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Full Length Research Paper

Analysis of outpatient prescription indicators and trends in Chinese Jingzhou Area between September 1 and 10, 2006-2009

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Analysis of outpatient prescription indicators and trends was done to investigate the effect of academic and administrative intervention. According to World Health Organization (WHO) criteria, the retrospective method was used. We sampled the daily prescriptions, computed the daily prescription indicator and compared the mean of ten days. We sampled 1180 from 36581 prescriptions; and the percentage of drugs prescribed by generic name (generic name percent) was 69.2%, percentage of prescriptions with an antibiotic prescribed (antibiotic percent) was 39.15%, percentage of prescriptions with an injection prescribed (injection percent) was 22.63%, average number of drug per prescription (drug number) was 2.04, and the average drug cost per prescription (drug cost) was ￥124.30 ($18.24). By comparing the prescribing trends, the drug cost and generic name percent increased yearly. Though other indicators had no statistical significance, they had a decreasing trend. Academic and administrative interventions have already been made by Chinese medical management, and it seen that some prescribing indicators are higher in other countries, but the prescribing trends are becoming more and more rational.

Key words: Pharmacoepidemiology, hospital pharmacy, prescription, rational use of drugs, antibiotic percent, injection percent.

INTRODUCTION

In 1985, World Health Organization (WHO) defined that "Rational use of drugs (Ie et al., 1999) requires that patients receive medication appropriate to their clinical needs, in doses that meet their own individual requirement for an adequate period of time and at the lowest cost to them and their community". The management and use of antimicrobials have clinical, economic and environmental implications. As such, antimicrobials account for 30 to 50% (USAID, 2008) of prescriptions in many countries. Expenditures on antimicrobials are increasing yearly, due to the fact that antimicrobials constitute about 20 to 40% of a hospital's medicine budget. In the US (Wysowski et al., 2006) between 1998 and 2003, out-patient prescriptions increased with 33.3% over the 6 year period and retail costs of dispensed outpatient prescription drugs increased with 104%. In 20 European countries (Coenen et al., 2009), the total outpatient antibiotic use ranged from 27.91 defined daily dose per 1000 inhabitants per day (DID) in France to 9.58 DID in Russia, while the proportion of outpatient parenteral antibiotic treatment ranged from 6.75% in Russia to 0.001% in Iceland. The use of antibiotic is more serious in developing countries and the super-bacteria are firstly found in developing counties (Kumarasamy et al., 2010). China is the largest developing country and it has 1.3 billion populations, but Chinese antibiotic use is seldom reported.

In 1993, how to investigate drug use in health facilities

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Table 1. Total prescribing indicator of 1180 prescriptions.

Indicator	Value (N =1180)
Total sampling percent=Total daily prescription number /Total daily prescription	3.23%
Percentage of drugs prescribed by generic name	69.2%
Percentage of prescriptions with an antibiotic prescribed	39.15%
Percentage of prescriptions with an injection prescribed	22.63%
Average number of drug per prescription	2.04
Average drug cost per prescription	￥124.30($18.24)
Average number of antibiotic per prescription	0.47
Percent of prescription with diagnosis written	75.68

￥--- Chinese Yuan, Renmingbi, $ --- dollar.

Table 2. Prescribing trend between September 1 and 10 of 2006-2009 (n = 10).

	2006-09	2007-09	2008-09	2009-09
Prescription number	27.20 ± 1.07	28.80 ± 1.41	30.40 ± 1.19	31.60 ± 0.81
Average number of drugs per prescription	1.98 ± 0.06	2.16 ± 0.13	2.04 ± 0.12	1.98 ± 0.07
Average number of antibiotic per prescription	0.48 ± 0.03	0.53 ± 0.04	0.44 ± 0.02	0.42 ± 0.04
Average drug cost per prescription (RMB)*	101.70 ± 8.16	120.65 ± 6.83	128.44 ± 7.34	122.72 ± 4.48

200609 is September of 2006.

(WHO et al., 1993) was published by WHO. The indicators could be used to make a comparison between different areas or at different times. In 2004, the principles guiding the clinical application of antibacterial was published by Chinese Medical Association and Pharmacy Administration Committee, while in 2007, the prescription management regulation (Yan et al., 2008) was promulgated by the Ministry of Health of the People's Republic of China. In order to investigate the prescribing indicator and prescribing trends impacted by the related regulations, we sampled prescriptions between September 1 and 10 in 2006 to 2009. The WHO method was used to investigate prescriptions of outpatients at the Tertiary Teaching Hospital in Jingzhou Area, Hubei Province, China.

Study design

Firstly, every prescription was assumed to be in one encounter (Liao et al., 2009), then the daily prescriptions, summed as N and SQRT (N), were used as the daily prescription number. We sampled the daily prescriptions, computed the daily prescribing indicator and compared the mean of ten days. We sampled the prescriptions of September 1 to 10 in 2006, and then continued the next year, until we got to 2009. For example, on September 1, the daily prescriptions were summed to 900(N), while the prescription number was 30 [SQRT (N)]. We computed the prescribing indicator of 30 prescriptions on September 1, and then got the date of ten days in 2006. We totally sampled 1180 from 36581 prescriptions, and the sampling percent was 3.23%.

MATERIALS AND METHODS

The Jingzhou Hospital, affiliated to Tongji Medical College, is the biggest general tertiary teaching hospital in Jianghan Champaign, in which the emergency, pediatrics and medical insurance prescription were included in the calculation. The traditional Chinese medicine (TCM), narcotic, poisonous substance, psychotropic substance and radiopharmaceuticals prescription were excluded.

Except the antidiarrhoeal drugs with gentamycin, quinolones, nifuroxazide or combinations are regarded as antibiotics; however, our antibiotic criteria are same with that of WHO. Antituberculosis drug, antifungal drug, antivirus drug, antiparasite drug, antitumoral antibiotic and botanical antimicrobial are not regarded as antibiotic. Likewise, vaccine, menstruum, local anesthetic, local sealant, conjunctival and retrobulbar injection are not regarded as injection.

Statistical method

SPSS13.0 for windows was used to make statistical analysis. The results were expressed as Mean ± Standard Error (M±SE) and some results were expressed as figures of error bar. Analysis of variance (ANOVA) (Enwere et al., 2007; Isah et al., 2008) was used to compare the mean of measurement data, while Kruskal-Wallis H was used to compare the mean of numeration data. The P-value <0.05 was statistically significant.

RESULTS

A total of 1180 prescriptions are sampled from 36581 cases, and the results are shown in Tables 1 and 2. Table 1 discusses the total prescribing indicator of 1180

Table 3. Comparison of the WHO indicators and Chinese indicators in 421 Hospital of people's liberation army.

Chinese indicator		WHO indicator	
Prescriptions	535	Encounters	399
Average number of drug per prescription	2.7	Average number of drugs per encounter	3.62
Percentage of prescriptions with an antibiotic prescribed	31.29	Percentage of encounters with an antibiotic prescribed	36.34
Percentage of prescriptions with an injection prescribed	16.4	Percentage of encounters with an injection prescribed	13.53
Average drug cost per prescription	￥106.1 ($15.57)	Average drug cost per encounter	￥142.26 ($20.88)

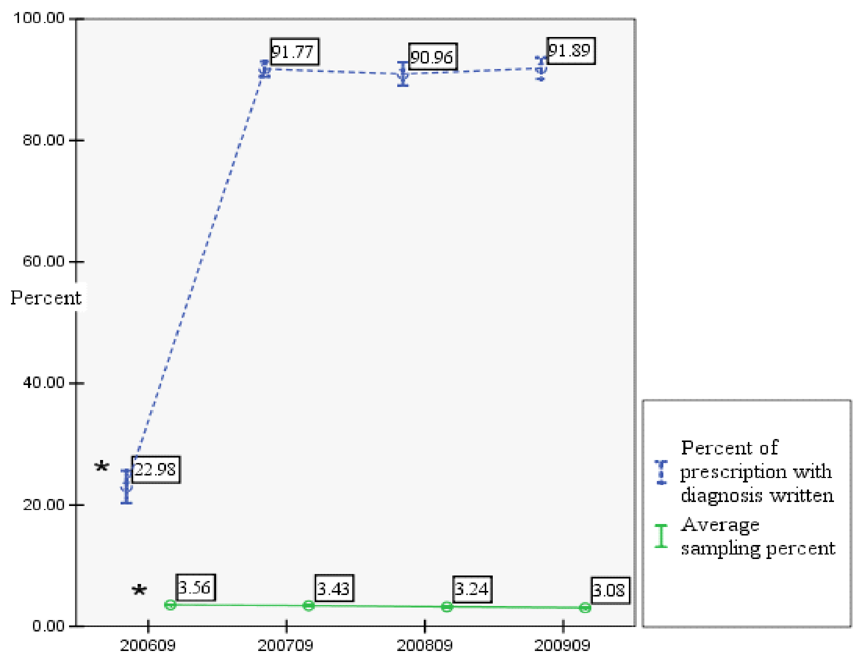

Figure 1. The complementary prescribing trend from 200609 to 200909 (n = 10). 200609 is September of 2006.

prescriptions, while Table 2 discusses the prescribing trend between September 1 and 10 of 2006-2009 (n = 10). The average number of antibiotic per prescription in Table 2 is an additional indicator to know the antibiotic used. We divided the daily total number of antibiotic by the number of daily prescription number and expressed the result with two decimal. The P of prescription number was 0.053 (F = 2.809), P of drug number was 0.520 (F = 0.766), and the P value of 'average number of antibiotic per prescription' was 0.169 (F = 1.775). They had no statistical significance, in that the P value of drug cost was 0.015 (F = 3.980). As such, it was statistically significant.

Table 3 discusses the comparison of the WHO indicators and Chinese indicators in 421 Hospital of People's Liberation Army. The comparison of the WHO and Chinese indicators of prescription management regulation is shown in Table 3 (Liao et al., 2009), and the results show that most of the Chinese indicators are fewer than the WHO indicators, but the percentage of injection is higher than that in WHO indicators. Figure 1 discusses the complementary prescribing trend from 200609 to 200909 (n = 10). After we divided the daily prescription number by daily total prescriptions, we got the indicator of the average sampling percent; where the P of the indicator was 0.041(X^2 = 8.269) and the P of 'percent of prescription with diagnosis written' was less than 0.01 (X^2 = 22.148). Consequently, they were statistically significant. Figure 2 shows the trend of core prescribing indicators from 200609 to 200909 (n = 10). The P of generic name percent was 0.007(X^2 = 11.981), and it had a statistical significance. However, the P of the

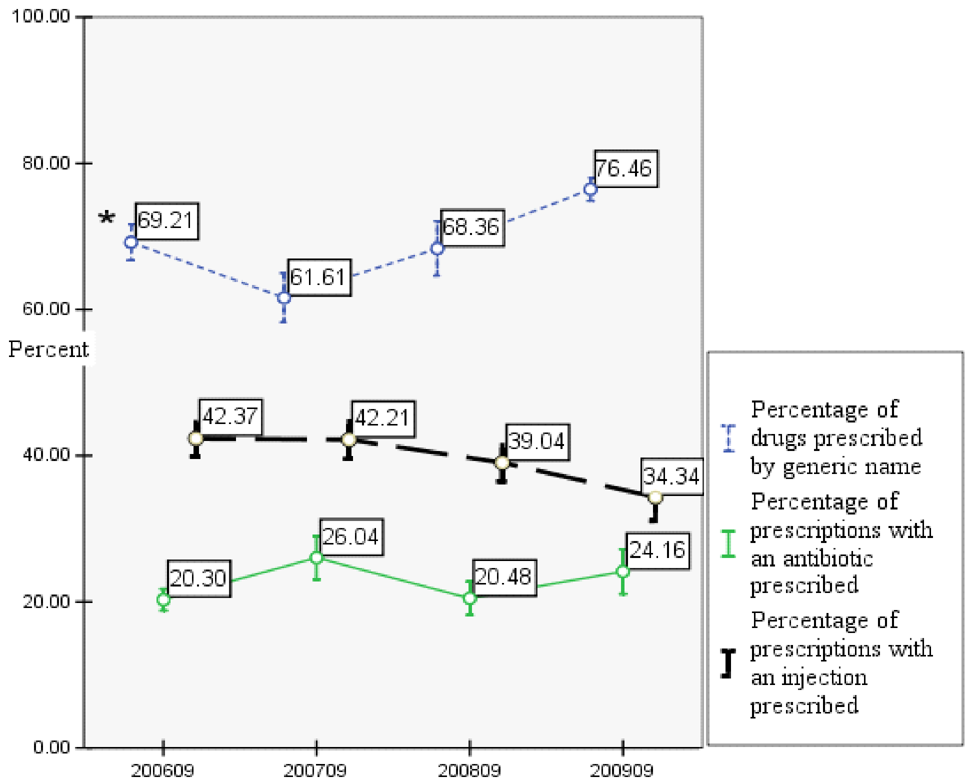

Figure 2. The trend of core prescribing indicators from 200609 to 200909 (n = 10).

antibiotic percent was 0.191 (X^2 = 4.754), and the P of injection percent was 0.520 (X^2 = 2.259), and they both had no statistical significance.

DISCUSSION

How to investigate drug use in health facilities was published in 1993. The indicators were the overall response of the socioeconomic situation, climate and environment, epidemic outburst, spectrum of disease and medical policy. WHO suggested that in one year, longer and large cases throughout the period were demanded to minimize bias due to seasonal variations or interruptions in the drug supply cycle (WHO et al., 1993). The retrospective method was used in our prescription investigation. We tried to minimize biases to make our results comparable to other countries.

How to investigate drug use in health facilities had been implemented for eighteen years; and it was thought that some indicators needed to be revised or updated. Chinese Hospital information systems (HIS) and electronic prescriptions are gradually becoming universal; some indicators in hospitals who own HIS are inevitably higher than those without HIS, such as the percentage of drugs prescribed from essential drugs list or formulary and generic name percent. 0/1 (no or yes) was used in the survey of antibiotics and injections, and the number of the prescription with two or more antibiotics was 1 (yes). It may result to loss of information, so we suggested that WHO should use the actual number instead of 0/1 (no or yes). In order to make comparisons between different areas or at different times and make the WHO indicators more compatible, we suggest that WHO should make appropriate adjustments, and add or delete some indicators. In 2008, how to investigate antimicrobial use in hospitals was published by the U.S. Agency for International Development (USAID, 2008), and it could be used as an assessment tool by hospital administrators in developing countries to identify problems of inpatient antimicrobial use. Sixteen indicators related to inpatient antimicrobial use in hospitals are described: 5 are hospital related, 9 are prescribing indicators, 2 are related to patient care and the 17th supplemental indicator is related to drug sensitivity test. A comparison of how to investigate drug use in health facilities and how to investigate antimicrobial use in hospitals was more complex and thus need harder work.

The results of Table 1 were similar to 12 secondary hospitals in Chinese Nantong Area (He et al., 2008) between June and December in 2007. The drug number was between 1.7 and 2.7, the antibiotic percent was between 33 and 43%, and the injection percent was between 7.6 and 35.7%.

In theory, the sample size (WHO, 2008) is the compromise between the statistical goal and feasible aim. If the sample size is small, the sample is less representative to the big population, which will result in bias due to less information of population; but if the sample size is big, more work must be made, so the balance must be kept between the representativeness and the reliability. We counted the daily total prescriptions to N and used SQRT (N) as the daily prescription number. The daily prescription number in Table 2 was about 29.5, which reached the WHO criteria and Chinese national standard.

The drug number in Table 2 ranged from 1.52 to 2.84, and it was similar to other countries. In a teaching hospital of Western Nepal (Lamichhane et al., 2006), the mean drug number was 1.99, in a general hospital in Nigeria, while the drug number was 3.16. In Uzbekistan, rural primary physicians prescribed 2.9 drugs per patient. Because the retrospective method was used and every prescription was assumed to be in one encounter, the patient who did not take medicine was not counted. As such, the daily drug cost in Table 2 ranged from 6.22 to 204.58 Yuan. According to the results, the drug cost is increasing yearly, and as a matter of fact, in the latest years, the Chinese common people are complaining about the increasing medical expenditures.

After we divided the daily prescription number by daily total prescriptions, we got the indicator of average sampling percent in Figure 1. Except those who do not take medicine, the daily outpatient can reach 1330. For the fact that the daily total outpatient is increasing, the sampling percent is decreasing in Figure 1, but the prescription number is increasing in Table 2.

The diagnosis is important for pharmacists to know the consistency of diagnosis and drugs, audit prescription and know potential drugs interaction and contraindication. Many Chinese domestic physicians did not like to write diagnosis on prescriptions until prescription management regulation was promulgated by the Ministry of Health in 2007. The percent of prescription with diagnosis written in Figure 1 was used to identify the change. Now the indicator had risen greatly and has reached 99% in recent times.

In China, some Chinese generic name of drugs has a dozen of characters and the trade name has fewer characters, which may be one reason for the poor generic name percent in Figure 2. In Western Nepal (Lamichhane et al., 2006), the generic name percent was 19.2%, while in Indian Mumbai, the percentage was 73.4%. However, the indicator could reach 94% (WHO et al., 1993). In Northern India (Dimri et al., 2009), the poor generic name percent was the non-availability of the pediatric formulations in the hospital pharmacy, where clinicians preferred to prescribe trade names they were familiar with and which would be easy for the patients to procure. In China, the clinicians had to serve many outpatients because of Chinese enormous population. In order to increase work efficiency or for bad habits, some clinicians were used to abbreviation and trade name.

The antibiotic percent in Figure 2 was about 39%, and the indicator was different in many countries. In Indian Bhopal (De Costa et al., 2008) primary health centers, 63.5% encounters were from the prescribed antibiotics, while in Europe (Coenen et al., 2009), the proportion of outpatient parenteral antibiotic ranged from 6.75 to 0.001% in Iceland. Apart from two countries, this indicator was between 29 and 43% (WHO et al., 1993). In Nigeria, antibiotic percent was 50.3% (Chukwuani et al., 2002) in out-patients and 96.7% in in-patients. The rational use of antibiotic had a socioeconomic and clinical meaning. A short duration of treatment could increase morbidity, while a long duration resulted in patient exposure to antimicrobials. This increased the risks of adverse drug reaction (ADR), the incidences of antimicrobial resistance and unnecessary expenditure. For Chinese, poor research and development, easy availability of antibiotics (some antibiotics are available in the drug store), patients' expectation, potential profits of prescription and poor antibiotic management, affected the rational use of antibiotic. The long-term misuse of antibiotic had made clinicians ignore pathogens identification and susceptibility tests, overlook the change of local pathogens and the pharmacokinetics and pharmaco-dynamic characteristics. The Chinese government had already found the problems, but in 2004, the guiding principles of clinical application of antibacterial were published and the hierarchical management of antibiotic had been implemented throughout the country. Though antibiotic percent had no statistical significance, the indicator had a decreasing trend.

The injection percent in Figure 2 was about 22%, while the indicator was higher in some countries. In Western Nepal (Lamichhane et al., 2006), 0.96% encounters were from the prescribed injection, while in Indian Mumbai, 13.8% drugs were from the prescribed injection. However, the indicator ranged from 0.2 to 48% among different countries (WHO et al., 1993). Due to the fact that more injections were used by the emergency patients, emergency prescriptions were included in our calculation. For the poor compliance of oral drugs, the pediatricians preferred to use injections and the pediatric prescriptions were also included in our calculation. Patients thought that injections were more efficient and they required clinicians to use injection. Consequently, they all made the indicator in our hospital to be higher in other countries.

According to Chinese medical policy, every prescription was assumed to be in one encounter. Liao Xiao-ling compared the WHO and Chinese indicators of prescription management regulation, and the results are shown in Table 3 (Liao et al., 2009). The difference was that "every encounter" was emphasized in WHO indicator, while "every prescription" was emphasized in Chinese indicator. If patients visited two or more doctors and every prescription was assumed to be as a result of one encounter, the Chinese indicators were fewer than the WHO indicators. Han et al. (2009) also compared the large sample statistical method and every prescription was assumed to be as a result of one encounter. In the large sample statistical method, the prescriptions made with the same patient's name were assumed to be as a result of one encounter, which made the present population (it is the denominator in the calculation) to be less than the latter. However, it is thought that the results of the former are higher than the latter.

Factors such as staffing pattern (presence or absence of a physician), geographic location, local socioeconomic levels and medical policy all affect the indicators. Studies in Western countries (Arustiyono, 1999) had shown that distribution of printed education materials alone resulted, briefly, to very small or non-existent improvements. A study from Uganda (Arustiyono, 1999) showed that implementation of standard treatment guidelines, followed by training and supervision was more effective than distributing STG alone.

Researchers from Australia (Buising et al., 2008) evaluated the impact of academic detailing and a computerized decision support system (CDSS) on clinicians' prescribing behavior for patients with community acquired pneumonia (CAP). The CDSS initially had a significant impact over and above the academic detailing, but the impact appeared to wane over time. The authors thought it was an initial fascination of a novel system, and they suggested they must find other ways to sustain the intervention over time.

Conclusion

The authors found out that academic and administrative interventions both affect indicators. Administrative intervention could bring temporary effects, while the academic intervention could play a long-term effect. The principles guiding the clinical application of antibacterial in 2004 were academic intervention of standard treatment guidelines. The prescription management regulation of 2007 was an administrative intervention. However, further education and training of physicians and pharmacists had already been made by Chinese Medical Management. Though some prescribing indicators were higher in other countries, the prescribing trends are becoming more and more rational.

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REFERENCES

Arustiyono (1999). Promoting rational use of drugs at the community health centers in Indonesia. http://dcc2.bumc.bu.edu/prdu/Other_Documents/ARUS_INDONESIA_PRDU.htm (accessed September 1999).

Buising KL, Thursky KA, Black JF, MacGregor L, Street AC, Kennedy MP, Brown GV (2008). Improving antibiotic prescribing for adults with community acquired pneumonia: Does a computerised decision support system achieve more than academic detailing alone? – A time series analysis. The Second Annual East African INRUD Meeting on Antiretroviral Therapy Adherence and Patient Retention. Ethiopia, 2008: 11.

Chukwuani CM, Onifade M, Sumonu K (2002). Survey of drug use practices and antibiotic prescribing pattern at a general hospital in Nigeria. Pharm. World Sci., 24(5): 188-195.

Coenen S, Muller A, Adriaenssens N, Vankerckhoven V, Hendrickx E, Goossens H, ESAC Project Group (2009). European Surveillance of Antimicrobial Consumption (ESAC): Outpatient parenteral antibiotic treatment in Europe. J. Antimicrob. Chemother., 64(1): 200-205.

De Costa A, Bhartiya S, Eltayb A, Nandeswar S, Diwan VK (2008). Patterns of drug use in the public sector primary health centers of Bhopal district. Pharm. World Sci,. 30(5): 584-589.

Dimri S, Tiwari P, Basu S, Parmar VR (2009). Drug Use Pattern in Children at a Teaching Hospital. Indian Pediatr., 46(2): 165-167.

Enwere OO, Falade CO, Salako BL (2007). Drug prescribing pattern at the medical outpatient clinic of a tertiary hospital in southwestern Nigeria. Pharmacoepidemiol. Drug Saf., 16(11): 1244-1249.

Han Wei, Liu Rili, Zhang Xiaojian (2009). Methodology of large sample prescription evaluation. Anhui Med. Pharm. J., 13(4): 451-452.

He Z, Zhang D, Zhu M, (2008). Evaluation of Prescriptions in 12 Secondary Hospitals in Nantong Area between June and Dec in 2007. China Pharm., 19(29): 2251-2254.

le GA, Hogerzeil HV, Haaijer-Ruskamp FM (1999). Intervention research in rational use of drugs: a review. Health Pol. Plan., 14(2): 89-102.

Isah AO, Isah EC, Aghomo OE (2008). WHO prescribing indicators (1991-1995) trends and perspective in an outpatient health care facility in Benin City, Nigeria. http://archives.who.int/icium/icium2004/resources/ppt/AC033.ppt (archived July 2008).

Kumarasamy KK, Toleman MA, Walsh TR, Bagaria J, Butt F, Balakrishnan R, Chaudhary U, Doumith M, Giske CG, Irfan S, Krishnan P, Kumar AV, Maharjan S, Mushtaq S, Noorie T, Paterson DL, Pearson A, Perry C, Pike R, Rao B, Ray U, Sarma JB, Sharma M, Sheridan E, Thirunarayan MA, Turton J, Upadhyay S, Warner M, Welfare W, Livermore DM, Woodford N (2010). Emergence of a new antibiotic resistance mechanism in India, Pakistan, and the UK: A molecular, biological, and epidemiological study. Lancet. Infect. Dis., 10(9): 597-602.

Lamichhane DC, Giri BR, Pathak OK, Panta OB, Shankar PR (2006). Morbidity profile and prescribing patterns among outpatients in a teaching hospital in Western Nepal. Mcgill J. Med., 9(2): 126-133.

Liao X, Zhang Z, Fan J (2009). Study on the Problems in Prescription Evaluation. Chin. J. Drug Appl. Monit., 6(5): 313-315.

U.S. Agency for International Development (USAID) (2008). How to Investigate Antimicrobial Drug Use in Hospitals: Selected Indicators, p. 10.

WHO DAP, INRUD (1993). How to Investigate Drug Use in Health Facilities, pp. 14-45.

WHO (2008). Sampling to Study Drug Use. 2000. http://archives.who.int/PRDUC2004/RDUCD/TOC.htm (archived July 2008).

Wysowski DK, Governale LA, Swann J (2006). Trends in outpatient prescription drug use and related costs in the US: 1998-2003. Pharmacoecon., 24(3): 233-236.

Yan Q, Wu Y (2008). Drug and Therapeutics Committee Training Course. The Second Annual East African INRUD Meeting on Antiretroviral Therapy Adherence and Patient Retention. Ethiopia, p. 11.