

Wastage of drugs by consumers – an unacceptable behavior

Taking prescription drugs should be an uncomplicated process. All that the patient or the healthcare giver needs to do, once the drugs are at hand, is to take them or administer them following the instructions of the prescriber and the dispenser. Unfortunately, studies have shown that drug use behavior is a complex phenomenon with many peculiarities from individual to individual. In the first place, the prescriber, and subsequently the dispenser, may not have given very clear and precise instructions. Secondly the formulations, dosage forms or strengths may not have been procured exactly as instructed. Thus, patients and their caregivers, often improvise, unwittingly committing medication errors in the process.

Various aspects of drug use behavior have been studied intensively. But one aspect that has not been given adequate attention is the problem of wasting drugs that have already been procured. Patients and their caregivers are unlikely to procure a greater quantity of medicines than has been prescribed, specially if they have to bear the cost of these medicines. In some instances the full course of medication is not completed owing to unacceptable adverse events. This is understandable. In most other instances when the patient has completed therapy, or thinks that therapy has been completed, but there are substantial leftover medicines, it usually implies that compliance has not been good. Poor compliance, as we all know, may lead to relapse of the condition being treated, even though it has initially responded to therapy, and result in therapeutic failure in the long run. With antimicrobials, there is the even greater danger of fostering drug resistance among pathogens.

Wastage of medicines appears to be a global problem although there is not enough data on the subject. For instance, a TV broadcast on Feb 7, 2000, by the BBC1's watchdog Healthcheck program, reported a survey which found that huge quantities of prescription drugs are being wasted in UK. Apparently, a third of the surveyed population failed to complete a course of prescribed medication while 1 in 10 collected prescriptions but did not even start to take the drugs. A quarter of all adults admitted to having unused medication at home. The broadcast showed a pharmacy which had a stockpile of several hundred pounds of returned medicines awaiting destruction. The National Pharmaceutical Association in UK estimated that unused medicines worth about £ 37.6 million were disposed off every year, although the true figure was probably higher when one allowed for medicines remaining piled up in people's homes or being disposed off by other means. The survey also found that repeat prescribing, which made up two thirds of the prescriptions, without adequate counseling, contributed largely to the problem of wastage.

To the best of our knowledge this problem of drug wastage has not been formally surveyed in India. However, going by the extent of non-compliance which is documented in this country, the problem is likely to be of mammoth proportions. We are not even talking here of the huge wastage in public healthcare set-ups due to poor stores and pharmaceutical management. This is totally unacceptable in country where large sections of the population are poor and do not have access to the basic healthcare and sanitation facilities, let alone costly prescription drugs. Formal survey of the drug wastage problem in India is urgent necessity.

What to do with the drugs that have been wasted but are still within the expiry dates. Again, there are no well-organized efforts to deal with this issue. There have been piecemeal attempts, mostly by voluntary organizations, to collect leftover medicines from consumers and redistribute them through charitable clinics to those who cannot afford to buy medicines. While the intention behind this is noble, supplying fragmented medication courses to poor consumers, who are also often likely to be ill-informed regarding proper drug use, is not good therapeutic practice. Expired drugs are chemical waste. We have no system in place to return unused medications to pharmacies so that they can be disposed off in bulk in a scientific manner. Inevitably, haphazard and piecemeal disposal contributes to environmental degradation. It is high time that all players in the drug use cycle – prescribers, dispensers, and consumers – as well as policy makers in India wake up to this serious problem of drug wastage.

Avijit Hazra

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The following article is the second of two parts. The first part appeared in the previous issue.

Adverse drug reactions - 2

Avijit Hazra

Pharmacovigilance strategies

There are many ways in which ADRs may be suspected and detected. These are outlined below while Table 3 lists examples of notable ADRs detected through various approaches.

1. Postmarketing surveillance [Phase IV of clinical drug development]
2. Intensive in-patient monitoring
3. Spontaneous ADR monitoring [Voluntary reporting by health professionals / manufacturers]
 - Well-established schemes are in operation in various countries.
4. Prescription event monitoring
 - Active solicitation of ADR reporting from clinical practitioners by monitoring prescriptions.
5. Case reports / Case series
 - Report of single case with an illness and an exposure.
 - Report of a series of cases with a common illness and/or a common exposure.
6. Analysis of secular trends
 - Comparison of trends in exposure with trends in events looking for coincidence.
 - Comparison over time or across geographical areas.
7. Case control studies

- Groups selected on basis of presence (cases) and absence (controls) of illness and studied for antecedent exposure.
 - Retrospective case comparison study.
 - Individuals with disease compared to individuals without disease.
 - Generally estimates relative risk in terms of odds ratio – ratio of odds of exposure among cases to odds of exposure among controls
8. Cohort studies
 - Groups selected on basis of presence (study cohort) and absence of exposure (control cohort) and studied for subsequent illness.
 - Prospective case finding study.
 - Exposed subjects compared to unexposed subjects with respect to outcome.
 - Generally estimates relative risk in terms of ratio of disease incidence in exposed group to incidence in control group.
 9. Randomized controlled trials [RCTs]
 - The ‘gold standard’ but difficult because of various technical, logistical and ethical factors.
 - Subjects randomly assigned to drug of interest group or control group (placebo or standard comparator drug) and followed up for a definite length of time. Incidence of adverse events compared statistically.
 - Studies may be open label or blinded to different extents.
 - Investigator has control over extraneous variables.
 - Multiple RCTs may be subjected to systematic reviews and meta-analysis.

Table 3. Examples of ADR detection through various surveillance approaches

Approach	Drug	ADR detected
Post-marketing surveillance	Felbamate	Hepatotoxicity
Intensive in-patient monitoring	Ampicillin	Skin rash
Spontaneous ADR monitoring	Zimeldine	Guillan-Barre syndrome
Prescription event monitoring	ACE inhibitors	Cough
Multipurpose database	Isotretinoin	Birth defects
	Thiazides	Hip fracture disproven
Case reports / Case series	Thalidomide	Birth defects
Case control studies	Various drugs	Agranulocytosis, Cancers
Cohort studies	Oral contraceptives	Thromboembolism
Randomized controlled trials	SSRIs	Weight gain

ACE = Angiotensin converting enzyme; SSRI = Selective serotonin reuptake inhibitor

Ideally, in a complete ADR report, the following information should be included

- ❑ Patient information e.g. initials / age / sex / weight / attending physician / hospital
- ❑ Information on suspect drug
 - Generic name / Brand name / Dosage form / Batch number
 - Therapeutic indication
 - Route and dosing schedule
 - Start and stop dates
- ❑ Information on suspected reaction
 - Nature and severity
 - Start and stop dates
 - Outcome
- ❑ Information on concomitant and recently (within last 3 months) used medication including OTCs
 - On similar lines to suspect drug
- ❑ Auxiliary information
 - Medical history
 - Laboratory test results
 - Known allergies
 - In case of teratogenicity all drugs taken in pregnancy and the LMP

Spontaneous ADR monitoring

The ADR reporting strategy that is globally most successful in detecting and quantifying adverse reactions to marketed drugs is spontaneous ADR reporting. Such a system should possess the following attributes:

- Sensitivity - capability to detect rare ADRs (< 1 in 10,000) without getting overwhelmed by common reactions.
- Promptness in data acquisition and processing.
- Quantification capability.
- Risk factor identification capability.
- Ability to provide feedback to reporters.

Spontaneous ADR monitoring systems have made very important contributions to the field of pharmacovigilance, so much so that it is now regarded as the sentinel method in drug safety surveillance. These include identification of new hazards, quantification and characterization of known hazards, delineation of comparative toxicity within a therapeutic group as well as identification of drugs as epidemiologic risk factors. However, some drawbacks remain such as:

- Under-reporting an inherent problem - estimated rates seldom > 10% of true incidence.
- Difficulty in causality assessment.
- Biased reporting - more severe reactions tend to get reported more often, frequency of reporting higher when the drug is new or when it has received media attention for some reason.

- Less successful in monitoring ADRs that mimic natural disease and in identifying delayed reactions.

Spontaneous ADR monitoring system examples

British Committee on Safety of Medicines [UK CSM] - Yellow card system

- Introduced in 1964 and is one of the most successful schemes globally.
- Doctors / Dentists / Pharmacists / HM Coroners report on prescribed yellow forms. Reporting solicited for all reactions to newly introduced products and severe / unusual reactions to existing products.
- In addition to prescription drugs, scheme applies to OTC products, herbal products, blood products, immunologicals, radiographic contrast media, dental and surgical materials, IUDs, contact lens fluids.
- Reporting is kept confidential and feedback on similar events provided to reporter on request.
- Computerization of database (ADROIT – Adverse Drug Reactions On-line Information Tracking) facilitates monitoring.

United States Food and Drugs Administration [US FDA] - ADR registry

- Manufacturers required by law to submit reports of suspected ADRs.
- 90% of reports in this database is from manufacturers contrasting to 12% with UK CSM.
- Serious suspected unlabeled reactions and increase in frequency of serious labeled reactions to be notified within 15 days.
- Other details vary depending on whether ADR originates in USA, seriousness of the reaction and length of time that the drug has been marketed.

WHO International ADR Monitoring system

- The operational responsibility for this program is vested, since 1978, with the WHO Collaborating Centre of International Drug Monitoring based in Uppsala, Sweden – the Uppsala Monitoring Centre [UMC].
- Collects and collates spontaneous ADR reports from 60 participating countries.
- Since inception has built up a database of over 1 million records.
- Notable feature is the filtering of signals - 'information on a possible causal relationship between an adverse event and a drug, this relationship being unknown or incompletely documented previously'.
- An international volunteer panel of signal reviewers assess the clinical significance of the drug-reaction associations that are reported to the database more frequently than expected.
- UMC also develops and publishes vital pharmacovigilance literature such as the WHO Adverse Reaction Dictionary.

- Currently involved in the development of a computerized methodology – Bayesian Confidence Propagation Neural Network [BCPNN] – for the identification and analysis of new adverse reaction signals for more efficient data mining from the already huge database that continues to grow rapidly.

ADR monitoring in India

The need for ADR monitoring in India is particularly urgent in view of the woeful lack of Indian data, the genetic diversity of the Indian population and the many singular factors that influence drug use behavior in the country, including the lax implementation of prescription-only norms.

Factors making ADR monitoring in India a dire necessity

- Plethora of formulations
- Multiple systems of medicine
- Rampant self-medication and other peculiarities of drug use
- Resources cannot be wasted on managing iatrogenic illnesses

Problems in ADR monitoring in India

- Lack of awareness - manufacturers / prescribers / dispensers / consumers
- Inadequate diagnostic capability
- Lack of patient records
- Inadequate financial and logistical resources

Unfortunately, to date, we do not have a nationwide ADR monitoring set-up, whether spontaneous or otherwise. With government's help some centers are functioning in different parts of the country including All India Institute of Medical Sciences, New Delhi [AIIMS]; Postgraduate Institute of Medical Research Education and Training, Chandigarh [PGIMER]; Christian Medical College, Vellore [CMC]; Jawaharlal Institute of Postgraduate Medical Education and Research, Pondicherry [JIPMER]; King George's Medical College, Lucknow [KGM] and King Edward Memorial Hospital, Mumbai [KEM]. These centers mostly

cater to the patient base of their respective hospitals. This is insufficient to gather population based data and, moreover, data for the entire country. Further, there is no coordination between the centers.

To address the above lacunae, the Government of India, through the Central Drugs Control machinery has recently planned to set up a network of regional ADR monitoring centers throughout the country along with reactivation of the existing but non-functional centers. The New Delhi center, functioning from the Department of Pharmacology at AIIMS, New Delhi, has recently been designated as the National Pharmacovigilance Centre and is the Indian participating center for the WHO International Drug Monitoring Programme. These efforts are welcome and requires the cooperation of all prescribers, dispensers, as well as consumers of drugs to succeed. Meanwhile all of us can contribute in our own modest way by remaining ever alert to the possibility of ADRs, using drugs carefully and rationally to minimize and restrict them, and if they do occur reporting them to appropriate forum.

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5. Status of pharmacovigilance in India in the new millennium [Editorial] Newsletter: National Pharmacovigilance Centre [India] 2000; 2(1):1-2.

Notice for Indian readers [abstracted from reference 5 above]

The National Pharmacovigilance Centre [NPVC], invites reports of all **suspected adverse reactions to drugs** and other medicinal substances including herbal, traditional or alternative remedies. NPVC particularly requests reports of:

- All suspected reactions to NEW DRUGS, especially DRUGS OF CURRENT INTEREST, and / or uncommon, life-threatening and other severe reactions to older drugs.
- All suspected drug interactions resulting in ADRs.
- Reactions to other drugs which are suspected of significantly affecting a patient's management including reactions suspected of causing:

Death / Danger to life / Resulting in hospitalization / Prolonging hospitalization / Absence from productive activity / Increased investigational or treatment costs / Birth defects.

Send ADR reports to:

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From time to time we receive queries regarding the proper use of various vaccines. In a series of write-ups we will try to cover the vaccines for human use that are being marketed in India. The first write-up is on the BCG vaccine which is used to prevent tuberculosis along with a brief outline of the tuberculin test.

The BCG vaccine

The BCG vaccine is used to reduce the risk of tuberculosis [TB], particularly in children, without evidence of cell mediated immunity to the tubercle bacillus. Vaccination, if successful, induces a state of benign infection that stimulates acquired resistance to subsequent virulent infection. Although the extent and duration of protection are controversial there is evidence that BCG vaccination can at least reduce childhood mortality and morbidity from TB. It is an integral component of our National Tuberculosis Control Program.

The product

BCG vaccine, a live bacterial vaccine, contains an attenuated strain of the bovine variety of the tubercle bacillus i.e. *Mycobacterium bovis*. This strain, Bacillus Calmette-Guérin, was developed after 13 years of research involving 200 series subcultures. BCG was first used in France in 1921 and has been widely used in the international control of TB since 1950. Due to different methods of maintenance in different vaccine-producing facilities, multiple substrains of the original vaccine strain have evolved during the past few decades. The World Health Organization recommends the Danish 1331 strain for the production of BCG vaccine. This strain is being used in India since 1967. The present day vaccine is distributed as a freeze-dried preparation which is more stable than liquid formulations.

Tuberculosis is a major illness, especially in the first year of life, and there is clear evidence that correctly administered neonatal BCG vaccination reduces the risk of overt infection for at least 15 years without obscuring the diagnosis of active infection by intradermal testing. Trials in later childhood have shown that BCG provides about 70% protection in western countries, but trials in developing countries have been less encouraging. Nevertheless, it probably protects the recipient from severe and disseminated forms of TB such as miliary TB and TB meningitis. BCG vaccination forms part of the global universal immunization program, but vaccination is not routinely offered to children in some developed countries, like the USA, at present, where there is a low prevalence of TB. In such countries vaccination is offered to at risk individuals such as tuberculin-negative contacts of known TB cases and hospital personnel

Indications

BCG vaccination is currently recommended at birth in India in case of institutional deliveries or at 6 weeks of age otherwise. To unvaccinated children, it can be offered any time, particularly when there is a family history of tuberculosis, that is any history

National Immunization Schedule

Primary immunization

At birth	BCG + Zero OPV
1½ months	DPT + OPV
2½ months	DPT + OPV
3½ months	DPT + OPV
9 months	Measles

Boosters

18 months	DPT + OPV
5 years	DT + OPV
10-15 years	TT

For pregnant women

Early in pregnancy	TT1 or TT booster
One month after TT1	TT2

- Hepatitis B can be given at 1½, 2½ and 3½ months. Hepatitis B given at birth will reduce risk of mother-to-child transmission.
- MMR can be given optionally at 15 months.

of infection in the last seven years in a first degree relative, grandparent, uncle, aunt or household member. Prior tuberculin testing is not necessary before administering BCG at birth, but this should always be undertaken in children more than three months old. Administration is delayed until discharge in the preterm baby to maximize the chance of tuberculin test conversion.

Babies being cared for in a family or household where there is a patient with active TB under treatment should be given prophylactic isoniazid for 6 months from birth, and then vaccinated at 6 months unless tuberculin test is positive. BCG vaccination can be offered to tuberculin negative children at any time in childhood if there is a high risk exposure due to contact or foreign travel.

The exact duration of protection from successful BCG vaccination is not known. There are no clear guidelines on revaccination and booster doses have not been included under the National Immunization Schedule in India at present.

Interactions

At least 3 weeks interval is recommended between the administration of BCG and any other live vaccine [other than oral polio vaccine]. Lymphadenitis may occur if the same arm is used again in the next 3 months.

Contraindications

Live BCG vaccine should not be given to anyone who is immunodeficient, immunosuppressed or on high dose corticosteroid treatment [the equivalent of more than 1 mg/kg of prednisolone per day]. In some countries like UK, where the prevalence of TB is low, BCG [unlike other live vaccines] is also withheld in HIV positive babies. Administration in an area affected by eczema is not advisable.

Administration

Babies less than 3 months old should receive 0.05 ml intradermally; older children receive 0.1 ml. Strict attention must be paid to the technique of administration if "conversion" is to be achieved and complications avoided. Injection is normally to be given into the upper left arm over the insertion of the deltoid muscle onto the humerus to minimize the risk of keloid formation. The point is only a little above the middle of the upper arm: vaccination is often inappropriately administered higher than this [over the bulk of the deltoid muscle]. Alternatively, BCG can be given into the upper lateral surface of the left thigh to minimize visible scarring. The skin only needs to be cleaned first if it is overtly dirty. If any spirit is used this must be allowed to dry before vaccination. Soap and water is better. A short (1 cm) 26 G needle [with the bevel facing upwards] and a 1 ml [tuberculin] syringe are used. A separate sterile syringe and needle must be used for each child to avoid any possibility of viral transmission. The skin is stretched between thumb and one finger and the needle inserted almost parallel to the surface about 2 mm into the superficial layers of the dermis. The tip should remain visible through the skin and a raised blanched bleb, about 5 mm in diameter, will appear if the injection has been given correctly. If no resistance is encountered the tip is almost certainly too deep.

For infants and children under 5, BCG may also be administered using a multipuncture technique.

'Conversion' of BCG vaccination causes a small swelling within 2-6 weeks that breaks down into a shallow ulcer and subsequently heals slowly by itself within 6-12 weeks forming a scar. No medicines should be applied to it. This is the normal reaction. However, with inappropriate technique or overdosage, a considerably larger scar may develop. Normally the vaccinated individual becomes tuberculin-positive about 2 to 3 months after vaccination, but occasionally this is delayed.

Adverse drug reactions

If a discharging ulcer develops at the vaccination site this should be covered with a simple dry non-occlusive dressing [occlusive dressings can delay healing]. The lesion will heal over 1-2 months and should only leave a small scar if the injection technique has been sound. Lymphadenitis may occur.

Serious local reactions should be referred to the appropriate doctor. An abscess that develops at the site and does not clear spontaneously needs to be treated by aspiration, and sometimes local incision and application of isoniazid powder.

In order to minimize complications, vaccination should be strictly intradermal and no other injection should be given into the arm used for BCG vaccination for at least 6 months.

Documentation

Neonatal vaccination should always be clearly documented in the child's own personal vaccination card and also in the community records. Failure to do this renders later interpretation of the child's tuberculin status very difficult.

Supply

Ten dose vials of freeze-dried live BCG suitable for intradermal use are provided by the Government of India under the National Immunization Program. A stock may be held in the pharmacy or dispensary. It should be used up within 2-3 hours of reconstitution with the diluent supplied. If no diluent is supplied, it may be reconstituted with 1 ml of normal saline or water for injection. The former is preferable as there is less irritation. The vial may be syringed in and out once or twice during reconstitution to ensure homogeneity, but should not be shaken. The vaccine must not be contaminated with alcohol, other antiseptic or detergent.

In ambient room conditions in tropical climates the vaccine is stable for several weeks and if stored in a cool environment protected from light it is stable for up to 1 year. The preferred storage condition is refrigerated at 2-8 °C. The vaccine is not to be frozen.

A different [high dose] product suitable for percutaneous administration may be available in certain settings. This form of administration should only be used in babies and very young children, and only works reliably if 18-20 puncture marks are made. Users must state clearly the exact preparation required.

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Seminar cum workshop on Rational Pharmaceutical Management

Community Development Medicinal Unit [CDMU], Calcutta, in collaboration with Community Health Medicinal Unit [CHMU], Patna, and Society for Health Action, Research and Education [SHARE], Calcutta, conducted a two-day seminar cum workshop on 'Rational Pharmaceutical Management' at Seva Kendra, Calcutta on December 15 & 16, 2001. The program was attended by 15 practicing pharmacists and store managers from West Bengal and Bihar, including three of CDMU's own staff. The objective of the program was to update the knowledge of the participants regarding management of pharmaceuticals and to refresh certain skills relevant to their day to day activities. Faculty members included doctors and pharmacists with an academic background, drawn from CDMU's panel of resource persons for training programs. The two day program was structured into 6 sessions of 1½ to 2½ hour duration each, namely:

- Overview of pharmaceutical management
- Good dispensing practice
- Drug information service
- Inventory control
- Medical stores management
- New drugs

After a brief inaugural session that provided an opportunity to the participants to get mutually introduced, discussion was commenced with a bird's eye view of the different aspects of the broad sphere of activity that pharmaceutical management is. These aspects included infrastructural considerations, materials management, personnel management, stores management, financial management and information management, among others. This session made it amply clear that although the overall activity of a practicing community pharmacist is complex, it can be managed better if resolved into its component parts, prioritized according to necessity, and knowledge and skills relevant to the components of interest acquired specifically and then integrated into the overall functioning.

The session on good dispensing practice was addressed in two parts. An initial didactic presentation was followed by a problem-based discussion, drawing upon the situations being faced by the participants in their day to day work. Several interesting problem solving methods were narrated by the individual participants and provided a learning opportunity to the audience as a whole. Common errors and

constraints in dispensing were pointed out and remedial measures suggested.

Drug information service turned out to be a highly interactive and entertaining session. The participants were presented with 10 mock situations that could be encountered in their daily schedule, as regards provision of information to prescribers and consumers, and asked to find out the correct information with the resources provided, which ranged from package inserts to journal articles. A discussion on primary, secondary and tertiary sources of drug information followed, the pros and cons of each type being outlined with examples.

Inventory management was the inaugural session for the second day of the program, presenting the modern principles and techniques of inventory control as applied to a drugs store or pharmacy. The concept of ABC analysis generated considerable interaction and the advantages and disadvantages of a computerized inventory control system were discussed.

Medical stores management was also a topic evoking considerable interest from most of the participants. Once again, the need for achieving a balance between what is ideal and what is feasible in our situations, was emphasized drawing upon the experience of the participants themselves. The issue of quality control in a medical store was raised but justice could not be done to it for want of time.

New drugs was again an interactive session that assessed first the existing knowledge of the participants as regards 5 new classes of drug, introduced in the Indian market relatively recently, and then correcting and supplementing their views. It became evident that practicing pharmacists are often confused by the pace at which new drugs are being introduced without corresponding efforts, from any quarter, to update them with correct information regarding use of these drugs.

The program concluded with the customary vote of thanks. There was no formal evaluation procedure although participants frankly opined on what they had expected and what they had gained over the two days. The enthusiasm and the forthrightness of the participants, coupled with the pleasant arrangements made by the Seva Kendra authorities, made it a rewarding experience for all concerned.

New drugs approved by Drugs Controller General of India in the period January to June, 2001

Name of the drug	Therapeutic category	Name of the drug	Therapeutic category
Bupropion [sustained release tablet]	Smoking cessation aid	Mosapride	Prokinetic agent
Butenafine hydrochloride [cream]	Antifungal, topical	Moxifloxacin	Antibacterial
Clopidogrel	Platelet aggregation inhibitor	Nelfinavir	Antiretroviral protease inhibitor [Anti-AIDS]
Donepezil	For Alzheimer's disease	Raloxifene	Menopausal osteoporosis
Efavirenz	Antiretroviral non-nucleoside reverse transcriptase inhibitor [Anti-AIDS]	Sildenafil citrate	Male erectile dysfunction
Indinavir sulfate	Antiretroviral protease inhibitor [Anti-AIDS]	Thymosin-alfa 1 [injection]	Anti-hepatitis B
Mirtazapine	Antidepressant	Triflusal	Prevention of thromboembolism
Misoprostol	Anti-ulcer	Vinorelbine tartrate [injection]	Anticancer

Source: Office of State Drugs Control – West Bengal

It is to be noted that approval of a new drug does not necessarily result in immediate introduction of the corresponding formulation in the Indian pharmaceutical market, whether imported or indigenously manufactured. Even if available prescribers should exercise due caution in the use of these drugs for obvious reasons, particularly for those drugs which are new in the global pharmaceutical market too.

Recent additions to our library

- Dickson M. Where There is No Dentist. Palo Alto, CA: Hesperian Foundation, 1983.
- Education Material for Teachers of Midwifery. Geneva: World Health Organization - Family and Reproductive Health: Maternal Health and Safe Motherhood Programme, 1996.
 - Module 1: Foundation module - the midwife in the community [WHO/FRH/MSM/96.1]
 - Module 2: Obstructed labor [WHO/FRH/MSM/96.2]
 - Module 3: Postpartum hemorrhage [WHO/FRH/MSM/96.3]
 - Module 4: Puerperal sepsis [WHO/FRH/MSM/96.4]
 - Module 5: Eclampsia [WHO/FRH/MSM/96.5]
- Hardman JG, Limbird LE, Gilman AG. Goodman & Gilman's The Pharmacological Basis of Therapeutics. 10th ed. New York: McGraw-Hill, 2001.



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