private institutions, which is consistent with previous literature indicating that public colleges often offer more rigorous clinical rotations, including exposure to rheumatology departments [30]. Additionally, physicians actively managing RA cases scored higher, corroborating the link between clinical involvement and applied diagnostic knowledge, as seen in other studies [15,31].

Importantly, misconceptions about RF were prevalent. Many physicians incorrectly believe that RF is highly specific to RA, a finding also reported in the scientific literature, where RF is frequently misinterpreted in clinical decision-making [32,33]. A Canadian study similarly noted that primary care physicians often overutilize RF without a clear understanding of its limitations [34]. These inaccuracies may lead to diagnostic delays, overreferrals, or unnecessary anxiety among patients. Contrary to expectations, neither gender nor daily patient volume significantly influenced knowledge levels. This finding supports studies showing that a sheer workload does not ensure better clinical accuracy unless guided by continuing education and institutional support [35].

This study provides a detailed assessment of family physicians' understanding of the diagnostic role and limitations of RF in diagnosing RA in a large, diverse province in Pakistan. One of the strengths of this study is its use of a stratified random sampling method, which ensures a balanced representation of physicians from the public, private, and NGO/not-for-profit sectors, as well as from urban and rural areas and with different levels of experience. The questionnaire was structured on the basis of the literature and validated by experts, enhancing its content validity. Additionally, pretesting the questionnaire improved its reliability. However, despite these steps, the reliance on multiple-choice questions may not fully capture the nuances of clinical decision-making or the contextual understanding needed to interpret RF results. Furthermore, excluding secondary and tertiary care physicians makes it difficult to compare findings across different levels of clinical exposure. Finally, collecting data online may unintentionally exclude physicians with limited access to digital tools or low digital literacy, especially in rural or underserved regions.

5. Conclusions

The study revealed that while some respondents had a good understanding of the topic, most had moderate to poor knowledge, especially among younger and less experienced physicians, as did recent graduates from post-COVID-19 programs. These findings highlight the urgent need for targeted educational interventions, updated clinical training, and improved referral pathways to ensure early and accurate diagnosis of RA in primary care settings.

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Ethics statement: Ethical approval for this study was obtained from the Institutional Review Board of FMH College of Medicine & Dentistry, Lahore (No. FMH-30/09/2024-IRB-1488).

Consent to participate: Not applicable.

Data availability: The data supporting this study's findings are available from the corresponding author, Mahrukh Khalid, upon reasonable request.

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Conflicts of interest: The authors declare no conflicts of interest.

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