

Geriatric Prescription in a Nigerian Tertiary Hospital

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ABSTRACT

Objectives: To assess the medications prescribed for elderly inpatients on specific days during hospital admission with a view to detecting areas of irrational prescription. **Methods:** It was a prospective study of all patients aged 65 years and above admitted to the medical wards of a Nigerian tertiary hospital over a 12-month period. The World Health Organization/International Network of Rational Use of Drugs (WHO/INRUD) drug use indicators were used to assess drug prescriptions on various days of admission. **Results:** A total of 1513 patient encounters involving 345 patients aged between 65 and 92 years were assessed on hospital days 1, 3, 5, 7, 14, and 28. The average number of medicines per encounter ranged from 6.1 ± 2.5 on hospital day 1 to 7.8 ± 2.4 on hospital day 28. This difference was statistically significant ($F = 14.42$; $P < 0.05$). The percentage of encounters with an antibiotic prescribed ranged from 50.4% on hospital day 1 to 62.9% on hospital day 28 while the percentage of encounters with an injection prescribed decreased from 72.8% on hospital day 1 to 50.0% on day 28. **Conclusions:** This study suggests some degree of irrational prescribing as evident by the high average number of medicine

per encounter and the high percentages of encounters with an antibiotic or injection prescribed. However, there is a need to develop standard values for the WHO/INRUD indicators based on the recently published national treatment guidelines for common elderly diseases which will serve as yardsticks to assess elderly inpatients prescriptions using WHO/INRUD core indicators in future studies.

Key words: Elderly, hospital inpatients, pharmacotherapy, standard values, World Health Organization drug use indicators

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INTRODUCTION

Irrational use of medicines is a global problem, and the cost implication is enormous.^[1] The use of medicines is said to be rational when patients receive medications appropriate to their clinical needs, in doses that meet their own individual requirements, over an adequate period of time, and at the lowest cost to them and their community.^[2] Irrational prescription of medicines exist in various forms, for example, polypharmacy, inappropriate use of antimicrobials/injections, and failure to prescribe in accordance with clinical guidelines among others.^[2]

The subject of irrational prescription is of utmost importance regarding pharmacotherapy in the elderly since they use more medicines than the younger population and are at a high risk for developing adverse drug events. Nigeria is not left out of the current demographic transition characterized by increase in the elderly population and this further justifies the need for this study. Nigeria is Africa's most populous country with well over 160 million people. Although the population of Nigeria is currently a relatively young one, the United Nations estimated that the proportion of elderly Nigerians will increase from 2.7% in 2010 to 3.8% by 2050 when Nigeria by estimate will be the third most populous nation on the earth.^[3,4] The country's elderly population, however, appears to be increasing faster than estimated, as the elderly account for 3.2% of the 2006 population census.^[5]

The World Health Organization/International Network of Rational Use of Drugs (WHO/INRUD) drug use indicators have proven to be a useful tool in assessing rational use of medicines in various hospital settings. Although these indicators were developed for outpatient use of medicines, they have also been found useful in the study of inpatient use of medicines.^[6,7] These indicators have revealed various levels of irrational use of medicines in Nigerian outpatient clinics. The use of these indicators to assess inpatient drug has been rather sparse though

periods of hospitalization are times of increased used of medicines. The absence of standard values for WHO/INRUD drug use indicators for inpatients prescription is another limiting factor for the use of these indicators for inpatient prescriptions' assessment.

Using the WHO/INRUD drug use indicators, we studied the prescriptions of medicines for elderly patients on various days of admission with a view to profiling the use of medicines in the elderly and detecting areas of irrational prescription. While this study is on the prescription patterns based on the WHO/INRUD drug use indicators for elderly patients, further studies aimed at developing standard values that will serve as yardsticks to assess the WHO/INRUD drug use indicators for elderly inpatients are being suggested.

METHODS

This was a prospective study of prescriptions of medicines on hospital days 1, 3, 5, 7, 14, and 28 for patients aged 65 years and above admitted in the medical wards of Nnamdi Azikiwe University Teaching Hospital (NAUTH), Nnewi, from January 2009 to December 2009. The patients were followed up till discharge, some in 2010. NAUTH is the largest tertiary hospital and referral center in Anambra state, Southeast Nigeria. The 350-bed hospital has two medical wards (a male ward and a female ward), with 36 beds each. Patients requiring care from all clinical

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subspecialties' in internal medicine are admitted to these wards through the emergency department or from the medical outpatient clinics.

On admission, patients' demographic data and relevant medical details including drug prescriptions were obtained. Patients were followed up until discharge or death. Prescription of medicines on hospital days 1, 3, 5, 7, 14, and 28 was entered into a case report form and each day's prescription was considered a drug encounter. According to the WHO document "How to investigate drug use in health facilities," surveys describing current treatment practices should have at least 600 drug encounters with a greater number, if possible.^[8] According to the same document, studies that involve comparisons of health facilities or prescribers should have more than 30 drug encounters but preferably 100 drug encounters per facility or prescriber to give the total 600 or more drug encounters.^[8]

The hospital days (1, 3, 5, 7, 14, and 28) were chosen because of the dynamics in drug prescriptions occurring during these periods of hospital admissions, especially the 1st week of admission. Drugs are prescribed for patients admitted through the emergency room on hospital day 1 by both the attending emergency room doctor and the medical officers on call in the medicine department. During hospital days 3–7, there are varying levels of specialist review of the patients, most investigations results will be available, diagnosis will be established, and a definitive treatment will be commenced for most patients. These processes involve varying degree of changes in drug prescriptions. Most patients with acute illness are treated within this 1st week of admission while those patients staying longer than the 1st week are not spared from further changes in their drug prescriptions.

All patients aged 65 years and above admitted in the medical wards of the NAUTH, Nnewi, during the study period were included in the study if they gave informed consent or consent was obtained from caregivers/relatives for patients who had impaired level of consciousness. Patients already on admission prior to the time of commencement of the study were excluded from the study.

The information obtained was used to characterize the prescribing patterns by determining the following WHO/INRUD prescribing indicators:^[8] the average number of medicines prescribed per encounter, percentage of medicines prescribed by generic name, percentage of encounters with an antibiotic prescribed, percentage of encounters with an injection prescribed, and percentage of medicines prescribed from essential medicines list or formulary.

Metronidazole was included as an antibiotic in this present study contrary to the recommendation of the WHO because for most part it was used as an antibiotic against anaerobic organisms rather than as an antiamebic agent. Antituberculous drugs were not included as antibiotics as recommended by the WHO protocol for studying drug use patterns in health facilities.^[8] The Nigerian essential drug list (EDL), 4th Revision 2003, published by the Federal Ministry of Health in collaboration with the WHO, was used for analysis because it was the extant edition at the time of the study. The Anatomical Therapeutic Chemical (ATC) Classification was used to characterize the classes of drugs prescribed. ATC classification system is a 5-level coding system recommended by the WHO.^[9] This system classifies drugs into 14 main anatomical groups, each divided into therapeutic subgroups that are further subdivided according to chemical group and the particular chemical substance. Patients' primary diagnosis was characterized using the WHO-recommended International Classification of Diseases and Health related problems 10th Revision, 2007.^[10]

Ethical approval for the study was obtained from the Ethical Committee of the NAUTH, Nnewi. Informed consent was obtained from the patients. Caregivers acted as proxy for patients who were unable to communicate.

Data were analyzed using the Statistical Package for the Social Sciences (SPSS version 15.0 for Windows XP, Chicago, IL, USA). Relevant percentages, frequencies, means, and standard deviations were calculated. Analysis of variance was used to compare the WHO core indicators on various days of encounter with the level of significance at $P < 0.05$. Findings were represented with relevant tables and charts.

RESULTS

Three hundred and forty-five patients were admitted during the period of study. They were aged between 65 and 92 years with a mean age of 72.41 ± 6.6 . Two hundred and twenty-one (64.1%) were males while 124 (35.9%) were females.

A total of 1513 drug encounters were assessed as follows: 345 patient encounters on hospital day 1, 336 on day 3, 312 on day 5, 283 on day 7, 175 on day 14, and 62 on hospital day 28. The average values of the prescribing indicators for the total duration of stay were assessed as shown in Table 1. The average number of medicines prescribed per encounter was 6.6 ± 2.4 . The percentage of medicines prescribed by generic name was 73% while the percentage of medicines prescribed from the National EDL was 81%. An antibiotic was prescribed in 59.9% of the encounters, and the percentage of encounters with an injection prescribed was 60%. The number of antibiotics prescribed to be taken daily for encounters with two or more antibiotics prescribed were 2, 3, and 4 antibiotics in 27.6%, 3.1%, and 0.13%, respectively. The number of injections prescribed for encounters with two or more injections prescribed to be administered daily were 2, 3, 4, and 5 or more injections in 14.8%, 10.9%, 5.6%, and 2.0% encounters, respectively. The injections prescribed on hospital day 28 were insulin for 37.1% ($n = 23/62$) of the patients, ceftriaxone for 11.3% ($n = 7/62$), gentamicin for 6.5% ($n = 4/62$), and metronidazole for 4.8% ($n = 3/62$). Other injections prescribed were artemether, pentazocine, diclofenac, and enoxaparin for 1.6% ($n = 1/62$) each [Table 1].

Table 2 shows the prescribing indicators for the various days on admission surveyed. The average number of medicines per encounter ranged from 6.1 ± 2.5 on hospital day 1 to 7.8 ± 2.3 on hospital day 28. There was a gradual increase in the average number of medicines per encounter as the admission days increased and this difference was statistically significant ($F = 14.016$; $P = 0.000$). The percentage of encounters with an antibiotic prescribed increased from 50.4% on day 1 to 65.4% on day 7 but decreased to 62.9% on day 28. There was a decrease in the percentage of encounters with an injection prescribed from 72.8% on day 1 to 50.1% on day 28. The percentage of medicines prescribed by generics ranged from 76.7% on day 1 to 72.9% on day 28, while the percentage of medicines prescribed from the EDL ranged from 84.3% on day 1 to 82.2% on day 28. The variations in the various WHO core indicators were statistically significant [Table 2].

The major classes of medicines prescribed were vitamins, 82.9% ($n = 286$), antibiotics for systemic use, 72.8% ($n = 251$), and analgesics, 60% ($n = 207$) [Table 3]. Others were intravenous fluid for 56.2% ($n = 194$), diuretics for 54.8% ($n = 189$), and renin-angiotensin-related drugs for 52.2% ($n = 180$). Antithrombotics

Table 1: The World Health Organization/International Network of Rational Use of Drugs core drug use indicators values

Prescribing indicator	Value
Average number of medicines per encounter	6.6±2.4
Percentage of medicines prescribed by generic name	73.4
Percentage of medicines prescribed from essential medicines list	82.9
Percentage of encounters with an antibiotic prescribed	59.9
Percentage of encounters with an injection prescribed	60.0

and antimalarials were prescribed for 48.1% ($n = 163$) and 45.2% of the patients ($n = 156$), respectively. The various classes of antibiotics prescribed were quinolones for 55.4% ($n = 191$), followed by cephalosporins for 40% ($n = 138$), and metronidazole for 39.7% of the patients ($n = 137$). Penicillins were prescribed for 10.1% ($n = 35$) of the patients while the other classes of antibiotics were prescribed for <10% of the patients each [Tables 3 and 4].

The prominent diagnostic categories that were the primary diagnosis accounting for the elderly admissions are shown in Table 5. The diseases of the circulatory system accounted for 40.6% ($n = 140$), endocrine and metabolic diseases in 18.3% ($n = 63$), and certain infectious and parasitic diseases in 15.1% ($n = 52$) of the patients [Table 5].

DISCUSSION

The overall average number of medicines per encounter on the various days on admission was high in our study. The average number of medicines per encounter is an index of the degree of polypharmacy. Although the precise minimum number of medication used to define polypharmacy is variable, it generally ranges from 5 to 10.^[11] However, in certain clinical conditions where patients present with multimorbidities, the rational use of multiple medications can be justified.^[12] In our study, the overall average number of medicines per encounter on the various hospital days was 6.6 ± 2.4 but significantly increased from 6.1 ± 2.5 on hospital day 1 to 7.8 ± 2.3 on hospital day 28. The number of medicines per encounter in our study was less than the 8 ± 0.2 drugs per encounter reported among elderly patients admitted in an Indian tertiary health-care facility.^[7] Direct comparison of research results is not as useful as using standard values in the assessment and judgment of the quality of prescriptions. Standard values are developed for specific regions because of differences in clinical case mix between different regions and when available such standard values act as yardsticks for measurements of drug use indicators in those regions. Standard values for the drug use indicators have been developed for outpatient prescriptions in developing countries but not for inpatients. The differences in morbidity mix between outpatients and inpatients

will limit direct application of these values for inpatients. In developing countries, 1.6–1.8^[13] number of medicines per encounter is the WHO standard value for the average number of drugs per encounter for outpatients prescriptions. Currently, there are no standard values for inpatient prescription assessments.

In the elderly with multiple chronic diseases, many medicines may be used as found among diabetic and heart failure patients.^[12] However, it is always safe to remember that the use of many medicines is an independent risk factor for adverse drug events irrespective of the age.^[14]

Irrational prescription was also noted in the percentage of encounter with an antibiotic prescribed in our study. In our study, the average percentage of encounters with an antibiotic prescribed was 59.9% but ranged from 50.4% on hospital day 1 to 65.4% on hospital day 7. Although <70% to 88.2% reported in other drug use studies among elderly inpatients,^[7,15] it appears to represent an overprescription of antibiotics. It is also of interest that two or more antibiotics were prescribed to be taken daily in about 31% (466/1513) of drug encounters in this present study. Appropriate antibiotic prescription is the first step for optimum antibiotic use and determination of their rational use may be obtained by a more in-depth audit. Rational combination of antibiotics to provide a broad antibacterial coverage is justifiable in certain clinical settings, but whether the combination for each individual case in this present study is justified was not determined. Rational use of antibiotics has the potential to reduce the development of resistant microorganisms and also reduce cost of management. Previous workers and the WHO have noted that antibiotics are commonly prescribed without sound justification.^[16,17]

The pattern of antibiotic prescriptions in this present study also showed a tendency toward prescribing newer and more expensive antimicrobial agents such as cephalosporins and quinolones. A similar finding was reported from Nepal,^[18] and the possible reasons for such antibiotic prescription patterns include unbridled advertisement, promotion and sale of antibiotics by drug sale representatives.^[19] Assumption by attending physicians that older classes of antibiotics

Table 2: Comparison of the World Health Organization drug use indicators values on various hospital days

WHO indicators	Day 1 (n=345)	Day 3 (n=336)	Day 5 (n=312)	Day 7 (n=283)	Day 14 (n=175)	Day 28 (n=62)	ANOVA (one-way) F, P
Average number of drugs	6.1±2.5	6.4±2.3	6.6±2.3	6.8±2.4	7.7±2.7	7.8±2.3	14.016, 0
Percentage of drugs prescribed by generic name	73.4	72.6	74.4	74.0	71.8	73.0	9.515, 0
Percentage of drugs prescribed from national EDL	80.7	81.5	85.4	85.2	81.6	82.2	13.493, 0
Percentage of encounters with an antibiotic prescribed	50.4	58.3	64.1	65.4	64.0	62.9	4.292, 0.001
Percentage of encounters with an injection prescribed	72.8	62.2	57.1	54.1	49.1	50.0	8.539, 0

EDL: Essential drug list, ANOVA: Analysis of variance, WHO: World Health Organization

Table 3: The major classes of drugs prescribed classified according to the Anatomical Therapeutic and Chemical classification

ATC group	ATC class/drug class	Number of patients	Percentage
Alimentary tract and metabolism	A11 – Vitamin	286	82.9
Anti-infectives for systemic use	J01 – Antibacterial for systemic use	251	72.8
Nervous system	N02 – Analgesics	207	60.0
Various	Intravenous infusions	194	56.2
Cardiovascular system	C03 – Diuretics	189	54.8
Cardiovascular system	C09 – Angiotensin-related agents	180	52.2
Blood and blood forming organs	B01 – Antithrombotic	163	48.1
Anti-parasitic products	P01 – Antimalarials	156	45.2

ATC: Anatomical Therapeutic Chemical

would have been used at referral centers may also be contributory. In previous Nigerian studies, penicillins, cotrimoxazole, gentamicin, and tetracycline were the most frequently prescribed antibiotics in private health institutions and secondary health centers.^[16,20] Quinolones were the most frequently prescribed class of antibiotics in this present study followed by the third-generation cephalosporins and metronidazole.

The percentage of encounters with an injection prescribed found in our study also indicated irrational drug prescriptions. The percentage of encounter with injection prescribed was 72.8% on hospital day 1, this however decreased to 50.0% by hospital day 28. The average percentage value of encounters with an injection prescribed on the various hospital days was 60% in our study and it is comparable to 60% and 62% reported in Ghana and Eastern Nepal, respectively,^[21,22] but <86.4% reported for elderly inpatients in India.^[7] Overuse and misuse of injections are commonly encountered in developing countries.^[23] Administration of drugs through the parenteral route entails additional expenditure, efforts, and hazards. Parenteral drugs are converted to oral routes when the severity of the illness reduces and patients can tolerate orally, except for drugs administered only through parenteral routes. The average percentage value of encounters of 50.0% on day 28 may suggest that nearly half of the patients staying up to 4 weeks on admission were either in a poor state of health and could not tolerate orally or were on medicines administered through parenteral routes only. For instance, in this study, the proportion of patients on insulin was 37.1%. Besides these reasons, the overprescription of injections might be the possible explanation.

In almost three quarters (73%) of cases in our study, prescriptions were in generic names while in more than three quarter (80%), medicines prescribed were listed in the EDL. Although these are below the 100% value recommended for both indicators by the WHO,^[13] there is still a latitude for improvement. Using generic names reduces confusion

relating to drug names particularly in the elderly. In a study of 204 elderly patients undergoing a multidisciplinary home medicines review, Sorensen *et al.*^[24] reported that one in ten patients was actually using multiple brands or types of the same drug.

Vitamins were the most frequently prescribed class of drugs. While the prescription of vitamins are justifiable to improve the healing process, especially when dietary patterns are inadequate in the elderly, tendency toward misuse abound.^[25,26] Analgesics which are among the most frequently used medicines for the elderly^[27] were prescribed for 60% of the patients in this present study. Vitamins and analgesics, though relatively safe, are the most commonly inappropriately or irrationally used drugs in many countries.^[8]

Intravenous fluids were prescribed for 56.2% of the patients in this present study in the course of hospital admission. This agrees with other studies on elderly where intravenous fluids were prescribed in 34.8% and 61% of elderly inpatients admitted in Western and Eastern Nepal, respectively.^[22,28]

Cardiovascular drugs were widely prescribed for the patients and this follows the high frequency of cardiovascular diseases among the patients. Among the cardiovascular drugs, diuretics (54.8%) and renin-angiotensin-related drugs (52.2%) were the most frequently prescribed classes of medicines. The high prescription of use of agents acting on the renin-angiotensin system is in keeping with their current recommendations in older hypertensive patients^[29] and their indication in heart failure and as renoprotective agents in diabetic patients.

CONCLUSIONS

This study outlines the profile of the use of medicines among the elderly in a Nigerian teaching hospital. It suggests some degree of irrational prescribing by physicians attending to this population of patients as evident by the average number of medicine per encounter and the percentages of encounters with an antibiotic or injection prescribed in the study. We suggest further studies to developed standard values for the WHO/INRUD indicators based on the recently published national treatment guidelines for common elderly diseases which will serve as yardsticks for the assessment of elderly inpatients prescriptions using WHO/INRUD core indicators.

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Conflicts of interest

There are no conflicts of interest.

Table 4: Distribution of the various classes of antibiotics prescribed

Class of antibiotic	Number of patients	Percentage of total population (n=345)
Quinolone	191	55.4
Cephalosporins	138	40.0
Metronidazole	137	39.7
Penicillins	35	10.0
Aminoglycosides	22	6.4
Macrolides	21	6.3
Sulfonamides + trimethoprim	10	2.9
Others*	9	2.6

*Others (nitrofurantoin, 4; carbapenems, 3; tetracyclines, 2)

Table 5: Percentage distribution of the primary diagnosis classified using the International Classification of Diseases 10th revision

Disease	Male (% of total male n=345)	Female (% of total female n=345)	Total (% of total population n=345)
Diseases of the circulatory system	89 (25.8)	51 (14.8)	140 (40.6)
Endocrine, nutritional, and metabolic diseases	40 (11.6)	23 (6.7)	63 (18.3)
Certain infectious and parasitic disease	34 (9.9)	18 (5.2)	52 (15.1)
Diseases of the digestive system	22 (6.4)	9 (2.9)	31 (9.0)
Neoplasms	8 (2.3)	7 (2.0)	15 (4.4)
Diseases of the nervous system	9 (2.6)	5 (1.4)	14 (4.1)
Diseases of the respiratory system	8 (2.3)	5 (1.4)	13 (3.7)
Diseases of the genitourinary system	5 (1.4)	1 (0.3)	6 (1.7)
Diseases of the skin and subcutaneous tissues	3 (0.9)	2 (0.6)	5 (1.4)
Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	3 (0.9)	1 (0.3)	4 (1.2)
Mental and behavioral disorders	0	2 (0.6)	2 (0.6)
Total	221 (64.1)	124 (35.9)	345 (100.0)

REFERENCES

- Hogerzeil HV. Promoting rational prescribing: An international perspective. *Br J Clin Pharmacol* 1995;39:1-6.
- World Health Organization. The Rational Use of Drugs. Report of the Conference of Experts. Geneva: WHO; 1985.
- United Nations Department of Economic and Social Affairs, Population Division, World Population Prospects: 2015 Revision (July 2015) Available at: <http://www.esa.un.org/unpd/wpp/index.htm>. [Last accessed on 2015 Aug 09].
- United Nations. Department of Economic and Social Affairs, World Population Prospects: 2012 Revision (June 2013). Available at <http://www.esa.un.org/unpd/wpp/index.htm>. [Last accessed on 2016 Aug 09].
- 2006 Census, Analytical Report at the National Level. National Population Commission, Nigeria. Available from: <http://www.population.gov.ng/>. [Last accessed on 2010 Dec 20].
- Quick JD, Thuo HM. Adaptation of WHO drug use indicators in hospital. *Lancet* 1994;343:237.
- Tiwari M, Tiwari P. Profile of pharmacotherapy in elderly Indian patients: Preliminary findings. *Int J Risk Saf Med* 2006;18:151-7.
- WHO. How to Investigate Drug Use in Health Facilities. Selected Drug Use Indicators WHO/DAP/93.1. Geneva: World Health Organization; 1993.
- Guideline for ATC Classification: WHO Collaborating Centre for Drug Statistics and Methodology. Oslo, Norway; 1998.
- International Statistical Classification of Diseases and Related Health Problems, 10th Revision; 2007. Available from: <http://www.who.int/classifications/apps/icd/icd10online/>. [Last accessed on 2010 Apr 22].
- Ferner RE, Aronson JK. Communicating information about drug safety. *BMJ* 2006;333:143-5.
- Good CB. Polypharmacy in elderly patients with diabetes. *Diabetes Spectr* 2002;15:240-8.
- Isah AO, Laing R, Quick J, Mabadeje AF, Santoso B, Hogerzeil H, *et al.* The development of reference values for the WHO health facility core prescribing indicators. *West Afr J Pharmacol Drug Res* 2002;18:6-11.
- Field TS, Gurwitz JH, Avorn J, McCormick D, Jain S, Eckler M, *et al.* Risk factors for adverse drug events among nursing home residents. *Arch Intern Med* 2001;161:1629-34.
- Lohani SP, Thapa P, Aryal UR, Satyal KR. Polypharmacy and geriatric patients: Patterns of prescribing in the Tribhuvan University Teaching Hospital in Nepal. *J Nepal Health Res Counc* 2006;4:1-4.
- Fehintola FA. Pre-hospital and prescription use of antibacterial drugs at a secondary health centre in Ibadan, Nigeria. *Afr J Pharm Pharmacol* 2009;3:120-3.
- Akinyede AA, Mabadeje AF, Aliu MO. A comparative study of patterns of prescription of antibiotics in two health centres in Lagos. *J Niger Assoc Infect Control* 2000;3:20-3.
- Joshi MP, Sugimoto T, Santoso B. Geriatric prescribing in the medical wards of a teaching hospital Nepal. *Pharmacoepidemiol Drug Saf* 1997;6:417-21.
- Akande TM, Ologe MO. Prescription pattern at a secondary health care facility in Ilorin, Nigeria. *Ann Afr Med* 2007;6:186-9.
- Ohaju-Obodo JO, Isah AO, Mabadeje AF. Prescribing pattern of clinicians in private health institutions in Edo and Delta states of Nigeria. *Nig Q J Hosp Med* 1998;8:91-4.
- Bosu WK, Ofori-Adjey D. A 1 day survey of drug prescribing patterns in the District General Hospital of the Wasswa West District of Ghana. *Trop Doct* 1997;27:222-6.
- Rehana HS, Nagarani MA, Rehan M. A study on the drug prescribing pattern and use of antimicrobials at a tertiary care teaching hospital in Eastern Nepal. *Indian J Pharmacol* 1998;30:175-80.
- Santoso B. Misuse of injections. A serious threat to Health Care in Developing Countries. *Medical Progress* 1995;22:5-8.
- Sorensen L, Stokes JA, Purdie DM, Woodward M, Roberts MS. Medication management at home: Medication-related risk factors associated with poor health outcomes. *Age Ageing* 2005;34:626-32.
- Enwere OO, Falade CO, Salako BL. Drug prescribing pattern at the medical outpatients' clinic of a tertiary hospital in South-Western Nigeria. *Pharmacoepidemiol Drug Saf* 2007;16:1244-9.
- Bok S. The ethics of giving placebos. *Sci Am* 1974;231:17-23.
- McLachlan AJ, Bath S, Naganathan V, Hilmer SN, Le Couteur DG, Gibson SJ, *et al.* Clinical pharmacology of analgesic medicines in older people: Impact of frailty and cognitive impairment. *Br J Clin Pharmacol* 2011;71:351-64.
- Shankar PR, Upadhyay DK, Subish P, Bhandari RB, Das B. Drug utilisation among older inpatients in a teaching hospital in Western Nepal. *Singapore Med J* 2010;51:28-34.
- Espeland MA, Kumanyika S, Kostis JB, Algire J, Applegate WB, Ettinger W, *et al.* Antihypertensive medication use among recruits for the Trial of Nonpharmacologic Interventions in the Elderly (TONE). *J Am Geriatr Soc* 1996;44:1183-9.