INTRODUCTION

In this 21st century, there is an increment in the life expectancy of the majority of the population around the world; due to improved nutrition, sanitation, medical advances, health care, education, and economic well-being [1]. The global population of the elderly population is projected to reach nearly 2.1 billion by 2050 [2]. The census of 2012 showed the presence of 5.28% of elderly people aged ≥65 years in Nepal [3].

Elderly people aged over 65 years are generally more likely to be on multiple medication or polypharmacy than younger people as they have a higher prevalence of chronic illness, disability, and dependency [4,5]. Due to reasons such as multiple comorbidities and multiple prescribing habits of physicians, polypharmacy is an increasingly serious global problem in the current health-care system. Polypharmacy in the elderly exposes them to adverse consequences such as greater health-care costs, increased risk of adverse drug events, drug-drug interactions (DDIs), medication non-adherence, reduced functional capacity, and multiple geriatric syndromes [6-8].

A potentially inappropriate medication (PIM) is defined as a drug in which the risks associated with prescribing it outweigh its potential benefits, particularly when safer alternatives exist. Inappropriate prescribing causes high cost of treatment, ineffective, unsafe treatment, exacerbation or prolongation of illness, distress, and harm to the patient [9]. Polypharmacy and PIM are commonly encountered scenarios in Nepal [10,11]. Evaluating drug prescribing pattern provides advantageous feedback to prescribers to improve their prescribing behavior and help the policymakers to set the priorities to promote the rational use of medicines nationwide [9]. The Beers Criteria are the most commonly used method for assessing the appropriateness of prescribed drugs for older people in all clinical settings [12-14]. Therefore, this study is aimed to determine the current prescribing pattern and inappropriate prescribing in the elderly population in the western part of Nepal.

METHODS

The study was a prospective cross-sectional study which was conducted in the outpatient department of Manipal Teaching Hospital, Pokhara, Nepal. Patients of all gender and age 65 years and above, who attended the various outpatient departments and hospital pharmacy for purchasing medicines, were included in this study with written consent.

The data were collected from August 2018 to November 2018. The study was approved by Institutional Review Committee (IRC), Pokhara University Research Centre Kaski, Nepal.

Data were collected in a structured pro forma, which include the patient’s demographic details (age and sex) and the department visited by the patient. Diseases and drugs were classified according to the international classification of diseases-10 and the anatomical therapeutic chemical classification, respectively [15,16].

The World Health Organization (WHO) prescribing indicators and Beers’ 2015 updated criteria were assessed to analyze the result.

RESULTS

The mean±standard deviation of the age was 73.47±6.42 years and the majority of patients were in the age group 65–74 (58.81%). Male preponderance (male: female=1.20:1) was found. The value of prescribing indicator includes the average number of drug per prescription (4.91), percentage of generic name prescription (34.0%), percentage of antimicrobials prescribed (19.40%), percentage of injections prescribed (27.0%), and percentage of the drug from essential drug list of Nepal (42.22%). At least one PIM was prescribed to 87 (21.6%) patients. Non-cyclooxygenase-selective nonsteroidal anti-inflammatory drugs (44%) and anticholinergics (18%) were the most frequently prescribed PIMs.

CONCLUSIONS

Polypharmacy, PIMs, and potential drug-drug interaction were prevalent in this study. It is recommended that all the doctors, pharmacists, other concerned health-care professionals, patients, policymakers, and all other stakeholders must be aware of these situations and a multidisciplinary approach must be developed for the promotion of rational use of drugs.

Keywords: Beers Criteria, Elderly patients, Polypharmacy, Potentially inappropriate medicine, Prescribing pattern.

ABSTRACT

Objective: The current study aims to evaluate prescribing pattern and potentially inappropriate medicine (PIM) among elderly patients in a tertiary care hospital of western Nepal.

Methods: A prospective cross-sectional study was conducted in the outpatient department of Manipal Teaching Hospital of Western Nepal. The World Health Organization prescribing indicators and Beers’ 2015 updated criteria were assessed to analyze the result.

Results: The mean±standard deviation of the age was 73.47±6.42 years and the majority of patients were in the age group 65–74 (58.81%). Male preponderance (male: female=1.20:1) was found. The value of prescribing indicator includes the average number of drug per prescription (4.91), percentage of generic name prescription (34.0%), percentage of antimicrobials prescribed (19.40%), percentage of injections prescribed (27.0%), and percentage of the drug from essential drug list of Nepal (42.22%). At least one PIM was prescribed to 87 (21.6%) patients. Non-cyclooxygenase-selective nonsteroidal anti-inflammatory drugs (44%) and anticholinergics (18%) were the most frequently prescribed PIMs.

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Keywords: Beers Criteria, Elderly patients, Polypharmacy, Potentially inappropriate medicine, Prescribing pattern.
Table 1: Age class of the patients

| Age class | Male (n=220, 54.59%) | Female (n=183, 45.41%) | Frequency | Percentage | Average number of drugs |
|-----------|----------------------|------------------------|-----------|------------|-------------------------|
| 65–74     | 118                  | 119                    | 237       | 58.81      | 4.77                    |
| 75–84     | 87                   | 49                     | 136       | 33.75      | 5.10                    |
| ≥85       | 15                   | 15                     | 30        | 7.44       | 5.20                    |

Table 2: Number of medication per prescription

| Number of medicine prescribed | Frequency | Percentage |
|-------------------------------|-----------|------------|
| 1.0                           | 20        | 4.96       |
| 2.0                           | 45        | 11.17      |
| 3.0                           | 71        | 17.62      |
| 4.0                           | 69        | 17.12      |
| 5.0                           | 60        | 14.89      |
| 6.0                           | 38        | 9.43       |
| 7.0                           | 35        | 8.68       |
| 8.0                           | 23        | 5.71       |
| 9.0                           | 22        | 5.46       |
| 10.0                          | 9         | 2.23       |
| 11.0                          | 4         | 0.99       |
| 12.0                          | 3         | 0.74       |
| 13.0                          | 1         | 0.25       |
| 14.0                          | 2         | 0.50       |
| 15.0                          | 1         | 0.25       |

Table 3: Drug prescribing pattern in elderly patients using the WHO core drug indicator

| Prescribing indicators | Findings (%) |
|------------------------|--------------|
| Average number of drugs per prescription | 4.91 |
| Percentage of drugs prescribed by generic name | 3.40 |
| Percentage of prescriptions with antimicrobial(s) | 19.40 |
| Percentage of prescriptions with injection(s) | 2.70 |
| Percentage of drugs prescribed from national essential drug list | 42.22 |

RESULTS

Demographics
A total of 403 patients were enrolled in this study, of which 220 were male (54.59%) and 183 were female (45.41%). The overall mean±standard deviation of age was 73.47±6.43 years. The majority of the patients were in the age group 65–74 (58.81%) followed by age group 75–84 (33.75%) and ≥85 (7.44%). The mean number of drugs prescribed within the age group of 65–74 years was 4.77, for those within the age group 75–84 was 5.10 and within the age group of ≥85 years was 5.20 as shown in Table 1.

Number of medication per prescription and polypharmacy
Most of the patients were prescribed with three medicine followed by four and least were taking 15 medicine. Among 198 (49.13%) patients with polypharmacy, high-level polypharmacy was present on 20 (4.96%) patients, as shown in Table 2.

Drug prescription pattern in elderly patients using the WHO core drug indicator
The total number of drug prescribed to 403 patients was 1980, with an average of 4.91±2.56 per person. The prescribing pattern evaluated based on the WHO core drug use indicator is shown in Table 3.

DISCUSSION
The drug prescription for elderly people affected with multiple chronic diseases with the lurking cases of polypharmacy is a challenging task [20]. Polypharmacy and the prescription of PIMs were frequently encountered among elderly patients enrolled in this study. Among 403 patients enrolled in this study, male preponderance (male:female=1.20:1) was seen in accordance with studies of Basnet et al., (1.95:1) [20], and Rakesh et al. (1.03:1) [21]. The possible reason for male preponderance can be due to easy access to medications, awareness, and comparatively good economic liberty of males in South Asian countries, including Nepal [22].

Prevalence of disease conditions among elderly patients
Diseases from the circulatory system (271, 67.25%) were the most prevalent in which hypertensive patients were 163. Diseases of the circulatory system were followed by endocrine, nutritional and metabolic diseases (91, 22.58%), and respiratory system (87, 21.59%), respectively. The disease classification and comorbidities are shown in Table 5.

Medicines mainly prescribed in elderly
Most drugs prescribed were cardiovascular (29.75%) followed by those of alimentary tract and metabolism (24.09%). The detailed classification of drug prescribed is shown in Table 6.

PIM use for the elderly based on Beers Criteria
In the total of 1980 drugs prescribed, 100 (5.05%) were found to be potentially inappropriate. At least one case of PIM prescription was found in every 87 (21.6%) cases. Non-cyclooxygenase-selective nonsteroidal anti-inflammatory drugs (NSAIDs) (44%) followed by anticholinergics (18%) were most frequently prescribed, as shown in Table 7.

Most frequently prescribed drugs with potential DDI
All the prescribed drugs were checked for DDI using Medscape drug interaction checker and 210 (52.10%) of the prescription were detected with at least one potential DDI, as shown in Table 8. Pantoprazole and digoxin was the most frequently prescribed drug with potentially serious DDIs. All the interaction listed in Table 8 has the possibility of interaction requiring caution and monitoring.

Department wise categorization of prescription
In this study, most of the enrolled patients were from the medicine department (68.73%) followed by orthopedics (15.63%) and surgery (9.43%), as shown in Table 4.
**Table 5: Prevalence of disease conditions among elderly patients**

| Disease group                              | Specific condition                        | Number | Total (percentage of comorbidity) |
|--------------------------------------------|-------------------------------------------|--------|---------------------------------|
| Circulatory system                         | Hypertension                              | 163    | 271 (67.25)                     |
|                                            | Others                                    | 108    |                                 |
| Endocrine, nutritional, and metabolic      | Diabetes mellitus                         | 64     | 91 (22.58)                      |
| diseases                                   | Endocrine disorder                        | 27     |                                 |
| Respiratory system                         | Chronic obstructive respiratory disease    | 57     | 87 (21.59)                      |
|                                            | Others                                    | 30     |                                 |
| Musculoskeletal system and connective      | Rheumatoid arthritis                      | 7      | 70 (17.37)                      |
| tissue                                     | Others                                    | 63     |                                 |
| Digestive system                           | Peptic ulcer, gastritis, and duodenitis    | 20     | 44 (10.92)                      |
|                                            | Others                                    | 24     |                                 |
| Genitourinary system                       | Benign prostatic hyperplasia              | 15     | 39 (9.68)                       |
|                                            | Renal failure                             | 8      |                                 |
|                                            | Others                                    | 16     |                                 |
| Eye and adnexa                             | Conjunctivitis                            | 6      | 25 (6.20)                       |
|                                            | Cataract                                  | 5      |                                 |
|                                            | Others                                    | 14     |                                 |
| Nervous system                             | Sleep disorders and others                | 17     | 17 (4.22)                       |
| Certain infectious and parasitic diseases  | Bacterial, viral, and other infections    | 17     | 17 (4.22)                       |
| Skin and subcutaneous tissue              | Urticaria, erythema, and others           | 14     | 14 (3.47)                       |
|                                            | Anorexia and other                        | 12     | 12 (2.98)                       |
| Symptoms, signs and abnormal clinical and  |                                           |        |                                 |
| laboratory findings, not elsewhere classified |                                           |        |                                 |
| Mental and behavioral disorders            | Schizophrenia and others                  | 9      | 9 (2.23)                        |
| Ear and mastoid process                    | Disorder of internal, middle, and external ear | 6    | 6 (1.49)                        |
| Blood and blood-forming organs and certain disorders involving the immune mechanism | Anemia | 5 | 5 (1.24) |

% Calculated from a total of 403 patients

**Table 6: Medicines mainly prescribed in elderly**

| Anatomical therapeutic chemical system main group | Medicines mainly used                      | No. of drugs | Total (percentage) |
|-------------------------------------------------|--------------------------------------------|--------------|--------------------|
| Alimentary tract and metabolism                 | A02BC Proton pump inhibitors               | 209          | 477 (24.09)        |
|                                                 | A10 Drugs used in diabetes                 | 95           |                     |
|                                                 | A12 Mineral supplements                     | 81           |                     |
| Blood                                           | Others                                      | 92           |                     |
|                                                 | B01AC Platelet aggregation inhibitors excl. heparin | 128          | 197 (9.95)         |
|                                                 | B03 Antianemic preparations                | 24           |                     |
|                                                 | Others                                      | 45           |                     |
| Cardiovascular                                  | C01DA Organic nitrates                     | 21           | 589 (29.75)        |
|                                                 | C03 Diuretics                              | 118          |                     |
|                                                 | C07 Beta blocking agents                   | 99           |                     |
|                                                 | C08 Calcium channel blockers               | 59           |                     |
|                                                 | C09 Agents acting on renin-angiotensin system | 132     |                     |
|                                                 | C10AA HMG CoA reductase inhibitors         | 113          |                     |
|                                                 | Others                                      | 47           |                     |
| Derma                                           | D01 Antifungals for dermatological use     | 11           | 25 (1.26)          |
|                                                 | D07 Corticosteroids, dermatological preparations | 7           |                     |
|                                                 | Others                                      | 7            |                     |
| Genitourinary system                            | G04 Urologicals                            | 37           | 37 (1.87)          |
| Systemic                                        | H02 Corticosteroids for systemic use       | 18           | 37 (1.87)          |
|                                                 | H03 Thyroid therapy                        | 19           |                     |
| Anti-infective                                  | J01C Beta-lactam antibacterials, penicillins | 22           | 102 (5.15)         |
|                                                 | J01F Macrolides, lincosamides, and streptogramins | 18           |                     |
|                                                 | Others                                      | 62           |                     |
| Antineoplastic                                  | L01 Antineoplastic agents                  | 2            | 2 (0.10)           |
| Musculoskeletal                                 | M01A Anti-inflammatory and antirheumatic products, nonsteroids | 67           | 118 (5.96)         |
| Systemic                                        | Others                                     | 51           |                     |
| Nervous System                                  | N02 Analgesics                             | 40           | 121 (6.11)         |
|                                                 | N03 Antiepiletics                          | 33           |                     |
|                                                 | Others                                     | 48           |                     |
| Antiparasitic                                   | P02 Anthelminics                          | 10           | 10 (0.51)          |
| Respiratory                                     | R03 Drugs for obstructive airway diseases  | 133          | 218 (11.01)        |
|                                                 | Others                                     | 85           |                     |
| Sensory                                         | S01 Ophthalmologicals                      | 28           | 47 (2.37)          |
|                                                 | Others                                     | 19           |                     |

% Calculated from a total of 1980 drugs
to be administered with four. These findings were similar to the study conducted by Kanagasanthosh et al., in which the majority of patients were administered with two medications and to a lesser content were administered with three, four, and five medicines [23]. The difference in the number of medicines in this study might be due to many factors such as the case of ailments and trends in prescription patterns [24].

With regard to the WHO drug prescribing indicator, the average number of drugs prescribed per individual in this study (4.91) was found concordant with another study conducted in Nepal [5.56] [20] and in India (4.8) [21]. However, the finding was higher than that found in Turkey (2.9 ±2.0) [25] and lower than that found in Argentina (6.1±2.7) [26]. The higher number of drugs prescribed can be stated as a practice of polypharmacy, which has been repeatedly found in various studies conducted in Nepal [10,20]. The percentage of medicines prescribed by their generic names was found to be 3.40% which was, however, found to be higher in similar studies carried out in India (12.60%) [27] and in Pakistan (56.6%) [28]. The decrement in the rate of prescription of medicines by their generic names can be due to the inefficient practice of prescribing medicines by their brand names for the sake of business. Prescribing by generic name allows flexibility of stocking and dispensing various brands of a particular drug that is cheaper than but as effective as proprietary brands [27].

In this study, percentage of antibiotics prescribed during the study period was found to be 19.40% which was similar to the findings of Sapkota et al., (18%) [11] in Nepal but higher than that found by Tasker et al., (3.62%) [29] in India. The judicial use of antibiotic is important to prevent the emergence of resistance and is recommended to be prescribed only after sample culture and sensitivity test [23]. Percentage of prescriptions with injection(s) being prescribed in this study was found to be 2.70%, which is lower than that found in a study conducted in India (26.33%) [23] but higher than that found in a study in Nigeria (0.8%) [30]. The possible reason for minimum cases of prescription of injection in this study may be due to the fact that the patients enrolled were of the outpatient department and injections were prescribed only for diabetic patients. Patient factor, cost factor, prescriber's habit, and risk of infection through the parenteral route often affect the prescription of injection(s) [23].

Percentage of medicines prescribed which belong to the national essential medicines list was found to be 42.44% which was lower than that found in a study carried out in Kathmandu, Nepal (75%) [11] and also lower than the result found in a study in Pakistan (98.8%) [28]. It is recommended to make usage of drugs enlisted in the essential drug list so that optimal use of limited financial resources takes place and also to have acceptable safety and satisfaction of the health needs of the majority of the population [11]. The reason for least number of medicines prescribed from the essential medicine list could be related to a lack of awareness about essential drug concept and essential drug list among prescribers along with irrational prescribing habits [11,31].

In this study, most commonly visited departments by elderly patients were found to be of medicine (68.73%) and orthopedics (15.63%); this finding was similar to that of a study in India where elderly patients most commonly visited the medicine department (28.83%), which was followed by the orthopedic department (25%) and cardiology department (15.83%) [23]. This pattern of patients visiting respective departments can be attributed to the fact that most of the patients in the study were suffering from hypertension, diabetes mellitus, chronic obstructive respiratory disease, and metabolic disorders.

Cases of polypharmacy were found common among 49.10% of patients enrolled in this study; this value was found to be lower than that found in a study conducted in Bharatpur, Chitwan, Nepal (86.66%) [10] but greater than that found in a study in Italy (39.4%) [32]. Along with polypharmacy, multiple comorbidities were found among the patients. In this study, most of the patients were suffering from hypertension (n=163, 40.45%), ischemic heart disease, and other cardiovascular diseases (n=108, 26.80%) and also from diabetes mellitus (n=64, 15.88%). These findings were similar to the findings of another study carried out in Nepal and India [20,21]. Polypharmacy is common in the elderly due to multiple comorbidities and inappropriate prescribing trends among physicians [7]. Most of the drugs prescribed in this study were from Group C (cardiovascular drugs – 589, 29.75%), Group A (alimentary and metabolism drugs – 477, 24.09%), and Group R (respiratory drugs – 218, 11.01%). This is similar to the findings in another study conducted by Basnet et al., in Nepal [10]. These kinds of prescriptions can be due to the fact that most of the patients in the study were suffering from circulatory, endocrine-metabolic, and respiratory disorders.

Of total 403 prescriptions in this study, 87 (21.6%) prescriptions were found to be potentially inappropriate which was similar to the findings of studies conducted in Nepal (26.3%) [20], India (19.9%) [21], and Netherlands (20%) [33]. However, it was lower than that found by another study in Nepal conducted by Basnet et al., which demonstrated 34.67% inappropriate prescriptions [10]. This study also shows that NSAIDs were commonly encountered class of PIMs which constitute 44% of total cases; this finding is similar to that reported in India (30.66%) [23].

This study also shows that 210 (52.10%) of the total prescriptions had drug interactions which are similar to the findings of another study done in Nepal that showed 48.9% drug interaction cases [10]. This study had one case of contraindicated reaction and 36 cases of serious interactions. Digoxin-pantoprazole was the frequently prescribed combination (11 patients) having potential DDIs. The possible reason for the higher DDI might be due to the cases of multiple comorbidities, polypharmacy, and multiple prescriptions by physicians [7].

![Table 7: Potentially inappropriate medication use for the elderly based on Beers Criteria](image-url)

**Table 7: Potentially inappropriate medication use for the elderly based on Beers Criteria**

| Medications and class to avoid in older adults | Name of drug | Number of drugs | Frequency (%) |
|---------------------------------------------|--------------|----------------|---------------|
| **Anticholinergics**                        | Chlorpheniramine | 6 | 18 |
|                                              | Ciproheptadine   | 5 |   |
|                                              | Hydroyzine       | 3 |   |
|                                              | Tripolidine      | 4 |   |
| **Antiparkinsonian agents**                 | Trihexyphenidyl  | 2 | 2 |
| **Anti-infective**                          | Nitrofurantoin   | 4 | 4 |
|                                              | Alprazolam       | 1 | 7 |
|                                              | Clonazepam       | 6 |   |
| **Cardiovascular**                          | Prazosin         | 5 | 13 |
|                                              | Methyldopa       | 3 |   |
|                                              | Digoxin (>0.125 mg/day) | 1 |   |
| **Central nervous system**                  | Amitriptyline    | 4 | 7 |
|                                              | Nortriptyline    | 2 |   |
|                                              | Paroxetine       | 1 |   |
| **Non- cyclooxygenase-selective NSAIDs**    | Diclofenac       | 10| 44|
|                                              | Ibuprofen        | 1 |   |
|                                              | Naproxen         | 15|   |
|                                              | Indomethacin     | 4 |   |
|                                              | Ketorolac        | 14|   |
| **Skeletal muscle relaxants**               | Chlorzoxazone    | 5 | 5 |

*% Calculated from 100 PIMs drugs*
CONCLUSIONS

Polypharmacy and prescription of inappropriate medication with potential DDI were observed in this study. The cases of prescriptions by generic names were found to be low, and thus efforts to encourage prescribing by generic name should be initiated. It is recommended that all the doctors, pharmacists, other concerned health-care professionals, patients, policymakers, and all other stakeholders must be aware of these situations and a multidisciplinary approach must be developed for the promotion of rational use of drugs.

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AUTHORS’ CONTRIBUTIONS

Sagarananda Giri, conception, data collection, data analysis, interpretation, and drafting of the article. Gulam Muhammad Khan conceptualized the study design and proofreading of the manuscript.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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| Interaction | Drugs | No. of interaction | Comment |
|------------|-------|-------------------|---------|
| Contraindicated | Warfarin+clopidogrel | 1 | Increases effects of other by pharmacodynamic synergism. Increased risk of bleeding |
| Serious | Pantoprazole+digoxin | 11 | Increasing gastric pH, pantoprazole increases digoxin absorption and toxicity |
| | Digoxin+metoprolol | 17 | Pantoprazole decreases effects of clopidogrel by affecting hepatic enzyme |
| Monitor closely | Spironolactone+furosemide | 58 | Monitor serum potassium level |
| | Metoprolol+losartan | 42 | Monitor serum potassium level |
| | Losartan+furosemide | 39 | Monitor serum potassium level |
| | Metoprolol+furosemide | 37 | Monitor serum potassium level |
| | Losartan+spironolactone | 37 | Monitor serum potassium level |
| | Pantoprazole+clopidogrel | 31 | Monitor serum potassium level |
| Others | Aspirin+furosemide | 30 | Aspirin decreases effects of furosemide by pharmacodynamic antagonism |
| | Metformin+furosemide | 9 | Metformin decreases levels of furosemide by unspecified interaction mechanism |
| | Aspirin+glimepiride | 7 | Aspirin increases effects of glimepiride by plasma protein binding competition |
| Others | 641 | | |
| Minor | Aspirin+furosemide | 30 | Aspirin increases effects of furosemide by pharmacodynamic antagonism |
| | Metformin+furosemide | 9 | Metformin decreases levels of furosemide by unspecified interaction mechanism |
| | Aspirin+glimepiride | 7 | Aspirin increases effects of glimepiride by plasma protein binding competition |
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