Frequency and risk factors for the development of drug related problems among rheumatoid arthritis patients

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ABSTRACT

Background: Rheumatoid arthritis (RA) patients are at high risk for development of drug related problems (DRPs) due to multiple drug use. This study aimed to estimate the frequency and risk factors for the development of drug related problems among RA patients in Indian setting.

Methods: A prospective cohort study was carried out for twenty-two months in a tertiary care teaching hospital. Patients who met study eligibility criteria were randomised either into intervention or usual care group. All the patients' data were screened for the presence of DRPs. Identified DRPs were categorized into problems and their causes using Pharmaceutical Care Network Europe (PCNE V8.02) DRP Classification system. Clinical pharmacists proposed interventions to resolve DRPs in intervention group.

Results: A total of 320 RA patients [Intervention group, n = 160 and usual care group, n = 160] were enrolled in this study. Overall, 463 DRPs were identified among 88.4% of patients, and frequency of DRPs was 1.6 per patient. Treatment safety (41.2%) and patient related factors (28.2%) was the most common category and cause of DRPs respectively. Advanced age and polypharmacy were the common risk factors identified for the development of DRPs.

Conclusion: This study revealed DRPs are common among RA patients and those are related to the treatment safety and efficacy. Clinical pharmacists' provided interventions had significant impact on DRPs resolution among RA patients.

1. Introduction

Rheumatoid arthritis (RA) is a chronic autoimmune disorders caused due to failure of immune responses against own immunity.¹ This is characterized by pain, swelling, tender, warm and stiffness of the joints. Progressive inflammation of joints in RA can leads to the joint deterioration and disability, and eventually increased the morbidity and economic burden to the patient.² The prevalence of RA in Indian population ranges from 0.28% to 0.7% and around 0.5% to 1% in global population.^{3,4} The incidence of RA is relatively three times higher in females as compared to the males. Genetic factors or combination of genetic and environmental factors such as female gender, hormonal changes, family history and tobacco smoking believed to be associated with the development and prognosis of RA.⁵ Presently, management with medications are a mainstay for the treatment of RA, but this has become challenging due to unwanted adverse effects and often expensive.⁶

Most frequently prescribed medications to manage RA includes

nonsteroidal anti-inflammatory drugs (NSAIDs), corticosteroids and disease-modifying anti-rheumatic drugs (DMARDs).⁷ An intensive and complex drug regimens may requires upon high disease activity and low remission rate for short to long period of time.⁸ This increases the risk of DRPs. Drug related problem (DRP) is defined as an event or circumstance involving drug therapy that actually or potentially interferes with desired health outcomes, that occurred at any stage of the treatment.⁹ The occurrence of DRPs may associated with the risk of patient harm, reduce patients' quality of life and economic loss.¹⁰ Thus, timely identification and resolution of DRPs become essential to enhance patient outcomes. Clinical pharmacist can play a critical role for the enhancement of patient outcomes by actively participate on the detection of DRPs and their management. Clinical pharmacist is well known to provide individual pharmaceutical care by suggesting safest and cost-effective alternatives to optimize the pharmacotherapy.¹¹ Furthermore, multiple studies revealed that collaborative care of clinical pharmacist with treating physician had higher acceptance rate of

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clinical pharmacist interventions and significant impact on the resolution of DRPs.^{12,13}

Limited study found that revealed the occurrence of DRPs in RA patients,¹⁴ but the participation of clinical pharmacist in the detection of DRPs and their management is still unpublished. Furthermore, the prevalence of DRPs among Indian population and the impact of clinical pharmacist in detection and resolution of DRPs is still uncertain. Hence, we aimed to conduct this study to estimate the frequency and risk factors for the development of drug related problems among rheumatoid arthritis patients in Indian setting.

2. Methods

This prospective cohort study was carried out over a period of twenty-two months (July 2019 to April 2021) at a tertiary care teaching hospital in southern India after obtaining the approval from Institutional Human Ethics Committee, meeting held on 10th June 2019. Rheumatoid arthritis patient of any gender and aged above 16 years, admitted to the hospital were screened for the study eligible criteria and were enrolled in this study after obtaining their written informed consent. Patients' demographic data, clinical manifestation, past medical and medication history, current diagnosis and medications, and relevant laboratory data, were collected and documented in a suitably designed data collection form.

Study participants were categorized either into intervention group or into usual care group following simple randomization technique. Participants in either group were screened for the presence of drug-related problems (DRPs). Participants in the intervention group received pharmacists' interventions to resolve identified DRPs, in addition to the usual care. Whereas, participants in the usual care group received only usual care by physician and nurses. However, their treatment chart was reviewed on daily basis by the clinical pharmacist to identify DRPs and to document the outcomes of DRPs till discharge.

The identified DRPs were verified through consulting international guidelines for the management of rheumatoid arthritis,¹⁵ pharmacist practice guidelines,¹⁶ recent publications and electronic databases such as Micromedex® and Medscape®. DRPs were categorized into their problems and associated causes by adopting Pharmaceutical Care Network Europe (PCNE V8.02) DRP classification system.¹⁷ Further, Clinical pharmacist planned the interventions following systemic search and critical appraisal of available best evidences to resolve the DRPs. All the identified DRPs notified and possible interventions to resolve the DRPs were discussed with the multidisciplinary care team (MDCT) on real-time basis within 24–48 h. The MDCT included the treating rheumatologist, two clinical pharmacists, and two nursing staff. The clinical pharmacist interventions were implemented after collective decision taken by the MDCT. The clinical significance of the accepted interventions was evaluated and categorized adopting Alderman's classification system.¹⁸ Patient in the intervention group were followed till discharge to document the outcomes of DRPs upon implemented interventions. The identified DRPs in the intervention group and usual care group were compared with respect to their frequency, nature and causes. The impact of clinical pharmacists' interventions on outcomes of DRPs was assessed among participants in the intervention group.

The descriptive data were analysed and expressed as frequencies and percentage values. A chi-square test (χ^2) was used to evaluate the association between categorical variables among groups. Multiple logistic regression analysis was performed to identify the risk of DRPs. All the statistical analysis was carried out using SPSS V25®.

3. Results

A total of 320 patients who met the study inclusion criteria were enrolled. Participants were equally divided into intervention group (n = 160) and usual care group (n = 160). A female predominance was observed in both the groups [Intervention group: 128/160 (80%) and

usual care group: 120/160 (75%)]. The mean age of study participants was 48.04 ± 17.13 years in the intervention group and 49.12 ± 20.66 years in the usual care group. The demographic details are presented in Table 1. A majority of patients were taking more than five drugs in both the groups [Intervention group: 128/160 (80%); Usual care group: 116/160 (72.5%)]. In majority of the study participants [Intervention group: 75/160 (46.8%); Usual care group: 86/160 (53.7%)] the duration of rheumatoid arthritis was 1–5 years. Hyperlipidaemia [137, 42.8%],

Table 1

Demographic details of the study participants (n = 320).

Variables	Parameters	Intervention group [n = 160, (100%)]	Usual care group [n = 160, (100%)]	Total [n = 320 (100%)]
Gender	Male	32 (20%)	40 (25%)	72 (22.5%)
	Female	128 (80%)	120 (75%)	248 (77.5%)
Age distribution (in years)	<19	12 (7.5%)	10 (6.2%)	22 (6.8%)
	19–40	55 (34.4%)	43 (23.8%)	98 (30.6%)
	41–60	60 (37.5%)	70 (43.7%)	130 (40.6%)
	61–80	25 (15.6%)	30 (18.7%)	55 (17.2%)
	>80	8 (5%)	7 (4.3%)	15 (4.6%)
Social habits	Alcoholic	10 (6.2%)	15 (9.3%)	25 (7.8%)
	Smoker	19 (11.9%)	24 (15%)	43 (13.4%)
	Both	11 (6.8%)	08 (5%)	19 (5.9%)
Body Mass Index (Kg/m ²)	≤18.5–24.9	57 (35.6%)	73 (45.6%)	130 (40.6%)
	25–29.9	75 (46.8%)	66 (41.2%)	141 (44.0%)
	≥30	28 (17.5%)	21 (13.1%)	49 (15.3%)
Educational status	Graduate or above	1 (0.6%)	4 (2.5%)	5 (1.5%)
	Intermediate/ diploma or High school certificate	15 (9.3%)	17 (10.6%)	32 (10%)
	Middle school certificate	21 (13.1%)	30 (18.7%)	51 (15.9%)
	Primary school certificate	38 (23.7%)	47 (29.3%)	85 (26.5%)
	Uneducated	85 (53.1%)	62 (38.7%)	147 (45.9%)
Occupational status	Professional and Semi-professional	1 (0.6%)	4 (2.5%)	5 (1.5%)
	Clerical, shop owner, skilled worker	26 (16.2%)	32 (20%)	58 (18.1%)
	Semi-skilled	31 (19.3%)	20 (12.5%)	51 (15.9%)
	Unskilled worker	27 (16.8%)	44 (27.5%)	71 (22.2%)
	Unemployed	75 (46.8%)	60 (37.5%)	135 (42.2%)
Socioeconomic status	Upper class	13 (8.1%)	8 (5%)	21 (6.5%)
	Upper-middle class	20 (12.5%)	17 (10.6%)	37 (11.5%)
	Lower middle class	33 (20.6%)	48 (30%)	81 (25.3%)
	Upper lower class	68 (42.5%)	56 (35%)	124 (38.7%)
	Lower class	26 (16.2%)	31 (19.4%)	57 (17.8%)

* All differences were not statistically significant (p > 0.05).

hypertension [90, 28.1%] and type 2 diabetes mellitus [80, 25%] were the most common comorbidities observed among the study patients. The details of clinical characteristics of study participants are presented in Table 2. There were no statistically significant differences observed both in demographic as well as clinical variables between participants in the intervention and usual care groups.

The average number of drugs prescribed per patient in intervention group and usual care group was 9.4 [1504/160] and 8.9 [1424/160] respectively. Overall, more than two-third (283/320, 88.4%) of the study population experienced at least one DRP. Among which 90.6% (145/160) and 86.2% (138/160) of participants in intervention and usual care group experienced at least one DRP respectively. A total of 463 DRPs were observed in 283 patients. Accordingly, the frequency of DRPs in our study was 1.6 per patient. The frequency of DRPs was almost equally distributed among participants in intervention group [242/145, 1.6 per patient] and the usual care group [221/138, 1.6 per patient].

Treatment safety was the most frequent [Overall: 191/463, (41.2%); Intervention group: 101/242 (41.9%); Usual care group: 90/221 (40.7%)] category of DRP identified in our study, followed by treatment effectiveness [Overall: 183/463, (39.5%); Intervention group: 96/242 (39.6%); Usual care group: 87/221 (39.3%)].

We observed more than one cause for some of the DRPs. A total of 528 causes [Intervention group: 277 causes for 242 DRPs; Usual care group: 251 causes for 221 DRPs] were recognized for 463 DRPs. Among seven primary domains of causes for DRPs recognized in our study, the most frequent [Overall: 149/528, (28.2%); Intervention group: 82/277 (29.6%); Usual care group: 67/251 (26.6%)] domain was patient-related followed by drug selection [Overall: 132/528, (25%); Intervention group: 70/277 (25.2%); Usual care group: 62/251 (24.7%)]. The details of various categories and causes of DRPs identified are presented in Table 3.

The clinical pharmacists' interventions were proposed for all the 277 causes recognized for the identified DRPs in the intervention group. A majority of the clinical pharmacists' interventions proposed were at patient level [124 (44.7%)], followed by drug [103 (37.1%)] and prescriber levels [50 (18%)]. Of which 253, interventions were accepted and implemented. Accordingly, the acceptance rate of the clinical pharmacists' interventions in our study was 91.3%. A majority [114/253, 45%] of the accepted interventions were moderate, followed by minor [85/253, 33.5%] and major [n = 54/253, 21.3%] in their clinical significance.

Outcomes of DRPs: In this study, the implemented clinical pharmacist interventions in intervention group resolved of [217/225, 96.4%] DRPs and [8/225, 3.5%] DRPs were unresolved or continued. In control

group, the frequency of DRPs resolved was lower [98/221, 44.3%] as compared to the DRPs not resolved or continued [123/221, 55.6%]. The difference in resolved DRPs in intervention group was highly statistically significant ($p < 0.0001$) as compared to the control group.

Predictors for DRPs: Application of multiple logistic regression shows that patient age group between 61 to 80 years [OR: 8.82, 95% CI: 2.34–33.23, $p = 0.0013$], patient receiving more than 5 drugs (polypharmacy) [OR: 8.20, 95% CI: 3.91–17.17, $p < 0.0001$] and number of comorbidities (≥ 3) [OR: 5.13, 95% CI: 2.07–12.67, $p = 0.0004$] were major three risk factors that significantly associated with the development of DRPs. The details in the risk factor associated with the development of DRPs are presented in Table 4.

4. Discussion

This is the first prospective cohort study that explored the frequency and risk factors for DRPs among hospitalized RA patients in Indian settings. The overall frequency of DRPs was 1.6 per patient, in both intervention and usual care groups. This finding was compared with a retrospective study conducted among RA patients by Ma SN et al., reported frequency of 1.5 DRPs per patient.¹⁴ There are many studies conducted in patients with other clinical conditions that reported the frequency of DRPs either equal or different than our findings.^{19,20} These differences are mostly due to the variation in the sample size, study design, age of the study population, extent of involvement by clinical pharmacist, polypharmacy and presence of other co-morbid conditions.

The most frequent category of DRPs observed in both intervention and usual care groups of our study was related to treatment safety that is possible occurring of adverse drug event. Treatment effectiveness was the second most frequent category of DRPs observed. However, Ma SN et al., observed, adverse reactions as the most frequent category of DRPs in their study.¹⁴

This difference could be because of use of different versions of PCNE classification of DRP. It is important to note that Ma SN et al., used PCNE version 5.01 that categorizes the DRPs differently than PCNE version 8.02 as used in our study. Similar to our findings, a study conducted among hospitalized COPD patients also reports treatment safety as the most frequent category of DRPs followed by treatment effectiveness.¹⁹ In a recent study conducted among hospitalized cancer pain patients, using PCNE version 9.0 classification of DRPs, treatment effectiveness was reported as the most frequent category of DRPs.²¹

Further, in this study we observed that the adverse drug reactions [83/191, (43.5%)] was the major problems related to the DRPs. This finding was compared with a recent retrospective study that reported

Table 2
Clinical characteristics of the study participants (n = 320).

Variables	Parameters	Intervention group [n = 160, (100%)]	Usual care group [n = 160, (100%)]	Total [n = 320 (100%)]
Polypharmacy	≤5 drugs	32 (20%)	44 (27.5%)	76 (23.7%)
	>5 drugs	128 (80%)	116 (72.5%)	244 (76.2%)
Disease duration	<1 year	29 (18.1%)	33 (20.6%)	62 (19.3%)
	1–5 year	75 (46.8%)	86 (53.7%)	161 (50.3%)
	>5 year	56 (35%)	41 (25.6%)	97 (30.3%)
Length of hospitalization	≤5 days	70 (43.7%)	78 (48.7%)	152 (47.5%)
	>5 days	90 (56.2%)	82 (51.2%)	168 (52.5%)
Number of comorbidities	<3	82 (51.2%)	91 (56.8%)	173 (54.1%)
	≥3	78 (48.2%)	69 (43.1%)	147 (45.9%)
Common comorbidities	Hyperlipidaemia	75 (46.8%)	62 (38.7%)	137 (42.8%)
	Hypertension	41 (25.6%)	49 (30.6%)	90 (28.1%)
	Type 2 diabetes	42 (26.2%)	38 (23.7%)	80 (25%)
	Cardiovascular disease	20 (12.5%)	27 (16.8%)	47 (14.7%)
	Hypothyroidism	17 (10.6%)	22 (13.7%)	39 (12.2%)
	Anaemia	26 (16.2%)	20 (12.5%)	46 (14.3%)
	Respiratory disease	23 (14.3%)	17 (10.6%)	40 (12.5%)
	Renal impairment	25 (15.6%)	17 (10.6%)	42 (13.1%)
	Hepatic impairment	14 (8.7%)	09 (5.6%)	23 (7.2%)
	Psychosis	02 (1.2%)	05 (3.1%)	07 (2.2%)

* All differences were not statistically significant ($p > 0.05$).

Table 3

The details of various categories and causes of DRPs identified in the study population.

Categories of identified DRPs:					
Primary domain	Subdomain code	Nature of DRPs	Intervention group	Usual care group	Total
Treatment effectiveness	P1.1	No effect of drug treatment	28 (11.5%)	20 (9%)	48 (10.3%)
	P1.2	Effect of drug treatment not optimal	38 (15.7%)	42 (19%)	80 (17.2%)
	P1.3	Untreated symptoms or indication	30 (12.3%)	25 (11.3%)	55 (11.8%)
Treatment safety	P2.1	Adverse drug event (possibly) occurring	101 (41.7%)	90 (40.7%)	191 (41.2%)
Others	P3.1	Problem with cost-effectiveness of the treatment	25 (10.3%)	21 (9.5%)	46 (9.9%)
	P3.2	Unnecessary drug treatment	20 (8.2%)	23 (10.4%)	43 (9.2%)
Total number of DRPs			n=242 (100%)	n=221 (100%)	n=463 (100%)
Causes of identified DRPs:					
Primary domain	Subdomain code	Nature of causes	Intervention group	Usual care group	Total
Drug selection	C1.1	Inappropriate drug according to guidelines/formulary	0 (0%)	1 (0.3%)	1 (0.1%)
	C1.2	Inappropriate drug (within guidelines but otherwise contra-indicated)	2 (0.7%)	3 (1.1%)	5 (0.9%)
Drug form	C1.3	No indication for drug	12 (4.3%)	8 (3.2%)	20 (3.7%)
	C1.4	Inappropriate combination of drugs or drugs and herbal medication	17 (6.1%)	18 (7.2%)	35 (6.6%)
	C1.5	Inappropriate duplication of therapeutic group or active ingredient	8 (2.8%)	9 (3.5%)	17 (3.2%)
	C1.6	No drug treatment in spite of existing indication	20 (7.2%)	15 (5.9%)	35 (6.6%)
	C1.7	Too many drugs prescribed for indication	11 (3.9%)	8 (3.1%)	19 (3.5%)
	C2.1	Inappropriate drug form (for this patient)	2 (0.7%)	0 (0%)	2 (0.3%)
	C2.2	Drug dose too low	12 (4.3%)	9 (3.5%)	21 (3.9%)
Dose selection	C3.2	Drug dose too high	3 (1.1%)	5 (1.9%)	8 (1.5%)
	C3.3	Dosage regimen not frequent enough	5 (1.8%)	2 (0.7%)	7 (1.3%)
	C3.4	Dosage regimen too frequent	3 (1.1%)	5 (1.9%)	8 (1.5%)
	C3.5	Dose timing instructions wrong, unclear or missing	4 (1.4%)	8 (3.1%)	12 (2.2%)
	C4.1	Duration of treatment too short	15 (5.4%)	12 (4.7%)	27 (5.1%)
Treatment duration	C4.2	Duration of treatment too long	8 (2.8%)	7 (2.7%)	15 (2.8%)
Dispensing	C5.1	Prescribed drug not available	5 (1.8%)	9 (3.5%)	14 (2.6%)
	C5.2	Necessary information not provided	3 (1.1%)	4 (1.5%)	7 (1.3%)
	C5.3	Wrong drug, strength or dosage advised (OTC)	1 (0.3%)	3 (1.1%)	4 (0.7%)
	C5.4	Wrong drug or strength dispensed	10 (3.6%)	8 (3.1%)	18 (3.4%)
Drug use process	C6.1	Inappropriate timing of administration and/or dosing interval	24 (8.6%)	21 (8.3%)	45 (8.5%)
	C6.2	Drug under-administered	15 (5.4%)	10 (3.9%)	25 (4.7%)
	C6.3	Drug over-administered	7 (2.5%)	6 (2.3%)	13 (2.4%)
	C6.4	Drug not administered at all	4 (1.4%)	9 (3.5%)	13 (2.4%)
	C6.5	Wrong drug administered	4 (1.4%)	4 (1.5%)	8 (1.5%)
Patient related	C7.1	Patient uses/takes less drug than prescribed or doesn't take the drug at all	16 (5.7%)	12 (4.7%)	28 (5.3%)
	C7.2	Patient uses/takes more drug than prescribed	14 (5%)	15 (5.9%)	29 (5.4%)
	C7.4	Patient uses unnecessary drug	18 (6.4%)	12 (4.7%)	30 (5.6%)
	C7.7	Inappropriate timing or dosing intervals	21 (7.5%)	17 (6.7%)	38 (7.1%)
	C7.8	Patient administers/uses the drug in a wrong way	11 (3.9%)	8 (3.1%)	19 (3.5%)
	C7.9	Patient unable to use drug/form as directed	2 (0.7%)	3 (1.1%)	5 (0.9%)
Total number of causes (one DRP may have one or more causes)*			n=277 (100%)	n=251 (100%)	n=528 (100%)

DRPs: Drug-related problems; PCNE: Pharmaceutical Care Network Europe; OTC: Over-the-counter drugs.

adverse reactions as the major [112, 38.8%] problems for DRPs among RA patients.¹⁴ This indicates that adverse drug reaction is more common problem associated with the drug therapy in modern medical practice. This may depend on drug and dose selection, alteration in drug use process, polypharmacy, drug interaction and changes in body physiology. Thus, these findings suggest that the RA patients are in need of adequate screening by the clinical pharmacists and treating physicians, for the possible risks of adverse drug events.

The most frequent causes of DRPs were related to the patient non-compliance [149/528, 28.2%] and drug selection [132/528, 25%]. In a previously conducted study by Ma SN et al., the causes of DRPs were not adequately reported among RA patients.¹⁴ However, Zhu Y et al., reported similar causes of DRPs, indicating patient related [127/492, 25.8%] and drug selection [118/492, 24%], as observed in the present study.²² The patient related contributing factors were frequent because of multiple drug therapy, lack of patients' knowledge and monitoring and long duration of drug therapy. This indicates that the prescriber and clinical pharmacist need to critically evaluate the patient or patient's care taker knowledge about drug use. Similarly, the prescribers must ensure that the selected drug is appropriate for the given patient and

clinical situation and patients is able to take the drugs as prescribed. Therefore, involvement of patient and their care takers is vital in drug selection process.

An intervention is any action by a clinical pharmacist that directly results in a change in patient management or therapy.²³ This is the first clinical pharmacist-led study among RA patients that suggested the interventions to all the identified DRPs and assessed its impact upon implementation. A majority (91.3%) of clinical pharmacist proposed interventions were accepted by the concerned personnel. This study finding was compared with a similar study conducted in an acute internal medicine ward by Lombardi N et al., reported a similar acceptance rate (93.2%) of clinical pharmacist proposed intervention by physicians.²⁴ Salman B et al. also reported 95% of clinical pharmacist proposed interventions were accepted by physicians.²⁵ This finding indicates that the clinical pharmacist provided interventions to resolve DRPs were highly appreciating and accepting by the physicians in modern clinical practice.

However, twenty-four (8.7%) clinical pharmacist interventions were not accepted leading to the seventeen DRPs remained unresolved. The reasons for non-acceptance were lack of physician confidence towards

Table 4

Risk factor associated with the development of DRPs among study participants.

Variables	Parameters	Drug related problems		OR at 95% CI*	P value
		Yes	No		
Gender	Male	63	9	1	0.77
	Female	220	28	1.12 (0.50–2.50)	
Age distribution (in years)	<19	13	9	1	0.0014
	19–40	86	12	4.58 (1.79–11.70)	
	41–60	120	10	8.30 (2.85–24.14)	0.0001
	61–80	51	4	8.82 (2.34–33.23)	0.0013
	>80	13	2	4.50 (0.81–24.98)	0.085
BMI (Kg/m ²)	≤18.5–24.9	108	22	1	–
	25–29.9	132	9	2.98 (0.41–3.68)	0.008
	≥30	43	6	1.45 (0.55–3.84)	0.444
Polypharmacy	≤5 drugs	52	24	1	–
	>5 drugs	231	13	8.20 (3.91–17.17)	<0.0001
Length of hospital	≤5 days	125	27	1	–
	>5 days	158	10	3.59 (1.59–7.31)	0.0016
Number of comorbidities	<3	142	31	1	–
	≥3	141	6	5.13 (2.07–12.67)	0.0004

Multivariate logistic regression analysis applied at 95% CI. *OR: Odds ratio, CI: Confidential interval, $P < 0.05$ considered as statistically significant.

suggested pharmacist interventions, inability of patient to bear the treatment cost of new medication, physician willingness to continue the same treatment, and delay in communication with concerned healthcare personnel and lack of drug availability.

Most (45%) of the accepted clinical pharmacist interventions were of moderate clinical significance indicating requirement of adjustments to enhance drug therapy efficacy or less than 20% chance of noticed effect. A study conducted in the internal medicine unit also reported that the majority (63.2%) of the interventions were of moderate severity.²⁴

In this study, accepted clinical pharmacist interventions were implemented and led to resolution of 96.4% DRPs. Our study finding are comparable with a study that reported 81.9% resolution of DRPs among patients with respiratory disorders.²² This difference could be due to implementation of less number of accepted interventions (85.6%) leading to resolution of less number of DRPs as compared to our study.

We observed that RA patients with increase in age are at increased risk of developing DRPs. This could be due to multiple drug therapy because of concurrent clinical conditions. However, our findings are inconsistent with a study that reported no association between increase in age and occurrence of DRPs.¹⁴ Patient with polypharmacy and multiple comorbidities (≥ 3) were also associated with the increased risk of DRPs. These finding was consistent with the other studies.^{14,24,26} Presence of multiple comorbidities results in polypharmacy as observed in our study. This could be justified by complexity of drug therapy, resulting from multiple comorbidities and that increases the risk of DRPs. Further, development of DRPs could be enhance as the polypharmacy increases the risk of patients' non-compliance towards prescribed drug therapy. This may result in increased length of hospital stay, organ impairment and economic burden. Therefore, clinical pharmacist and prescriber needs to be vigilant in screening the possible risk factors that could contribute in the development of DRPs. We conclude that the prevalence of DRPs is common among RA patients, and the clinical pharmacist-led MDCT provided patient care had a high impact on DRPs resolution rate. Therefore, clinical pharmacists can play

a vital role in identifying and resolving the DRPs among RA patients. Pharmacists are at a right position to support individualized patient care by adequately reviewing the medications and providing suitable solutions that can promote safe and effective use of medications among RA patients.^{27,28}

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Declaration of competing interest

There are no conflicts of interest.

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