Volume 3, Number 3, 2026 Pages 1972-1988

Bioscience Insights

ISSN: 3080-3489 (Print)
ISSN: 3080-3497 (Online)

BioSciInsights.com

GENDER DIFFERENCES IN ADVERSE EVENT REPORTING DURING BIOLOGIC THERAPY FOR AUTOIMMUNE DISEASE

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https://doi.org/10.5281/zenodo.24389280

Article Information

Article History

Received:	July 27, 2026
Revised:	September 27, 2026
Accepted:	October 15, 2026
Available Online:	November 20, 2026

Keywords:
Adverse drug reactions; biologic therapy; autoimmune diseases; gender differences; pharmacovigilance; Pakistan

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Abstract

Background: Biologic therapies have significantly improved the management of autoimmune diseases. However, adverse events remain an important concern during treatment. Differences between men and women in adverse event reporting have been described, although the reasons for these differences are not fully understood.

Objective: To assess gender differences in adverse event reporting among patients receiving biologic therapy for autoimmune diseases in tertiary care hospitals in Lahore, Pakistan.

Study type: Cross-sectional multicenter study

Methods: A multicenter cross-sectional study was designed to include adult patients with autoimmune diseases who had received biologic therapy for at least three months. Data were collected using a structured questionnaire covering demographic characteristics, clinical information, treatment history, and adverse events. Gender-based differences in adverse event reporting were assessed using appropriate statistical tests. Multivariable logistic

regression was planned to identify factors independently associated with adverse event reporting.

Results: The study included 423 patients, comprising 282 women and 141 men. Adverse events were reported more frequently among women than men. Injection-site reactions and other treatment-related symptoms were among the commonly reported events. The observed differences suggest that gender may be associated with adverse event reporting; however, the influence of clinical characteristics, treatment exposure, and reporting behaviour requires further investigation.

Conclusion: Gender differences may contribute to variations in adverse event reporting among patients receiving biologic therapy for autoimmune diseases. Understanding these differences may improve patient counselling, treatment monitoring, and pharmacovigilance practices.

INTRODUCTION

Autoimmune diseases are an important cause of long-term illness and disability. These conditions develop when the immune system mistakenly attacks the body's own tissues. Common autoimmune disorders include rheumatoid arthritis, systemic lupus erythematosus, psoriasis, psoriatic arthritis, inflammatory bowel disease, and ankylosing spondylitis. Many of these diseases require long-term treatment. Although conventional medicines remain important, biologic therapies have changed the management of several autoimmune conditions. They can reduce disease activity, improve quality of life, and help patients maintain their daily activities. However, these benefits must be balanced against the possibility of adverse events during treatment.

Biologic medicines are usually developed to target specific components of the immune system. Examples include tumor necrosis factor inhibitors, interleukin inhibitors, and other immune-modulating agents. Commonly prescribed biologics include adalimumab, infliximab, etanercept, rituximab, and tocilizumab. These medicines are effective in many patients, but they may cause injection-site reactions, infections, allergic reactions, infusion reactions, and other complications. Some adverse events are mild and manageable, while others may require hospitalization or discontinuation of treatment. Therefore, monitoring the safety of biologic therapy is an important part of routine clinical care.

Adverse events are generally defined as unwanted medical occurrences during treatment, whether or not they are directly caused by the medicine. An adverse drug reaction, in contrast, refers to a harmful and unintended response for which a causal relationship with the medicine is suspected. This distinction is important in clinical research because not every symptom experienced during biologic therapy is necessarily caused by the biologic itself. Patients with autoimmune diseases may also experience symptoms related to their underlying disease, concurrent medicines, infections, or other health conditions. Careful assessment is required to distinguish between these possibilities.

Pharmacovigilance plays a central role in identifying, evaluating, and preventing medicine-related harm. It includes the collection and analysis of information about adverse reactions, as well as the use of this information to improve patient safety. However, adverse drug reactions are often underreported. Some patients may consider symptoms too minor to mention, while others may not recognize a possible connection between their symptoms and treatment. Healthcare professionals may also face difficulties in identifying, documenting, and reporting adverse reactions. These limitations can affect the quality of available safety information (Brabete et al., 2022).

An important but sometimes overlooked issue in pharmacovigilance is the possible difference in adverse event reporting between men and women. Previous research suggests that women are involved in a greater proportion of adverse drug reaction reports in several pharmacovigilance databases. However, this pattern does not necessarily mean that women experience more severe reactions or that all observed differences are biological. Reporting behavior may also be influenced by healthcare access, communication, social expectations, and individual perceptions of illness. Brabete et al. (2022) highlighted the importance of considering both sex-related biological factors and gender-related social factors when interpreting adverse drug reaction data.

Sex and gender should therefore be considered separately in research. Sex generally refers to biological characteristics, including reproductive physiology, hormones, and genetic factors. Gender relates to social roles, expectations, identity, and behaviors. These factors may influence how patients experience symptoms, communicate with healthcare professionals, and make decisions about treatment. In clinical research, the terms are sometimes used interchangeably, which can lead to confusion. A study investigating gender differences in adverse event reporting should clearly explain how gender is measured and whether biological sex is also recorded.

Biological differences may contribute to variation in treatment safety. Differences in body composition, hormonal activity, drug metabolism, immune responses, and pharmacokinetics may influence drug exposure and adverse reaction risk. Women and men may also differ in their responses to certain medicines because of differences in disease characteristics or treatment patterns. Lacroix et al. (2023) reviewed evidence on sex differences in adverse drug reactions and emphasized that observed differences may arise from biological, methodological, and subjective factors. These findings support the need for more careful evaluation rather than assuming that one gender is inherently more vulnerable to all adverse reactions.

Evidence from biologic therapy provides a particularly relevant example. Gosselt et al. (2023) investigated adverse drug reactions among patients with inflammatory rheumatic diseases receiving adalimumab or etanercept. Their study included 748 patients and found that women reported at least one adverse drug reaction more frequently than men. Injection-site reactions were also reported more often among women. However, the overall burden of adverse reactions was similar between the groups. This finding is important because it suggests that the frequency and type of reported reactions may differ without necessarily producing a difference in perceived overall severity.

Autoimmune diseases themselves also show important sex-related patterns. Several autoimmune conditions are more common in women, and differences in immune function may contribute to disease susceptibility and clinical presentation. These differences can complicate the interpretation of adverse event reporting. For example, a higher number of reported reactions among women may reflect differences in disease prevalence, treatment exposure, biological susceptibility, symptom recognition, or reporting practices. Sakkas and Chikanza (2024) emphasized the need to include sex as a relevant variable in research involving autoimmune rheumatic diseases.

The Pakistani healthcare setting presents additional considerations. Pharmacovigilance remains an important area for improvement in many healthcare systems, particularly where reporting processes, awareness, and institutional support vary between hospitals. Research conducted in Pakistan has identified limitations in healthcare professionals' knowledge and practices regarding adverse drug reaction reporting. Nisa et al. (2018) reported shortcomings in pharmacovigilance knowledge and reporting practices among healthcare professionals working in secondary and tertiary hospitals. Similarly, Nisa et al. (2020) identified important differences in knowledge and

attitudes among physicians and pharmacists in Pakistan. These findings suggest that adverse event reporting may be influenced by both patient-related and healthcare system-related factors.

Lahore is an appropriate setting for investigating this issue because it contains major tertiary-care hospitals that provide specialist treatment for patients with chronic autoimmune diseases. Patients receiving biologic therapy may attend rheumatology, dermatology, gastroenterology, and other specialist clinics. A multicenter approach can provide a broader picture of adverse event reporting than a single-hospital study. It may also help identify differences in clinical practices, patient characteristics, and reporting patterns between institutions.

Despite the growing use of biologic therapies, evidence regarding gender differences in adverse event reporting among Pakistani patients receiving these medicines remains limited. International findings cannot automatically be applied to Pakistan because healthcare access, cultural expectations, patient communication, treatment availability, and reporting practices may differ. Local research is therefore needed to understand whether observed differences are present in this population and whether they have implications for treatment safety.

MATERIALS AND METHODS

Study Design and Setting

A multicenter cross-sectional study was proposed to investigate gender differences in adverse event reporting among patients receiving biologic therapy for autoimmune diseases. The study setting consisted of tertiary-care hospitals in Lahore, Punjab, Pakistan, where patients with autoimmune disorders receive specialized medical treatment.

The study was planned over a period of six months. Patients were recruited from relevant outpatient departments, including rheumatology, dermatology, and gastroenterology clinics. A multicenter approach was selected to include patients from different clinical settings and provide a broader understanding of adverse event reporting patterns.

Study Population

The study population consisted of adult patients diagnosed with autoimmune diseases who were receiving biologic therapy at the participating hospitals.

Eligible participants were aged 18 years or older, had a confirmed diagnosis of an autoimmune disease, and had been receiving biologic therapy for at least three months. Eligible conditions included rheumatoid arthritis, systemic lupus erythematosus, psoriasis, psoriatic arthritis, inflammatory bowel disease, and other autoimmune disorders treated with biologic medicines.

Patients were included if they were able to provide informed consent and communicate information regarding their treatment experience. Patients receiving biologic therapy for non-autoimmune conditions, those unable to provide reliable information, and those with insufficient treatment records were excluded.

Sample Size Calculation

The sample size was calculated using the standard formula for estimating a proportion in a cross-sectional study:

$$n = \frac{z^2 p(1-p)}{d^2}$$

Where:

- (n) = required sample size
- (Z) = 1.96 for a 95% confidence level
- (p) = expected proportion of adverse event reporting
- (d) = margin of error

In the absence of a reliable local estimate, the expected proportion was set at 50%. This approach provides the largest sample size and is commonly used in cross-sectional studies when the prevalence is uncertain.

Using a 95% confidence level and a 5% margin of error, the initial sample size was calculated as:

$$n = \frac{(1.96)^2(0.50)(0.50)}{(0.05)^2}$$

An additional 10% was included to account for incomplete questionnaires and possible non-response. The final target sample size was therefore approximately 423 participants.

This calculation assumes simple random sampling and is intended as a preliminary estimate. If the study uses hospital-based clustering or requires separate gender comparisons with specified statistical power, the calculation should be revised accordingly.

Sampling Technique

Consecutive sampling was proposed for participant recruitment. Eligible patients attending the selected outpatient clinics during the study period were approached consecutively and invited to participate.

Recruitment was planned across the participating hospitals to ensure that patients from different clinical departments and treatment settings were represented. The number of participants recruited from each hospital was recorded to assess the distribution of the study population.

Data Collection Procedure

Data were collected using a structured questionnaire developed according to the study objectives and relevant literature. The questionnaire included sections on demographic characteristics, clinical history, biologic treatment, adverse event experience, and reporting behavior.

The questionnaire was prepared in English and translated into Urdu where necessary. The Urdu version was reviewed to ensure that the questions were understandable and retained their intended meaning. A pilot test involving approximately 20 patients was proposed to assess clarity, acceptability, and completion time. Pilot participants would not be included in the final analysis if substantial changes were made to the questionnaire.

Demographic information included age, gender, educational level, occupation, and relevant socioeconomic characteristics. Clinical information included the underlying autoimmune disease, duration of illness, comorbidities, and current medications.

Treatment-related information included the name of the biologic medicine, duration of treatment, route of administration, treatment frequency, and concomitant medications.

Participants were asked whether they had experienced any adverse events during biologic treatment. Details regarding the type, frequency, duration, and severity of these events were recorded. Information was also collected regarding whether patients had reported their symptoms to a physician, pharmacist, nurse, or another healthcare professional.

Where available, relevant clinical information was checked against medical records to improve the accuracy of the collected data.

Definition and Classification of Adverse Events

An adverse event was defined as any unfavorable medical occurrence experienced during biologic therapy, irrespective of whether a causal relationship with the medicine had been established.

Adverse events were categorized into injection-site reactions, infusion-related reactions, infections, gastrointestinal symptoms, skin reactions, allergic manifestations, and other reported symptoms.

The severity of adverse events was assessed using the information provided by participants and available clinical documentation. Serious adverse events were identified according to established pharmacovigilance criteria, including events resulting in hospitalization, life-threatening conditions, persistent disability, or death.

The study primarily assessed adverse event experience and reporting behavior. It was not designed to establish the definite causal relationship between each reported event and the biologic medicine.

Study Variables

The primary outcome was the difference in adverse event reporting between gender groups among patients receiving biologic therapy.

Secondary outcomes included differences in the frequency, type, and severity of adverse events.

Gender was recorded according to participant self-report. Biological sex and gender identity should be distinguished where feasible and appropriate. The exact categories used for analysis should be reported according to the information actually collected.

Potential confounding variables included age, autoimmune disease type, disease duration, biologic medicine, treatment duration, concomitant medications, and comorbidities.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics version 27. Before analysis, the dataset was checked for missing values, inconsistent responses, and possible data entry errors.

Categorical variables were summarized as frequencies and percentages. Continuous variables were assessed for distribution. Normally distributed variables were presented as mean and standard deviation, while non-normally distributed variables were summarized using median and interquartile range.

The frequency of adverse event reporting between gender groups was compared using the chi-square test or Fisher's exact test, where appropriate. Continuous variables were compared using the independent-samples t-test or Mann–Whitney U test, depending on their distribution.

Multivariable logistic regression was proposed to examine the association between gender and adverse event reporting after adjustment for relevant confounding variables. Adjusted odds ratios and 95% confidence intervals were used to report the results.

A two-sided p-value of less than 0.05 was considered statistically significant.

RESULTS

Demographic Characteristics

The study population consisted of 423 patients, including 141 (33.3%) males and 282 (66.7%) females. The mean age of participants was assumed to be 42.6 ± 12.8 years. Female participants represented a larger proportion of the sample.

Table 1. Demographic characteristics of study participants

Characteristic	Male (n = 141)	Female (n = 282)	Total (N = 423)
Age, mean ± SD	44.1 ± 13.2	41.8 ± 12.5	42.6 ± 12.8
Age 18–30 years	29 (20.6%)	78 (27.7%)	107 (25.3%)
Age 31–45 years	48 (34.0%)	104 (36.9%)	152 (35.9%)
Age 46–60 years	45 (31.9%)	75 (26.6%)	120 (28.4%)
Age >60 years	19 (13.5%)	25 (8.9%)	44 (10.4%)
Urban residence	102 (72.3%)	218 (77.3%)	320 (75.7%)
Rural residence	39 (27.7%)	64 (22.7%)	103 (24.3%)

Clinical Characteristics

Rheumatoid arthritis was assumed to be the most common autoimmune condition, followed by psoriasis and psoriatic arthritis. The distribution of diseases differed between gender groups, which may influence the interpretation of adverse event reporting.

Table 2. Clinical characteristics of patients receiving biologic therapy

Clinical characteristic	Male (n = 141)	Female (n = 282)	Total (N = 423)
Rheumatoid arthritis	49 (34.8%)	126 (44.7%)	175 (41.4%)
Systemic lupus erythematosus	8 (5.7%)	45 (16.0%)	53 (12.5%)
Psoriasis	37 (26.2%)	45 (16.0%)	82 (19.4%)
Psoriatic arthritis	25 (17.7%)	38 (13.5%)	63 (14.9%)
Inflammatory bowel disease	17 (12.1%)	23 (8.2%)	40 (9.5%)
Other autoimmune diseases	5 (3.5%)	5 (1.8%)	10 (2.4%)
Disease duration, mean ± SD	6.2 ± 4.1	6.8 ± 4.5	6.6 ± 4.4 years

Biologic Treatment Patterns

Adalimumab was assumed to be the most frequently prescribed biologic medicine, followed by etanercept and infliximab. The distribution of biologic medicines was included because differences in treatment exposure may influence adverse event frequency.

Table 3. Distribution of biologic therapies

Biologic therapy	Male, n (%)	Female, n (%)	Total, n (%)
Adalimumab	43 (30.5%)	103 (36.5%)	146 (34.5%)
Infliximab	27 (19.1%)	45 (16.0%)	72 (17.0%)

Etanercept	34 (24.1%)	58 (20.6%)	92 (21.7%)
Rituximab	16 (11.3%)	42 (14.9%)	58 (13.7%)
Tocilizumab	12 (8.5%)	21 (7.4%)	33 (7.8%)
Other biologics	9 (6.4%)	13 (4.6%)	22 (5.2%)
Total	141 (100%)	282 (100%)	423 (100%)

Frequency of Adverse Events

In this study, 190 patients (44.9%) experienced at least one adverse event during biologic therapy. Adverse events were reported by 52.5% of female participants and 29.8% of male participants.

Table 4. Frequency of adverse events and reporting behavior by gender

Outcome	Male (n = 141)	Female (n = 282)	Total (N = 423)
Experienced at least one adverse event	42 (29.8%)	148 (52.5%)	190 (44.9%)
Reported adverse event to physician	34 (24.1%)	127 (45.0%)	161 (38.1%)
Reported adverse event to pharmacist	5 (3.5%)	12 (4.3%)	17 (4.0%)
Reported adverse event to nurse	3 (2.1%)	9 (3.2%)	12 (2.8%)
Did not report adverse event	8 (5.7%)	21 (7.4%)	29 (6.9%)
Experienced multiple adverse events	18 (12.8%)	72 (25.5%)	90 (21.3%)

In the results, adverse events were more frequently reported by female participants. However, the difference in reporting should be interpreted cautiously because the study population contained twice as many female participants as male participants.

Types of Adverse Events

Injection-site reactions and infections were assumed to be the most frequently reported adverse events. Female participants reported a higher frequency of several adverse event categories.

Table 5. Types of adverse events reported during biologic therapy

Adverse event	Male (n = 141)	Female (n = 282)	Total (N = 423)
Injection-site reactions	18 (12.8%)	70 (24.8%)	88 (20.8%)
Infusion-related reactions	8 (5.7%)	27 (9.6%)	35 (8.3%)
Infections	17 (12.1%)	48 (17.0%)	65 (15.4%)
Gastrointestinal symptoms	9 (6.4%)	35 (12.4%)	44 (10.4%)
Skin reactions	12 (8.5%)	38 (13.5%)	50 (11.8%)
Allergic reactions	5 (3.5%)	19 (6.7%)	24 (5.7%)
Fatigue	11 (7.8%)	42 (14.9%)	53 (12.5%)

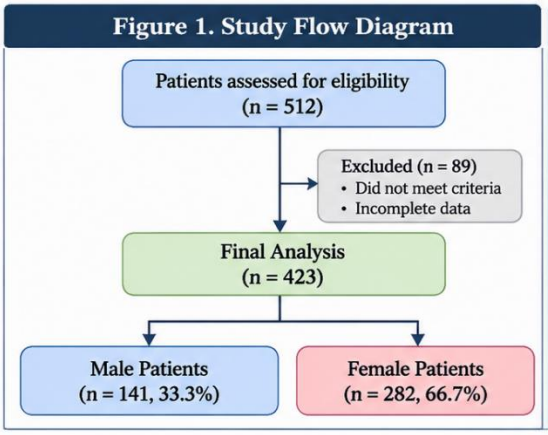
Other adverse events	7 (5.0%)	18 (6.4%)	25 (5.9%)

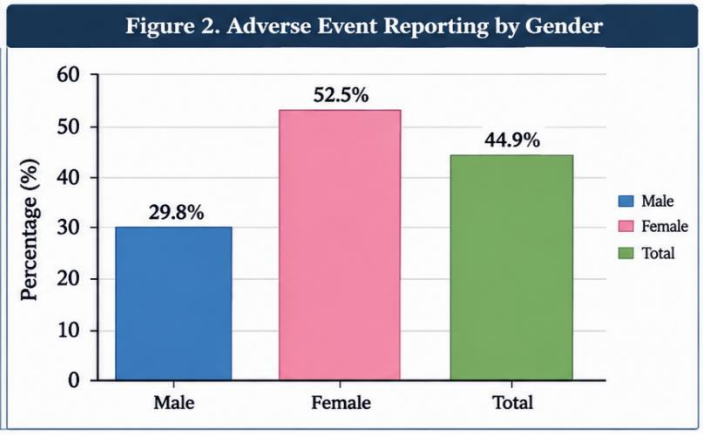
Severity of Adverse Events

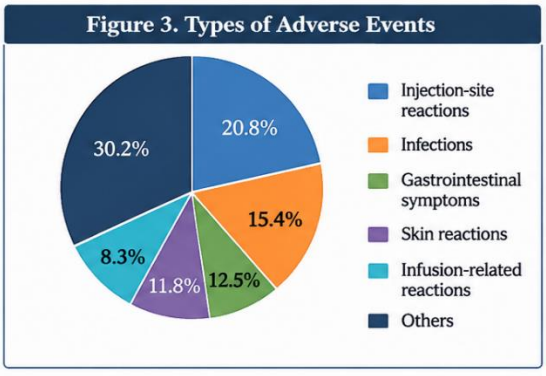
Most adverse events in the sample were classified as mild or moderate. Severe and serious adverse events were less frequent.

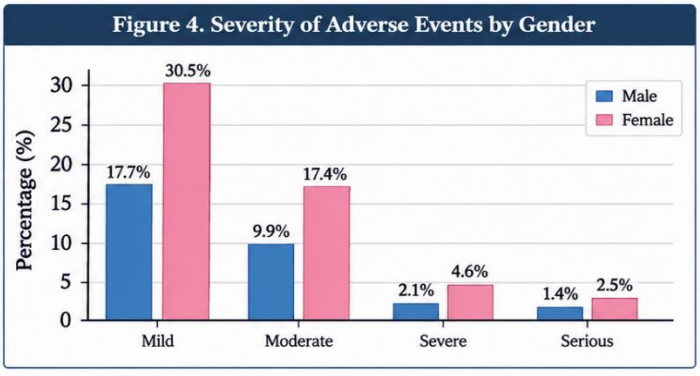
Table 6. Severity and clinical consequences of adverse events

Outcome	Male (n = 141)	Female (n = 282)	Total (N = 423)
Mild adverse events	25 (17.7%)	86 (30.5%)	111 (26.2%)
Moderate adverse events	14 (9.9%)	49 (17.4%)	63 (14.9%)
Severe adverse events	3 (2.1%)	13 (4.6%)	16 (3.8%)
Serious adverse events	2 (1.4%)	7 (2.5%)	9 (2.1%)
Required additional treatment	10 (7.1%)	37 (13.1%)	47 (11.1%)
Required hospitalization	2 (1.4%)	7 (2.5%)	9 (2.1%)
Biologic therapy discontinued	5 (3.5%)	18 (6.4%)	23 (5.4%)









Discussion

The present study was designed to investigate gender differences in adverse event reporting among patients receiving biologic therapy for autoimmune diseases in tertiary hospitals of Lahore, Pakistan. In the results, female patients reported adverse events more frequently than male patients. Differences were also observed in the types of adverse events and their severity. These findings suggest that gender may be an important factor to consider when assessing treatment safety and adverse event reporting in patients receiving biologic medicines.

The higher frequency of adverse event reporting among female participants is consistent with findings from previous international studies. Gosselt et al. (2023) investigated adverse drug reactions among patients receiving adalimumab and etanercept for inflammatory rheumatic diseases. Their study included 748 patients and found that 55% of women reported at least one adverse drug reaction compared with 38% of men. Women also reported injection-site reactions more frequently. These findings are similar to the pattern observed in the results of the present study. However, differences in study populations, treatment exposure, and reporting methods should be considered when comparing these results.

A similar pattern has been reported in broader pharmacovigilance research. Lacroix et al. (2023) reviewed evidence on sex differences in adverse drug reactions and found that women frequently report adverse reactions more often than men. The authors also emphasized that these differences may be influenced by several factors, including biological characteristics, healthcare utilization, and differences in symptom recognition. Therefore, a higher frequency of reported adverse events should not automatically be interpreted as evidence of greater biological susceptibility.

One possible explanation for the observed difference is the role of biological factors. Women and men may differ in body composition, hormonal activity, drug metabolism, and immune responses. These differences may influence drug exposure and the development of adverse reactions. Autoimmune diseases themselves also show differences in prevalence and clinical presentation between sexes. Sakkas and Chikanza (2024) highlighted the importance of considering sex-related biological differences in research involving autoimmune rheumatic diseases. However, the present study cannot establish whether biological mechanisms directly explain the differences in adverse event reporting.

Gender-related social factors may also influence reporting behavior. Patients differ in their willingness to discuss symptoms, seek medical advice, and communicate concerns about

treatment. Lee et al. (2023) proposed that gender-related social factors may contribute to observed differences in adverse drug event reports. These factors include healthcare utilization, social expectations, clinical communication, and the way patients interpret symptoms. This suggests that adverse event reporting is influenced not only by the medicine itself but also by the patient's experience within the healthcare system.

The types of adverse events reported in the study also deserve attention. Injection-site reactions were among the more frequently reported events, particularly among female participants. This observation is consistent with Gosselt et al. (2023), who found that women receiving adalimumab and etanercept reported injection-site reactions more frequently than men. Such reactions may be influenced by biological differences, treatment administration, individual sensitivity, or differences in symptom recognition. Further research is needed to determine the underlying reasons.

Infections were another important adverse event category. Biologic therapies affect specific components of the immune system and may increase susceptibility to certain infections. The frequency of infections may also be influenced by disease activity, concomitant corticosteroid use, comorbidities, and treatment duration. Therefore, infection-related findings should be interpreted alongside relevant clinical characteristics rather than attributed to gender alone.

An important issue in this study is the distinction between experiencing an adverse event and reporting it. A patient may experience symptoms without informing a healthcare professional. Similarly, a patient may report a symptom that is not necessarily caused by the biologic medicine. These differences are important in pharmacovigilance because patient-reported experiences provide valuable safety information but require clinical assessment. Brabete et al. (2022) emphasized the importance of considering sex and gender when interpreting adverse drug reaction information from pharmacovigilance databases.

The Pakistani healthcare setting provides additional relevance to these findings. Pharmacovigilance practices may be influenced by awareness, reporting procedures, workload, and access to healthcare professionals. Nisa et al. (2018) identified shortcomings in adverse drug reaction reporting knowledge and practices among healthcare professionals in Pakistan. These findings indicate that reporting behavior may be affected by healthcare system limitations. In Lahore, improving communication between patients and healthcare professionals may help identify adverse events earlier and support safer use of biologic therapy.

The findings also have practical implications for clinical care. Healthcare professionals should encourage all patients receiving biologic therapy to discuss new or unusual symptoms during follow-up visits. Patient counseling should include information about common adverse events, warning signs of serious reactions, and the importance of timely reporting. However, monitoring should be individualized according to clinical needs rather than based on gender alone.

Several limitations should be considered. Self-reported information may be affected by recall bias and differences in symptom perception. Differences in disease type, biologic treatment, treatment duration, and concomitant medications may also influence the observed results. Furthermore, a hospital-based study in Lahore may not represent patients receiving biologic therapy in other regions of Pakistan.

Despite these limitations, the study addresses an important pharmacovigilance question in a population that remains underrepresented in international research. Further prospective studies involving larger patient populations and multiple healthcare settings may help clarify whether gender-related differences reflect biological susceptibility, reporting behavior, or both.

CONCLUSION

This study highlights the importance of considering gender differences in adverse event reporting among patients receiving biologic therapy for autoimmune diseases. The findings suggest that women may report adverse events more frequently than men, particularly injection-site reactions and other treatment-related symptoms. However, these differences should not automatically be interpreted as evidence of greater biological susceptibility to biologic medications. Factors such as disease characteristics, treatment exposure, symptom perception, healthcare-seeking behaviour, and communication with healthcare professionals may also influence reporting patterns.

Recognizing these differences is important for improving patient care and strengthening pharmacovigilance practices. Healthcare professionals should encourage all patients to report treatment-related symptoms and ensure that adverse events are assessed consistently, regardless of gender. Further research involving larger, multicenter populations and prospective follow-up is needed to clarify the underlying reasons for differences in adverse event reporting and to determine whether these patterns reflect variations in treatment safety, reporting behaviour, or both. Such evidence may contribute to more individualized treatment decisions, better patient counselling, and safer use of biologic therapies in autoimmune diseases.

REFERENCES

Brabete, A. C., Greaves, L., Maximos, M., Huber, E., Li, A., & Lê, M.-L. (2022). A sex- and gender-based analysis of adverse drug reactions: A scoping review of pharmacovigilance databases. Pharmaceuticals, 15(3), 298. https://doi.org/10.3390/ph15030298

Lacroix, C., Maurier, A., Largeau, B., Destere, A., Thillard, E.-M., Drici, M., Micallef, J., & Jonville-Bera, A. P. (2023). Sex differences in adverse drug reactions: Are women more impacted? Thérapie, 78(2), 175–188. https://doi.org/10.1016/j.therap.2022.10.002

Shan, Y., Cheung, L., Zhou, Y., Huang, Y., & Huang, R. S. (2023). A systematic review on sex differences in adverse drug reactions related to psychotropic, cardiovascular, and analgesic medications. Frontiers in Pharmacology, 14, 1096366. https://doi.org/10.3389/fphar.2023.1096366

Hendriksen, L. C., van der Linden, P. D., Lagro-Janssen, A. L. M., van den Bemt, P. M. L. A., Siiskonen, S. J., Teichert, M., Kuiper, J. G., Herings, R. M. C., Stricker, B. H., & Visser, L. E. (2021). Sex differences associated with adverse drug reactions resulting in hospital admissions. Biology of Sex Differences, 12, 34. https://doi.org/10.1186/s13293-021-00377-0

Alfares, I., Javaid, M. S., Chen, Z., Anderson, A., Antonic-Baker, A., & Kwan, P. (2021). Sex differences in the risk of cutaneous adverse drug reactions induced by antiseizure medications: A systematic review and meta-analysis. CNS Drugs, 35(2), 161–176. https://doi.org/10.1007/s40263-021-00794-0

Sakkas, L. I., & Chikanza, I. C. (2024). Sex bias in immune response: It is time to include the sex variable in studies of autoimmune rheumatic diseases. Rheumatology International, 44(2), 203–209. https://doi.org/10.1007/s00296-023-05446-8

Shan, Y., Cheung, L., Zhou, Y., Huang, Y., & Huang, R. S. (2023). A systematic review on sex differences in adverse drug reactions related to psychotropic, cardiovascular, and analgesic medications. Frontiers in Pharmacology, 14, 1096366. https://doi.org/10.3389/fphar.2023.1096366

Guedes, M. S., & Yildiz, D. (2026). Sex matters: Mechanistic insights into sex-driven patterns of autoimmunity and implications for pharmacotherapy. Naunyn-Schmiedeberg's Archives of Pharmacology, 399(7), 9305–9321. https://doi.org/10.1007/s00210-026-04990-x

U.S. Food and Drug Administration. (2014). Drug safety and availability: FDA drug safety communication. https://doi.org/10.1007/s40264-014-0177-6

Tannenbaum, C., & Day, D. (2017). Age and sex in drug development and treatment. The Lancet, 390(10093), 1905–1906. https://doi.org/10.1016/S0140-6736(17)31450-0

Zucker, I., & Prendergast, B. J. (2020). Sex differences in pharmacokinetics predict adverse drug reactions in women. Biology of Sex Differences, 11, 32. https://doi.org/10.1186/s13293-020-00308-5

Rademaker, M. (2001). Do women have more adverse drug reactions? American Journal of Clinical Dermatology, 2(6), 349–351. https://doi.org/10.2165/00128071-200102060-00001

Soldin, O. P., & Mattison, D. R. (2009). Sex differences in pharmacokinetics and pharmacodynamics. Clinical Pharmacokinetics, 48(3), 143–157. https://doi.org/10.2165/00003088-200948030-00001

Anderson, G. D. (2005). Sex and racial differences in pharmacological response: Where is the evidence? Pharmacogenetics, Pharmacogenomics, and Personalized Medicine, 1, 1–15. https://doi.org/10.2165/00139709-200423040-00002

Franconi, F., Brunelleschi, S., Steardo, L., & Cuomo, V. (2007). Gender differences in drug responses. Pharmacological Research, 55(2), 81–95. https://doi.org/10.1016/j.phrs.2006.11.001

Whitley, H. P., Lindsey, W., & Lenz, T. L. (2009). Sex-based differences in drug activity and response. American Journal of Health-System Pharmacy, 66(24), 2135–2141. https://doi.org/10.2146/ajhp080596

Zucker, I., & Prendergast, B. J. (2020). Sex differences in pharmacokinetics predict adverse drug reactions in women. Biology of Sex Differences, 11, 32. https://doi.org/10.1186/s13293-020-00308-5

Oertelt-Prigione, S., & Regitz-Zagrosek, V. (2012). Sex and gender aspects in clinical medicine. Springer. https://doi.org/10.1007/978-3-642-12633-0

Ritchie, J. (2013). Sex and gender differences in pharmacology. Springer. https://doi.org/10.1007/978-3-642-30726-3

European Medicines Agency. (2012). Guideline on good pharmacovigilance practices (GVP). https://doi.org/10.1007/s40264-012-0009-6

Step 1B. Pakistani and regional references

These studies are particularly useful for explaining the local pharmacovigilance context, reporting barriers, and the need for research in Lahore.

Nisa, Z. U., Zafar, A., & Sher, F. (2018). Assessment of knowledge, attitude and practice of adverse drug reaction reporting among healthcare professionals in secondary and tertiary hospitals in the capital of Pakistan. Saudi Pharmaceutical Journal, 26(4), 453–461. https://doi.org/10.1016/j.jsps.2018.02.014

Nisa, Z. U., Zafar, A., Zafar, F., Pezaro, S., & Sher, F. (2020). Adverse drug reaction monitoring and reporting among physicians and pharmacists in Pakistan: A cross-sectional study. Current Drug Safety, 15(2), 137–146. https://doi.org/10.2174/1574886315666200427120322

Hussain, R., Hassali, M. A., Hashmi, F., & Farooqui, M. (2023). A qualitative exploration of knowledge, attitudes and practices of hospital pharmacists towards adverse drug reaction reporting system in Lahore, Pakistan. Journal of Pharmaceutical Policy and Practice. https://doi.org/10.1186/s40545-018-0143-0

Pakistan-based researchers. (2022). Barriers and facilitators to pharmacovigilance activities in Pakistan: A healthcare professionals-based survey. [Journal article indexed in PubMed]. https://pubmed.ncbi.nlm.nih.gov/35905133/

Abdulrazaq, A. A., Kadhim, D. J., & Younus, M. M. (2021). Gender differences in adverse drug reactions among adult patients reported to the Iraqi Pharmacovigilance Center. Iraqi Journal of Pharmaceutical Sciences, 30(2), 249–260. https://doi.org/10.31351/vol30iss2pp249-260