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A Research Study on Navigating Medication Risks Through MFRS (Medication Fall Risk Score and Evaluation Tool) and DART (Drug Associated Risk Tool) Among Patients with Polypharmacy

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Abstract

Background information*: The advancements in medical science continue, but the safety of medication usage is still a question mark and has become a crucial area for researchers to focus on. In the need of the above, various scoring systems and tools have been developed in pharmacy practice research. Prior to the present work, we did a systematic review and meta-analysis and identified two such tools: the medication fall risk score and evaluation tool (MFRS) and the drug associated risk tool (DART) for effective evaluation of risks and prevention of drug-related problems, but the literature regarding their usage is very limited in Indian medical practice, which serves as a major gap.* ***Aim and Objectives****: To analyze the impact and outcomes of MFRS (medication fall risk score and evaluation tool) and DART (drug associated risk tool) in evaluating drug safety and in navigating and minimizing medication risks and drug-related problems.* ***Methodology****: The present study is a prospective cohort study carried for 12 months from January 2023 to January 2024 in the general medicine, obstetrics and gynaecology departments of Akash Hospital, Bangalore Karnataka, India, all the in-patients admitted with various diseases/disorders with polypharmacy were included and patients not willing to participate in the study were excluded, the data was collected through the personal interviews, case sheets and prescriptions with polypharmacy has been evaluated by using the medication risks through MFRS (medication fall risk score and evaluation tool) and DART (drug associated risk tool) to identify and prevent the risk of drug-related problems and risk factors involved with it, for statistical analysis Prismgraph Pad software version 10.2.1 was used.* ***Results****: Out of a total of 200 individuals, 45 (22.5%) reported medication allergies, while 52 (26%) acknowledged taking more than three medications daily. Psychological disorders were prevalent in 38 (19%) of the population, with gestational diabetes and anemia during gestation reported by 12 (6%) and 14 (7%) of female participants, respectively. Respiratory diseases were noted in 26 (13%) individuals, while fall history within the last six months was documented in 40 (20%) cases. The application of MFRS and DART tools facilitated comprehensive risk assessment. MFRS identified potential fall risks in 66 (33%) of the population, with recent changes in medications documented in 32 (16%) cases. Antihypertensive drugs were commonly prescribed, with 70 (35%) of participants using them. Additionally, 22 (11%) reported an intake of antithyroid drugs. The DART analysis highlighted medication-related concerns, with 40 (20%) of participants using seven or more prescription medicines regularly. Recent initiation of medication within the last four weeks was reported*

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by 26 (13%) individuals. Symptoms such as drowsiness, high blood pressure, and confusion were prevalent among the population, prompting further evaluation. Furthermore, 28 (14%) of participants were using medications with a narrow therapeutic index, necessitating regular monitoring. ***Conclusion:*** *This research promotes the significance of medication risk assessment tools in promoting the safety of special populations, emphasizing the need for personalized interventions to optimize therapeutic outcomes while minimizing adverse effects.*

Keywords: Medication-related risks, medication fall risk score and evaluation tool (MFRS), drug associated risk tool (DART), adverse effects, polypharmacy.

INTRODUCTION

The advancements in medical science continue, but the safety of medication usage is still a question mark and has become a crucial area for researchers to focus on. In the need of the above, various scoring systems and tools have been developed in pharmacy practice research. Prior to the present work, we did a systematic review and meta-analysis and identified two such tools: the medication fall risk score and evaluation tool (MFRS) and the drug associated risk tool (DART) for effective evaluation of risks and prevention of drug-related problems, but the literature regarding their usage is very limited in Indian medical practice, which serves as a major gap.

OBJECTIVE

To analyse the impact and outcomes of MFRS (medication fall risk score and evaluation tool) and DART (drug associated risk tool) in evaluating drug safety and in navigating and minimizing medication risks and drug-related problems.

Methodology

The present study is a prospective cohort study carried for 12 months from January 2023 to January 2024 in the general medicine, obstetrics and gynaecology departments of Akash Hospital, Bangalore Karnataka, India, all the in-patients admitted with various diseases/disorders with poly pharmacy were included and patients not willing to participate in the study were excluded, the data was collected through the personal interviews, case sheets and prescriptions with poly pharmacy has been evaluated by using the medication risks through MFRS (medication fall risk score and evaluation tool) and DART (drug associated risk tool) to identify and prevent the risk of drug-related problems and risk factors involved with it, for statistical analysis Prism Graph Pad software version 10.2.1 was used.

Annexures Used

- *Annexure I:* Informed consent form-English and Kannada.
- *Annexure II:* Pharmacist Patient Data Documentation Form.
- *Annexure III:* DARTTOOL Form.
- *Annexure IV:* MFRSTOOL Form.
- *Annexure V:* ADR Reporting Form (Yellow Form).
- *Annexure VI:* CDSCOADR Reporting Form.

POLYPHARMACY

Polypharmacy refers to the simultaneous use of multiple medications by a patient, typically involving five or more regular prescriptions [1]. This phenomenon is most frequently observed among older adults, particularly those aged 60 and above, who often manage multiple chronic conditions necessitating diverse treatments [2]. Additionally, polypharmacy can encompass the inappropriate or excessive utilization of medications, thereby posing potential health risks and complications.

Prevalence of Polypharmacy

The global prevalence of polypharmacy is on the rise, especially within the elderly population. This trend is largely attributed to an increasing number of comorbidities among older adults, which require the administration of multiple medications [3]. Research indicates that a substantial proportion of this demographic is affected by polypharmacy, with evidence suggesting it is becoming a prevalent concern in healthcare settings. For instance, studies conducted in various Indian states have underscored the escalating incidence of polypharmacy among elderly patients, mirroring broader global trends [4]. Polypharmacy represents a significant public health issue, particularly among older adults. Its prevalence is anticipated to increase in tandem with the aging population and the growing complexity of healthcare needs [5].

The growing concern in healthcare systems is due to an aging population and the rise in chronic diseases.

The aging population and the increasing prevalence of chronic diseases present significant challenges for global healthcare systems. This demographic transition demands immediate attention and innovative solutions [6].

Aging Population Trends

The global population aged 60 and over is increasing at an unprecedented pace. Projections suggest that by 2025, there will be approximately 1.2 billion individuals in this age group, rising to 2 billion by 2050. A significant portion of this growth will occur in developing countries, where healthcare systems may lack the resources to meet the escalating demand for services. In Europe, projections indicate that by 2030, individuals aged 65 and older will comprise 23.5% of the population. This demographic shift requires a reassessment of existing healthcare models, which are often outdated and primarily focused on disease, to better meet the needs of older adults [7].

Impact of Chronic Diseases

The increase in chronic diseases is closely associated with the aging population. As people live longer, they are more likely to develop conditions such as diabetes, heart disease, and arthritis. In the European Union, over 83% of healthcare expenditures are allocated to the treatment of chronic diseases. This trend places a growing burden on healthcare systems, which must adapt to provide effective management and care for these conditions [8].

Socioeconomic Factors and Access to Care

Access to healthcare is significantly influenced by socioeconomic status (SES). Older adults with lower SES often encounter barriers to accessing care, leading to poorer health outcomes. Addressing these disparities is crucial for improving the health and well-being of the aging population. Interventions aimed at enhancing SES and access to care can result in better health outcomes and alleviate the strain on healthcare systems [9].

Technological Innovations

To address the challenges posed by an aging population and the rise in chronic diseases, healthcare systems are increasingly turning to technology. Innovations such as remote monitoring systems and smart home technologies are being developed to provide care to elderly patients in their homes, thereby reducing the need for hospital visits and improving their quality of life [10]. These systems enable healthcare providers to monitor patients' health in real-time, allowing for timely interventions and support. The growing concerns in healthcare systems due to an aging population and the rise in chronic diseases necessitate a comprehensive approach that includes updating healthcare models, addressing socioeconomic disparities, and leveraging technology to enhance care delivery [11].

Significance of Assessing and Managing Medication Risks

Polypharmacy, the concurrent use of multiple medications, poses significant threats to patient safety and quality of life, particularly for individuals with complex health conditions [12]. The intricate nature of managing multiple medications necessitates routine assessments to identify potential issues such as duplications, contraindications, and drug interactions. Research underscores the complexity of polypharmacy, with over 130 different definitions in use, indicating that merely counting medications does not adequately capture the intricacies of patient care. Medications prescribed for one ailment may negatively impact another, highlighting the critical need for thorough medication reviews by healthcare professionals, especially nurses, during each patient interaction [13].

Existing Approaches to Medication Risk Management

Various strategies have been developed to mitigate the risks associated with polypharmacy:

1. *Medication-based risk scores:* These tools assist in identifying patients at high risk for adverse effects and guiding prescribing initiatives. They promote discussions between patients and healthcare providers regarding potentially harmful medications, aiming to minimize inappropriate prescribing and reduce healthcare utilization [14].
2. *Electronic medication management systems:* Computerized decision-support systems (CDSS) have been implemented to aid general practitioners in assessing medication appropriateness. These systems analyze patient data to identify potentially inappropriate prescriptions, thereby supporting informed decision-making [15].
3. *Routine medication reviews:* Regular medication reviews by healthcare providers, particularly in rehabilitation settings, are crucial to ensuring patients do not suffer from complications due to their medication regimens. This practice is vital for maintaining patient safety and enhancing quality of life [16].

Constraints on Existing Strategies

Despite the implementation of these strategies, several limitations remain:

- *Implementation challenges:* Integrating CDSS into clinical practice faces hurdles, such as technical issues in connecting to electronic medical records. These obstacles can impede the effectiveness of such systems in identifying and rectifying inappropriate prescriptions [17].
- *Variability in practice:* There is significant variability in the frequency and comprehensiveness of medication reviews among healthcare providers, leading to inconsistencies in patient care [18].
- *Complexity of polypharmacy:* Managing multiple chronic conditions often requires ongoing polypharmacy, complicating risk management efforts. In some instances, additional medications may be necessary despite the associated risks, illustrating the need for a nuanced approach to treatment decisions [19].

Although current strategies for managing medication risks in polypharmacy are crucial, their effectiveness is frequently limited by implementation challenges and the inherent complexities of patient care. Continuous evaluation and adaptation of these strategies are essential to improving patient safety and treatment outcomes [20].

Development of the MFRS

The medication fall risk score (MFRS) was formulated by examining data from a substantial cohort of older adults to identify specific medications and medication classes that correlate with an elevated risk of falls. Researchers employed a case-crossover study design, comparing medication exposure during periods immediately preceding a fall (case period) to exposure during control periods without falls. This methodology enabled them to determine which medications were more frequently present during the case period, indicating an association with falls [21].

Mechanism of Fall Risk Assessment by the MFRS

The MFRS allocates points to each medication based on its association with falls, with higher scores signifying a greater risk. The overall score is obtained by summing up the points for all the medications a patient is currently taking. Based on their total MFRS, patients are categorized into low, moderate, or high fall risk groups. This categorization enables healthcare providers to promptly identify patients at the highest risk and prioritize interventions accordingly [22].

Supporting Evidence for the MFRS

Numerous studies have validated the effectiveness of the MFRS in clinical environments:

1. A prospective cohort study demonstrated that patients with a high MFRS had a significantly increased risk of falls compared to those with a low MFRS, even after adjusting for other fall risk factors.
2. Another study indicated that the MFRS was more effective in predicting falls than a simple tally of fall-risk-increasing drugs (FRIDs), underscoring the importance of considering specific medications involved.
3. The MFRS has been integrated into clinical practice guidelines, such as the world guidelines for falls prevention and management, which advocate using the MFRS to identify high-risk patients and inform medication management strategies [23].

The medication fall risk score is an instrumental tool for evaluating fall risk associated with medications in older adults. Its implementation in clinical settings aids in identifying high-risk patients and guiding interventions to reduce falls and enhance patient safety [24].

The drug associated risk tool (DART) is an advanced medication risk assessment instrument designed to identify and manage drug-related risks in patients, particularly those experiencing polypharmacy. DART aims to enhance patient safety by systematically evaluating medication regimens and providing healthcare providers with guidance on potential risks and strategies for mitigation.

Objective of DART

The primary objective of DART is to decrease the incidence of adverse drug events (ADEs) and improve medication safety in patients taking multiple medications. By identifying high-risk medications, potential drug interactions, and instances of inappropriate prescribing, DART aids healthcare providers in making informed decisions to optimize medication regimens and minimize drug-related risks [25].

Methodology of DART

DART employs a comprehensive approach to assess medication risks:

1. *Comprehensive medication review:* DART involves a thorough evaluation of a patient's complete medication list, including prescription drugs, over-the-counter medications, and dietary supplements.
2. *Risk factor identification:* The tool identifies patient-specific risk factors that may increase the likelihood of drug-related problems, such as age, renal function, and comorbidities [26].
3. *Drug-drug interaction screening:* DART utilizes drug interaction databases to detect potential interactions between medications, considering both the severity and clinical significance of each interaction.
4. *Potentially inappropriate medications:* The tool flags medications that may be inappropriate for a particular patient based on established criteria, such as the Beers criteria or STOPP/START criteria [27].
5. *Risk scoring:* DART assigns a risk score to each patient based on the identified risk factors and potential drug-related problems. This score helps prioritize patients for intervention and monitoring [28].

Validation Studies and Evidence

Numerous studies have demonstrated the effectiveness of DART in managing medication risks:

1. A retrospective study found that implementing DART in a geriatric outpatient clinic significantly reduced the number of potentially inappropriate medications prescribed and decreased the incidence of ADEs.
2. Another study showed that using DART in a long-term care setting led to a reduction in the number of medications prescribed per patient and improved medication appropriateness.
3. A systematic review and meta-analysis concluded that medication risk assessment tools such as DART can effectively identify high-risk patients and reduce the risk of ADEs when used in conjunction with other interventions, such as medication reviews and patient education.

The drug associated risk tool (DART) is an invaluable resource for healthcare providers to identify and manage drug-related risks in patients with polypharmacy. By systematically assessing medication regimens and providing guidance on risk mitigation strategies, DART can significantly improve patient safety and optimize medication management.

RESULTS AND DISCUSSION

Table 1 represents the gender-wise distribution of the study population, with males 96 (48%) and females 104 (52%), out of the total 200 (100%) study population (Figure 1).

Table 1. Gender-wise distribution of patients.

Gender-Wise Distribution of Patients	Number (n)	Percentage (%)
Males	96	48
Females	104	52
Total	200	100

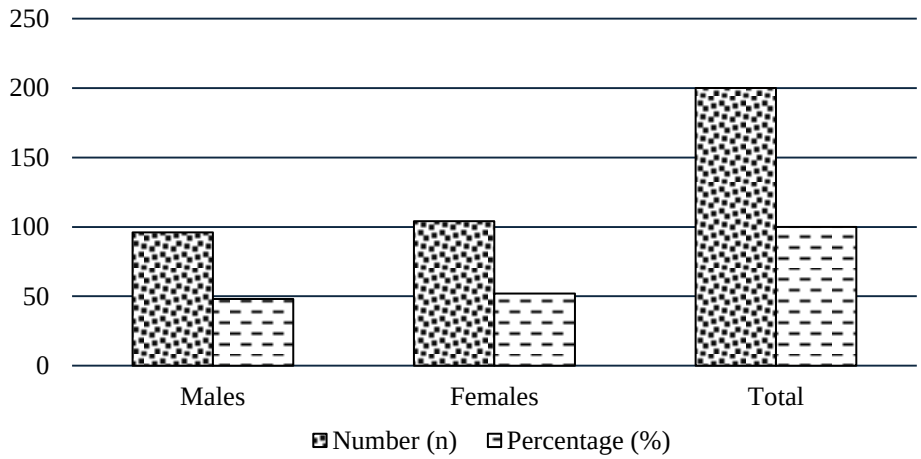

Figure 1. Gender-wise distribution of patients.

Table 2. Age-wise distribution of patients.

Age-Wise Distribution of Patients	Males number (n)	Percentage (%)	Females number (n)	Percentage %)
18–30	8	8.3	12	1.153
31–40	28	29.16	22	21.15
41–50	22	22.19	23	22.11
51–60	15	15.62	17	16.34

61–70	21	21.87	16	15.38
71–80	8	8.333	12	11.53
81–90	3	3.125	2	1.923
91–100	1	1.041	0	0
Total	96 out of 200	48 out of 100	104 out of 200	52 out of 100

Table 2 represents the age-wise distribution of the study population of both males and females, of which the highest of the male population 28 (29.16%) falls in the range of 31–40 years and the lowest 1 (1.041%) at 91–100 years, while the highest of the female population 23 (22.11%) falls in the range of 41–50 years and the lowest 0 (0%) at 91–100 years (Figure 2).

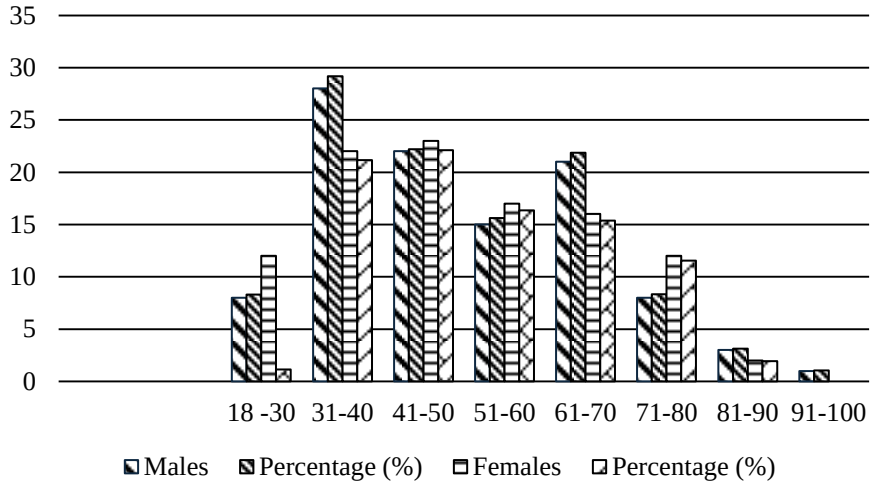

Figure 2. Age-wise distribution of patients.

Table 3. Current diagnostics with co-morbid conditions.

Status of Co-Morbidity	Number	Percentage
DM	9	4.5
Bronchitis	5	2.5
HTN	7	3.5
DM+ HTN	12	6
Hypothyroidism	8	4
Hyperthyroidism	3	1.5
DM+ HTN+ hyperthyroidism	8	4
DM+ HTN+ hypothyroidism	2	1
DM+ hypothyroidism	1	0.5
DM+ hyperthyroidism	3	1.5
Polycystic ovarian syndrome (PCOD)	12	6
Urinary incontinence	5	2.5
Ectopic pregnancy	11	5.5
Miscarriage	8	4
Pelvic floor prolapse	6	3
Uterine fibroids	4	2
Menstrual disorders	9	4.5
Cervical dysplasia	6	3
Severe vaginal bleeding	7	3.5
Vulvar abscesses	8	4
Pelvic inflammatory disease (PID)	8	4
Ovarian cyst	5	2.5
CHF	3	1.5
Chronic atrial fibrillation	4	2

Epilepsy	2	1
Stroke with ventricular arrhythmias	4	2
HTN+ hypothyroidism	8	4
HTN+ hyperthyroidism	6	3
Asthma	10	5
COPD	9	4.5
Asthma + COPD	7	3.5
Total	200	100
		P Value < 0.01
DM = diabetes mellitus, HTN = hypertension, MI = myocardial infarction, and PID = pelvic inflammatory disease.		

Table 3 represents the status of various diseaseand disorder comorbidities among the study population in both number and percentage (Figure 3).

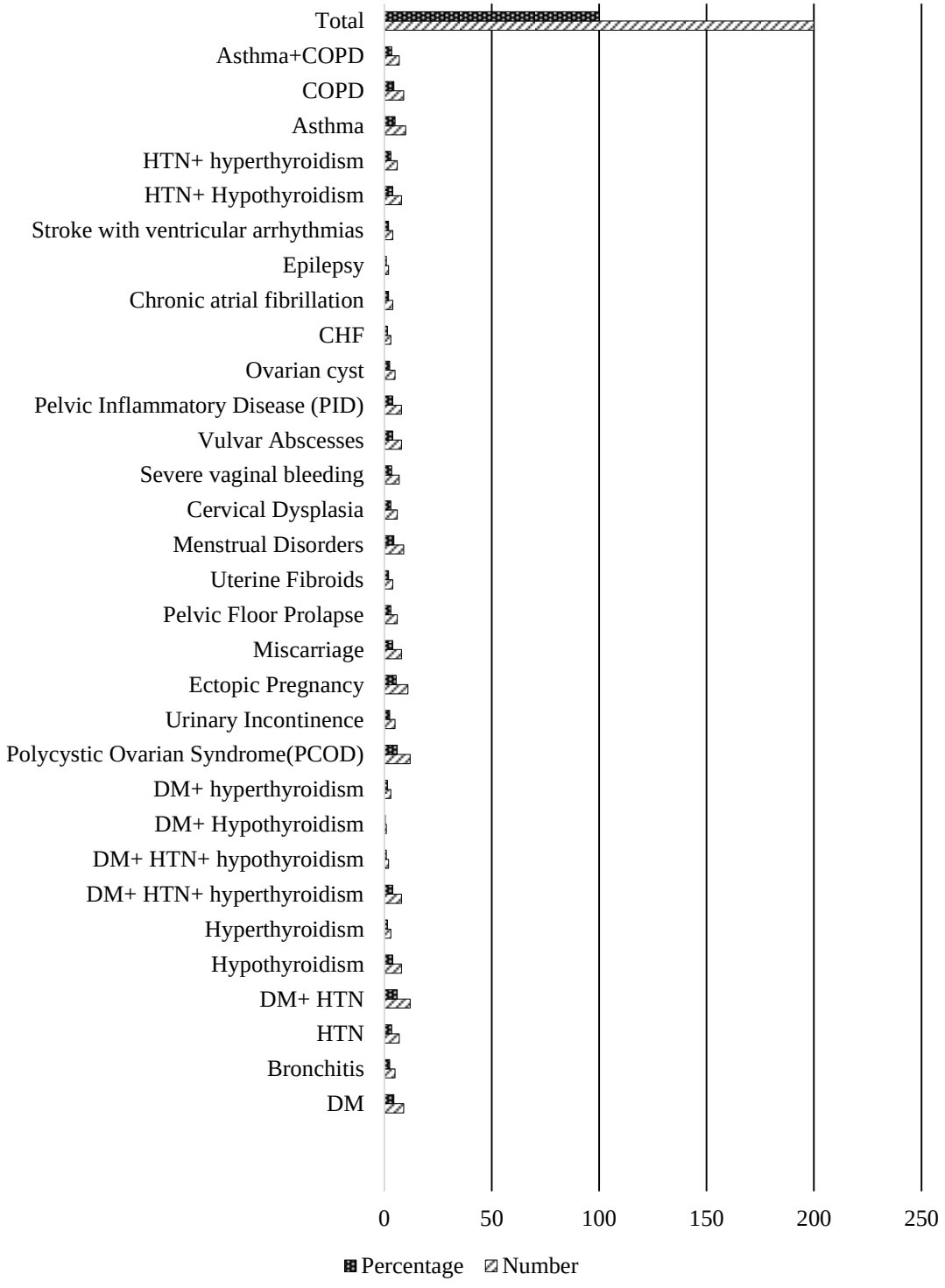

Figure 3. Current diagnostics with co-morbid conditions.

Table 4 represents the social status population, where the highest falls in the alcoholic group, accounting for 39 (19.5%) and the lowest (2.1%) in the category of tobacco chewing, whereas (Table 5) represents the literacy state of the study population, in which 176 (88%) were illiterates and 24 (12%) are literates (Figure 4).

Table 6 represents the distribution of the study population by department (Figure 5).

Table 4. Social status.

Social habits	Number (n)	Percentage (%)
Alcoholic	39	19.5
Smoking	18	9
Alcoholic + smoking	14	7
Tobacco chewing	2	1
Total	73 out of 200	39.5 out of 100

Table 5. Literacy-wise distribution of the study population.

Status	Total	Percentage (%)
Number of literates	176	88
Number of illiterates	24	12
Total number of patients.	200	100
		P Value < 0.01

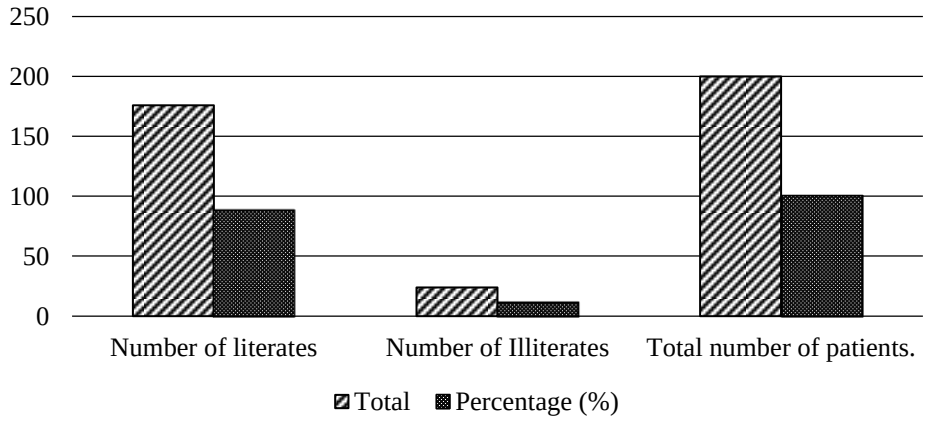

Figure 4. Literacy-wise distribution of the study population.

Table 6. Departmental-wise distribution of the study population.

Name of the Department	Number of Patients	Percentage (%)
General medicine	112	56
Obstetrics and gynecology	88	44
Total number of patients	200	100
		P Value < 0.01

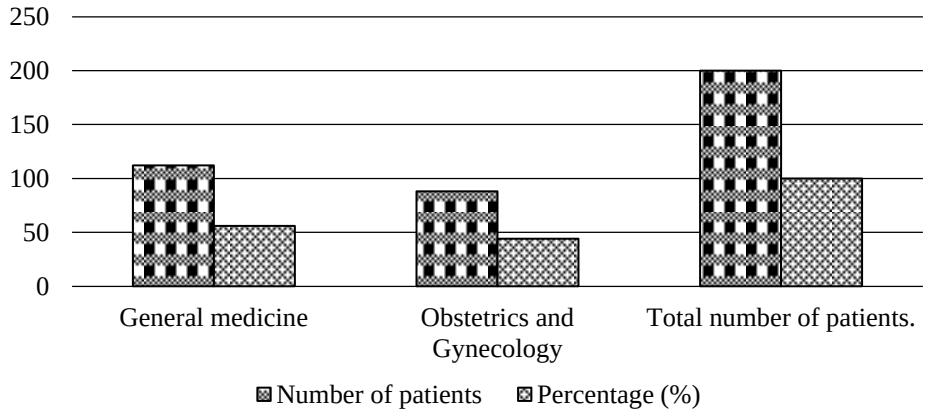

Figure 5. Departmental-wise distribution of the study population.

Table 7. Categories of drugs taken by patients.

Category of Drug
Antihypertensive drugs.
Antithyroid drugs.
Antidiabetic drugs.
Antihistamine drugs.
Bronchodilators.
NSAIDs (non-steroidal anti-inflammatory drugs).
Hormonal contraceptives.
Sulfonamide antibiotics.
Cephalosporin.
Anti-fibrinolytics.
Hormones.
Non-steroidal aromatase inhibitors.
Anti-hyperlipidemic drugs.
Prostaglandin analogue.
Antiplatelets.
Anticholinergics.
Nitrates.
Anti-coagulants.
Diuretics.
Anti-hyperlipidemic drugs.

Table 7 represents the various categories/class of drugs taken by the study population.

DISCUSSION

As per Tables 8 and 9, out of a total of 200 individuals, 45 (22.5%) reported medication allergies, while 52 (26%) acknowledged taking more than three medications daily. Psychological disorders were prevalent in 38 (19%) of the population, with gestational diabetes and anemia during gestation reported by 12 (6%) and 14 (7%) of female participants, respectively. Respiratory diseases were noted in 26 (13%) individuals, while fall history within the last six months was documented in 40 (20%) cases. The application of MFRS and DART tools facilitated comprehensive risk assessment. MFRS identified potential fall risks in 66 (33%) of the population, with recent changes in medications documented in 32 (16%) cases. Antihypertensive drugs were commonly prescribed, with 70 (35%) of participants using them. Additionally, 22 (11%) reported an intake of anti-thyroid drugs. The DART analysis highlighted medication-related concerns, with 40 (20%) of participants using seven or more prescription medicines regularly. Recent initiation of medication within the last four weeks was reported by 26 (13%) individuals. Symptoms such as drowsiness, high blood pressure, and confusion were prevalent among the population, prompting further evaluation. Furthermore, 28 (14%) of participants were using medications with a narrow therapeutic index, necessitating regular monitoring.

Table 8. Medication falls risks core and validation tool.

MFRs Questionnaires	Yes	%	No	%
1. Do you have any medication allergies?	45	22.5	155	77.5
2. Do you take more than 3 medications daily?	52	26	148	74
3. Do you have any psychological disorder?	38	19	162	81
4. Do you have diabetes?	12	6	188	94
5. Do you have anemia?	14	7	186	93
6. Do you need an assistant for walking?	12	6	188	94
7. Do you have any respiratory diseases?	26	13	174	87
8. Is there any history of falls in the previous year?	40	20	160	80
9. Recent changes in medications?	32	16	168	84
10. Do you take antihypertensive drugs?	70	35	130	65
11. Do you take antithyroid drugs?	22	11	178	89

Table 9. Drug-associated risk tool: development and validation.

Questionnaire	Yes	%	No	%
1. Does the patient take seven or more prescription medicines in current regular use?	40	20	160	80
2. Has the patient started taking medicine in the last 4 week?	26	13	174	87
3. Does the patient uses medication that relieve pain by reducing inflammation elevate the rate of urination (diuretics)?	12	6	188	94
4. Are you intended to lower the cholesterol level?	7	3.5	193	96.5
5. Do you follow one of the following applications?	–	–	–	–
*Inhalation device	24	12	176	88
*Syringe for self-injection	29	14.5	171	85.5
*Skin patch	17			
6. Do you have any of the following symptoms?	–	–	–	–
*Drowsiness	38	19	162	81
*High blood pressure	22	11	178	89
*Memory problem	36	18	164	82
*Swelling	19	9.5	181	90.5
*Visual problem	25	12.5	175	87.5
*Confusion	14	7	186	93
7. Does the patient use any of the following medicines? (The list contains drugs with narrow therapeutic index, medicine for which regular monitoring would be necessary and medicine that otherwise are problem for age.)	28	14	172	86
*Amiodarone	4	2	196	98
*Carbamazepine	2	1	198	99
*Digoxin	7	3.5	193	96.5
*Warfarin	4	2	196	98

Note

Microsoft Word Excel was used for recording and analyzing the data of recruited subjects and calculating the mean, standard deviation, etc. Descriptive statistics and Prism Graph Pad software (PRISM 10.11 version) were used for the study to calculate the P-value to state the level of significance, and the P-value for the present study was found to be 0.01, which states the present study is statistically significant.

Permissions/Approvals

The present study got approvals from the Institutional Ethics Committee ABIPER.

Funding Support

The present work hasn't received any grant or financial support.

CONCLUSION

The present research promotes the significance of medication risk assessment tools in promoting the safety of special populations, emphasizing the need for personalized interventions to optimize therapeutic outcomes while minimizing adverse effects.

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