Policy, Research, and External Affairs

WORKING PAPERS

Population, Health, and Nutrition

Population and Human Resources
Department
The World Bank
June 1990
WPS 456

Improving the Supply and Use of Essential Drugs in Sub-Saharan Africa

S. D. Foster

The supply and use of essential drugs in Sub-Saharan Africa is at best inadequate because of inappropriate practices in the selection, procurement, storage, distribution, and prescription of drugs. This paper recommends solutions based on drug policies implemented successfully in several African countries.

Policy, Research, and External Affairs

WORKING PAPERS

Population, Health, and Nutrition

WPS 456

This paper — a product of the Population, Health, and Nutrition Division, Population and Human Resources Department — is part of a larger study in PRE of African health policy. A policy paper is being written based on the study. Copies of this paper are available free from the World Bank, 1818 H Street NW, Washington DC 20433. Please contact Zarine Vania, room S6-266, extension 33664 (38 pages with tables).

Few people in Sub-Saharan Africa have access to essential drugs. And where drugs are available, they are inequitably distributed and improperly used. The main problems -- and possible solutions -- are:

Drugs are distributed through the private sector, nonprofit organizations, and governments. The private sector consists of a large proportion of unqualified illicit peddlers of drugs who dispense adulterated or expired drugs without prescription. Pharmacies run by qualified pharmacists are a small minority. Nonprofit organizations -- usually humanitarian, secular, or religious -- and public agencies run by governments also distribute drugs.

African countries do not have the capacity to produce the drugs they need. Pharmaceutical industries in Africa depend on imported raw materials that are expensive when bought in small quantities. It is generally cheaper to import generic drugs than to produce them locally. The paper discusses procurement strategies that have resulted in savings in several countries.

Drugs are wasted due to poor storage conditions, inadequate security, and deficient inventory control systems. Proper selection, quantification, storage, and inventory management of drugs could alleviate this problem.

Drugs are also wasted because of inappropriate and over-prescription, and noncompliance by patients. Efforts to involve prescribers in using standard treatment schedules and to inform patients about the proper use of drugs could result in improved efficiency.

Africa has special characteristics in its land-use patterns, population density, and road infrastructure that affect the distribution of drugs. Counterfeit drugs and difficulties in financing essential drugs are also serious problems. The advent of AIDS has presented new challenges in the provision of essential drugs.

WHO estimates that worldwide, as many as 2.5 billion people--half the world's population--have little or no regular access to essential drugs (WHO, 1988b). The 435 million people in sub-Saharan Africa are even worse off, since only one-third are thought to have access to essential drugs (Annex 1). This paper will attempt to review the causes of this situation. The first part describes drug supply systems in Africa, both public and private; the second describes opportunities for improving efficiency and reducing waste and gives evidence for the savings to be made; and the third reviews several issues of specific importance to Africa, namely, geographic and spatial constraints; the problem of counterfeit drugs; financing of drug supplies and cost recovery or "cost sharing;" and the impact of AIDS on drug supplies.

How much are African countries actually spending on drugs? Table 1 gives an estimate of annual per capita drug imports for eight countries in Africa from 1982-84.

How does this compare with what is estimated to be needed for adequate drug supply? Table 2 provides some data on treatment costs by level of health facility from a variety of countries in Africa. These are only indicative, and in some senses are not comparable, as in some of the countries drugs are locally produced and therefore may be more expensive;

Table 1. Drug Imports Per Capita in Eight African Countries, 1982-84

Country	Per Capita Drug Imports US$
Senegal	7.40
Zambia	6.50
Swaziland	4.80
Ethiopia	1.47
Burkina Faso	1.36
Rwanda	0.93
Uganda	0.93
Guinea	0.86

* Unadjusted; in current terms (1982-84).

Source: Catsambas and Foster, 1986.

transport costs vary greatly from one country to another as well. These figures do, however, give an idea of the relative order of magnitude required to provide basic treatments using essential drugs. Whether a given amount of drugs is "sufficient" depends on coverage of health services, and on how many annual contacts with the health services for some form of treatment are thought to be "adequate".

Data on per capita drug consumption may also overstate the availability of drugs in rural areas, as drugs tend to "stick" at central levels and in hospitals. Unless specific measures have been taken to ensure regular availability of drugs in rural health centers, as in Zambia, Kenya, Uganda, Zimbabwe, Tanzania and a number of other countries, it is likely that virtually no drugs are reaching the lower level health facilities. In Tanzania

Table 2. Average Costs per Treatment Episode at Various Levels in Several African Countries (US$)

Country	Year	Village	Dispensary	Health Center	Hospital OPD
Kenya	1984		0.29	0.20	
Kenya	1985				0.50
Sudan	1985	0.15	0.32	0.32	0.59
Burundi	1986		0.37	0.37	
Gambia	1987	0.12	0.24	0.35	0.50
Guinea-Bissau	1987			0.31	
Uganda (a)	1988		0.29	0.29	0.29

(a) Represents total number of outpatient treatments, without designation of level.

Source: WHO Data.

in 1978, prior to the introduction of a "kit" system of drug distribution, the national per capita expenditure was US$1.20. At the national teaching hospital, however, the average expenditure was US$9, with as much as US$13 in the ward which received private patients and senior officials, but $5.90 in the general ward. But in rural dispensaries, only $0.02 was spent per patient (Yudkin, 1980). A similar picture of mal-distribution within a facility is reported from Nigeria; one author reports that "drugs and other equipment said to be out of stock in the general ward, meant for the masses, are stock full in the amenity ward" (Ityavyar, 1988.)

Economic, geographical, and cultural factors, therefore, all combine to reduce the effective access of many Africans to basic drugs, in all likelihood exacerbating the generally high morbidity and mortality observed in Africa.

Drug Distribution Systems in Africa

Drugs are distributed in most African countries through three systems; one private commercial, one private non-profit, and another public or government-run. A fourth possibility is a parastatal agency which although owned by the government often operates along commercial lines. The relative importance of these varies greatly from one country to another, with the private commercial sector virtually non-existent in some and the government-run network nearly defunct in others. The importance of the private non-profit sector varies greatly as well, with a relatively greater presence in English-speaking East Africa and in the coastal countries of West Africa. Each of these will be described briefly.

The Private Pharmaceutical Sector

It is customary to compare drug distribution in public and private sectors by the relative value of their sales or throughput. This may lead to an underestimation of the volume of drugs distributed by the public sector, however, as the private commercial sector typically distributes brand-name drugs which are usually 4-5 times more expensive than generic equivalents (Szuba, 1984; Sepulveda-Alvarez, 1985). In order to give a more accurate picture of the volume of drugs distributed by both public and private sectors, Table 3 presents the results of an adjustment by the relatively conservative factor of 2 to make public sector value comparable to that of the private sector, enabling a comparison of overall drug volume to be made. This shows that for several African countries, the value of drugs distributed by the public sector is significantly higher than the unadjusted value would indicate; for four of the six countries, the public sector accounts for at least half of the drugs distributed. Adjustment by a factor of 3 would bring the public sector share to over two-thirds of the total in four of the countries. This of course assumes that the public sector procures drugs which are less expensive than those procured by the private sector, which may not be the case for all drugs. Most public sector drug agencies, however, do purchase some part of their

drugs in bulk, generic form. In some cases, the same drugs purchased in bulk through competitive bidding by the public sector are significantly cheaper than those purchased directly by the private pharmacies; in Zaire, the same drug was purchased by the public sector for less than half of the private sector price (Glucksberg and Singer, 1982).

Private sector pharmacies in Africa are concentrated in urban areas. For example, of a total of 542 pharmaciess in 9 French-speaking West African countries, 301 (56%) were located in the capital city (Scrip, November 27, 1985). In Mali, the World Bank project zone of Kita, Bafoulabe, and Kenieba circles (districts) had 7% of Mali's population, but only 1.3% of the Pharmacie Populaire du Mali's (PPM) sales were made in that area. Half of the PPM's sales are in Bamako, where 10% of the population lives (World Bank, 1983). While the situation in many English-speaking countries and particularly in East Africa is somewhat better, the same concentration of private pharmacies in urban areas pertains. Even the presence of pharmacies

Table 3. Relative Importance of Public and Private Sector Drug Distribution

Country	(1) Public by Value (Unadjusted) (Percent)	(2) Adjusted Total (Percent)[a]	(3) Public as Percent of Adjusted Total	(4) Private by Value (Percent)	(5) Public by Value (Percent)
Burkina Faso	64	36	72	136	53
Niger	57	43	86	143	60
Rwanda	77	23	46	123	37
Senegal	85	16	32	117	27
Zambia	57	43	86	143	60
Zimbabwe	50	50	100	150	67

a. Value of public sector drugs adjusted to private sector prices for comparison by multiplication by factor of 2.

Source: World Bank, Pharmaceuticals in the Third World, PHN Tech. Note 86-31, 1986, and WHO data.

may not in itself guarantee access; the urban poor are also prevented from having access to drugs due to the high prices of drugs available through the private sector and the shortages of free or low-cost drugs available in the public sector facilities. In Burkina Faso and Mali, for example, the price of French brand-name drugs in private pharmacies was fixed at 150-200% of the retail price in France, despite the very much lower purchasing power of the clients and the fact that reimbursement is virtually non-existent. A study in Abidjan, Ivory Coast found that the average cost of a prescription was the

equivalent of 100 French francs (about US$17); a similar study carried out in Paris found the average prescription price was 112 French francs (Bessard et. al., 19[illegible] In France, however, in addition to income levels being 15 times greater than in Ivory Coast, most (if not all) of this price would be reimbursed by Social Security.

What is a "private pharmacy" in the African context? It may have little in common with a "pharmacy" in the Western sense. Pharmacists are so few in number that in most countries it would not be possible to require the presence of a pharmacist in a pharmacy. As a result, there is some indication that unlicensed private drug sellers are the targets for distributors of counterfeit drugs (Atueyi, 1988). In Nigeria, a survey of retail pharmacies in Maiduguri, Borno State, found that there were 90 retail pharmacies in the town. Of these, 10 were "ethical pharmacies" run by qualified pharmacists, and the remainder were "dry drug peddler shops," run by unqualified persons. These had licenses to sell only proprietary (non-prescription) medicines but in fact had a wide range of drugs available. Many were expired and were adulterations of popular drugs. The drug peddlers often had an "injection room" where customers judged to be "safe" were taken. The public apparently did not distinguish between the two types of pharmacy, and used both as clinics where they consulted and were given prescriptions and treatment. Health problems for which they sought treatment were (in order) malaria, cuts, eye pains, general body pains, dysentery/diarrhea, skin infection, abdominal pain, family planning, cough, chest pain, and venereal disease. The most frequent treatment was antibiotics, especially injections; antibiotics represented 35% of treatments given. The second most frequent treatment was drugs for diarrhea (not ORS), followed by treatment for malaria. The reasons most frequently cited for seeking treatment at the pharmacies was that treatment was expeditious, drugs were rarely out of stock, and the drugs given were efficacious and often better than hospital treatment (Igun, 1987). In Africa, drug shops or peddlers are much more common than pharmacies run by qualified pharmacists. Village drug shops are often patronized because they are close, not because they are considered to be suitable. In Saradidi, Kenya, people cited lack of transport and distance to alternatives, and that they were open in emergencies, as major reasons for patronizing the drug shops. Prior to introduction of a scheme whereby village health workers provided antimalarial treatments, 53% of the people obtained their antimalarial treatments from a shop, and the shopkeeper provided advice on dosage, etc. But when antimalarial treatment was available from the village health worker, 85% of the people preferred to get their treatment there. When the scheme was in place, use of the shops declined significantly, with 90% reporting that they no longer used the shops for antimalarial treatments (Mburu et. al., 1987).

Another type of drug outlet is the illicit drug seller who does not operate from a fixed pharmacy premises. In Pikine, a suburb of Dakar, Senegal, 102 illicit drug sellers were identified and a sample of ten were interviewed in depth. They had set up in markets, on street corners, or were itinerant. On average they had 14.5 clients per day. Drugs were sold primarily for symptomatic treatment, with pain and fatigue accounting for 77% of visits; aspirin in combination or alone is part of more than half of

sales. Other drugs sold for actual cure were primarily antibiotics and antimalarials. Antibiotics included mainly tetracyclines, sulfaguanidine for diarrhea, and isoniazid (an anti-tuberculosis drug) for cough. Antimalarials included primarily chloroquine and amodiaquine. Most people consulted these sellers because prices are low, since the drugs are sold in small amounts--one or two tablets. Such a practice may lead to selection of resistant organisms. The risk might be small given the fact that these drugs are not sold often; of the 147 consultations, 9% received tetracycline, 7% an antimalarial, and 1% sulfaguanidine. Yet the value of drugs sold on the street in this way was almost as great as that provided through official public drug outlets. (Fassin, 1988) In Cameroon, informal drug sellers were popular especially with poor people, since unlike the registered pharmacies, they would sell drugs in any quantity. This works to the advantage of the pharmacist, who sells drugs to the informal vendors who then undertake the unprofitable part of the retail trade for them (van der Geest, 1987).

Yet a third type of drug seller is the traditional healer who uses "modern" drugs, especially antibiotics, in his practice. This is an increasingly common occurrence in Africa as well as throughout the developing world (Bledsoe and Goubaud, 1985; Haak and Hardon, 1988).

A further private commercial drug source is the sale of drugs pilfered from public health facilities by health staff. This may take the form of an extra charge for government drugs which are supposed to be free, "private" practice in the afternoon or evening using government drugs, or from the sale of drugs to other sellers. In many countries, the risk of getting caught and the potential penalties are less than the gain to be made by removing small amounts of materials and drugs from the system, primarily for personal use. Typically "everyone does it", and pilferage is merely an income supplement, which people may have come to think of as a perquisite of their position. Yet even though the scale of individual acts of pilferage is relatively small (several dollars or tens of dollars would typically be involved), in some countries, pilferage is so widespread that its cost is considerable. In Cameroon, health service personnel sell enough of the public drugs to be considered "wholesalers" since they in turn sell to drug vendors. Yet another category would be the port workers and customs officials, who use their position to obtain medicines for sale to others, and thus could be considered wholesalers (van der Geest, 1987). In Kenya, prior to introduction of the kit system, losses were estimated at 25%; these were reduced to less than 5% when the kit system was in operation (Ministry of Health, Kenya, et. al.). A similar situation has been described in Sierra Leone (Bledsoe and Goubaud, 1985).

The fact that so many people benefit from the system creates great resistance to needed improvements and control procedures; no one has an incentive to improve logistics, and the pressures to maintain the status quo are considerable. (van der Geest, 1982) In Sierra Leone, the local dispenser realized that he would lose his livelihood if WHO-recommended oral rehydration therapy and malaria treatments were adopted, and he successfully

pressured town leaders to prevent the health educators from the hospital from coming back (Bledsoe and Goubaud, 1985).

The private non-profit sector is quite different, and is usually operated by missionaries or other non-governmental humanitarian organizations such as Medecins sans frontieres, Save the Children, etc. In the best of cases, the non-profit sector uses private sector management techniques in the pursuit of social goals. They often purchase their drugs overseas through special purchasing agencies such as ECHO, IDA, or UNICEF in some cases, in bulk and using generic names. In a growing number of countries they are forming their own procurement and distribution agencies to enable the different missions and organizations to benefit from bulk purchase and consequently lower prices. As many of these organizations have to charge a user fee for their services to complement any support they may get from overseas or from the government in form of a capitation fee or a bed-day subsidy, they are eager to keep prices low so that utilization does not decline due to patients' inability to pay the fee. In Kenya, for example, where missions and NGO's are responsible for about 25% of all health care provided, overprescription and increasing drug prices were having a serious impact on utilization. Each hospital was purchasing small quantities of a large number of mostly brand-name drugs. In cooperation with WHO, the various hospitals and church organizations created a drug procurement and distribution agency (MEDS). As a result, prices dropped and efficiency was improved.(Hogerzeil and Moore, 1987) A similar organization exists in Ghana (Christian Health Association of Ghana, CHAG) (Hogerzeil and Lamberts, 1984) and is being contemplated in a number of other countries including Sierra Leone, Zambia, Uganda, and Nigeria.

What is the contribution of the private sector in the distribution of essential drugs? As noted above, the private non-profit sector is increasingly turning to bulk generic drugs, in part to keep their fees low and thus ensure their continued financial health. The private commercial sector, however, has yet to play a significant role. This is mainly because in most African countries where private pharmacies operate, the income of the pharmacist or owner is derived from a profit margin calculated on the basis of the wholesale price. There is therefore no incentive to carry low priced essential drugs. Indeed many such incentives have backfired; typically the tendency has been to permit a lower margin on already low-priced essential drugs, which further reduces the pharmacist's incentive to carry these drugs. If the private commercial sector is to become more involved in distribution of essential drugs, new pricing mechanisms will need to be found to reverse the pattern of incentives.

A related question is the allocation of foreign exchange between public and private sectors. Inevitably, in cases of foreign exchange shortage, the import of a high-priced product precludes the import of a larger volume of a cheaper equivalent essential drug. Health benefit considerations need to be taken into account; and the authorities responsible for allocation of foreign exchange need to ensure that the basic drug needs of the public sector are met, while remaining aware of the private sector's demands.

(Catsambas and Foster, 1986) Both private sector importers and the Ministry of Health have a responsibility to use available funds as efficiently as possible. The ministry of finance must support rationalization efforts by making required foreign exchange available, since international competitive bidding--usually the most advantageous method of procurement--is out of the question unless the necessary foreign exchange is available. It is especially important for the public sector to avoid the need for emergency purchases from the local private traders who have had privileged access to foreign exchange, whose prices typically are as much as three times the international market price. (Catsambas and Foster, 1986)

The Public Sector

Two types of public drug distribution structure are commonly found in Africa, and may exist side by side in some countries. One is known in English-speaking countries usually as Central Medical Stores (CMS) and in French-speaking countries as the Pharmacie d'approvisionnement or "Pharmappro". It is usually wholly government owned, under the Ministry of Health. Although some of these are poorly run and inefficient, in a number of countries they have been rehabilitated and are able to provide a fully satisfactory service. The other type of structure is the parastatal or para-public drug importing and distributing enterprise, often a monopoly, which is partly government owned and usually administered under a ministry other than the Ministry of Health. Typically these operate along commercial lines and depending on the degree of government intervention in their affairs, they are often indistinguishable from the commercial private sector. In most cases they are permitted to cover most or all of their costs. In some cases they also carry out manufacturing or formulation activities on behalf of the government. Several of these organizations maintain their own network of retail pharmacies as well as selling drugs to the Ministry of Health for distribution through its own health facilities.

In both cases, the typical public sector drug supply system relies at least in part on the existing network of health facilities as distribution points. Potentially, therefore, the density of distribution points is as great as the density of overall health facilities coverage. In the three circles of the western region of Mali mentioned above, for example, there were only 3 pharmacies but 21 dispensaries and 3 health centers, all of which could serve as drug distribution points. The typical structure of a drug import and distribution system involves all drugs transiting a central warehouse and then being distributed either to regional stores or to depots at regional hospitals. From there, the drugs are distributed to lower level health facilities.

What problems does the public sector face in distributing drugs especially to rural areas? One problem is that typically, the public sector relies on government budgetary support which is uncertain and often insufficient, and is prevented from charging the full cost of its services. As a result, it is often running a deficit. This in turn means that there is not

enough money to provide the quantity of drugs needed in the system to permit enough to flow down to all levels; the "pipeline" is not full. Insufficient "pressure" of drugs flowing through the system means not enough is available at the end point. Another constraint is that the public sector is responsible for reaching all the population and cannot content itself with serving those who are easiest to reach, or those whose incomes allow them to purchase high-priced drugs. The average costs of providing services increase as they are extended to more remote areas and to under-served populations, and diseconomies of scale begin to appear. (Over, 1986)

A third problem is that typically, low priority and prestige are attached to drug supply and more generally, logistics in public health. Logistics has a sort of negative prestige in that it is only important when it is time to apportion the blame. Ministries of health are often run by medical doctors who may lack appreciation for the difficulties and importance of logistics; logistics specialists, usually not medical doctors, may not be viewed as "professionals". Logistics is not considered a stepping stone in a public health career. In a number of countries, this most important of posts has been given as a sinecure to someone who is past retirement age and has little training or aptitude for the job. (Foster, 1987) This may be in part responsible for the presence of some degree of corruption and pilferage in a number of public systems. Suggested measures for reducing corruption include high-level commissions to conduct inquiries, courses and seminars to heighten awareness of the problem, and simplification of administrative procedures and strengthening of financial management. (Gould and Amaro-Reyes, 1983). Some countries have temporarily solved the problem by employing expatriates, who are outside of the bureaucratic culture and have no kinship ties to the local population, for sensitive posts.

"Pilferage" on the other hand, is usually more widespread but on a much smaller scale. The main remedy for pilferage is better management controls, including punishment of those caught pilfering. In many countries, the risk of getting caught and the potential penalties are less than the gain to be made by removing small amounts of material and drugs from the system, primarily for personal use. The fact that so many people benefit from the system creates great resistance to needed improvements and control procedures; no one has an incentive to improve logistics, and the pressures to maintain the status quo are considerable. (van der Geest, 1982).

What can be done to improve the efficiency of the public sector, and to enhance the usefulness of the private sector? The following discussion will attempt to trace the elements of a rational approach to drug supply. Areas of complementarity between public and private sectors will be noted, as well as areas where the goals appear to be in conflict.

Improving Efficiency and Reducing Waste in Drug Supply

Selection and Quantification of Drugs

The starting point for an essential drugs policy is the careful selection and quantification of drug needs according to the health needs of the population to be served. Selection involves balancing considerations of cost with those of efficacy, safety, ease of administration, and other local considerations. An example of the range of costs of treatment with various comparable drugs is quite useful to aid in the selection process. In 1975, an article appeared which used Tanzanian data to compare the prices of treatments with various drugs. The author distinguished between "type A" drugs, which are older, proven drugs, and often available in generic form; and "type B" drugs, invented more recently and still under patent and available only under brand names and usually much more expensive. The ranges between the cheapest (usually an older drug available in generic form) and the most expensive brand-name drug were quite wide; for example, analgesic treatment with a brand of ibuprofen was 150 times the cost of treatment with aspirin; the range for tranquilizers was 50-60 times, for hookworm, 130 times, and for oral antibiotics, 10-50 times. He made the argument that unnecessary use of more expensive drugs exhausts the drug budget and deprives fellow citizens of needed treatment. (Speight, 1975)

A more detailed treatment of the subject was provided in 1980 with the publication by AMREF of a manual on therapeutic guidelines which was later reprinted under the title, Guidelines to Drug Usage. (Upunda et al, 1983) In it the authors compared the various drugs used for the major diseases. Although the costs are now out of date, the relative comparisons still remain valid. A few of the cost comparisons are presented in Table 4.

Clearly the costs of different drugs need to be taken into account in selecting drugs. Expenditures on antibiotics are particularly important in

Table 4. Cost Comparisons of Alternative Drugs for Common Conditions

Condition/course	Lowest cost	US$	Highest cost	US$	Percent Difference
arthritis (wk)	aspirin	0.21	ibuprofen	1.88	895
ascariasis (dose)	piperazine	0.08	mebendazole	0.60	750
hypertension (yr)	reserpine	24.50	methyldopa	141.25	576
inflammation (wk)	aspirin	0.21	naproxen	2.67	1271
epilepsy (yr)	phenytoin	3.56	carbamazepine	219.83	6209
urinary tract inf. (wk)	nitrofurantoin	0.46	ampicillin	2.80	609
otitis media (wk)	phenoxym.pen.	0.84	amoxicillin	3.50	417

NB: Prices in 1982 US$.
Source: Upunda, Yudkin, and Brown, Guidelines to Drug Usage, 1983.

many developing countries, so particular care is called for in selecting antibiotics for use at various levels of the health care system. Countries with high burdens of chronic disease, such as arthritis, epilepsy, diabetes, and hypertension, need to pay particular attention to the costs of drugs used, since treatment for these conditions is lifelong and inevitably costly.

In addition to the decision as to which essential drug is to be recommended as the first line drug for a given condition, there is also the decision as to whether non-essential drugs will be used, and if so, under what conditions. One author concluded in Thailand that while enough money was spent on drugs, the actual consumption of needed drugs was in most cases below 15% of the requirement, while more expensive items, including analgesics, diuretics, tranquilizers, hormones, and antibiotics, were "widely--and possibly wildly--overconsumed." Between 1969 and 1976, the annual growth of consumption of psychotherapeutics and diuretics were 189% and 154% respectively. (Sepulveda-Alvarez, 1985). In the Yemen Arab Republic between 1983 and 1987, as much as 20% of the drugs budget was spent on dried human plasma and albumin injection, which are not considered to be vital drugs. (Van Haperen, 1988) Clearly much can be done to improve decision-making about which drugs should be purchased given the overall scarcity of resources.

After the decision has been made as to which drugs are needed, the next crucial question concerns the quantity of each drug which will be required over a given period, usually a year. While it may seem difficult to arrive at a good estimate, methods have now been developed to make use of available morbidity data and appropriate treatment schedules in arriving at a workable estimate. (WHO, 1988a) Such estimates can be invaluable in procurement, and can help a country to avoid such anomalies as have been reported, such as the order of 46 years' worth of consumption of a drug by a corrupt official. (Yudkin, 1978) However, such estimates are only as good as the morbidity data on which they are based, and the linking of the data with the provision of drugs could provide an incentive to health staff to improve the quantity of the data they provide.

Excessive stock levels of low priority drugs tie up needed funds and run the risk of expiring unused. Surprisingly, in view of the overall scarcity which prevails, expiration of drugs is a major problem in many low-income countries. In Mauritania, the drug supply authorities estimated that $1m worth of expired drugs were on the shelves of the government drug supply organization. On the assumption that this had accumulated over, say, 4 years, this means an annual wastage of $250,000. In 1986, the government drugs budget was $1m, so the value of the expired drugs represented about 25% of the total. (WHO, 1986) In Liberia, of 318 drugs on the shelves, 44 were expired or unusable. On the assumption that their average value was roughly equivalent, the wastage due to expiration was on the order of 15%. (Management Sciences for Health, 1984)

Similarly, in Ghana, a World Bank-funded quantification of drug needs for the public sector, based on morbidity, was recently carried out by

the Ministry of Health. The overall estimated needs came to approximately US$4 million equivalent--only half of what had actually been spent on drugs. The high wastage of drugs was confirmed by a Bank-funded audit of drug stocks throughout the country--45% of the drugs were either expired (33%) or due to expire within the next six months (12%). In part this may be due to the introduction of user charges in 1985, which has reduced utilization of health facilities significantly and shifted drug purchase to the private sector; ordering of pharmaceuticals for the public sector has not yet caught up with the trend.

Stockouts of high priority drugs, on the other hand, may result in costly local purchases from private suppliers. Local purchases are commonly twice or three times the cost of imported drugs, and price differentials of up to 10 times have been reported. (See below, "Procurement".)

Once the drug needs have been quantified, it is a relatively easy step to cost them and then establish the overall cost of drugs. This link, between estimating and costing drug needs, and using the results in discussions with the financial authorities, is a crucial step towards improving the financing of drug supplies. Financial authorities--those responsible for budget allocations and for release of foreign exchange--have shown themselves responsive to such iron-clad proof and justification of needs. In fact, Zimbabwe recently used its drug quantification to obtain an agreement from the financial authorities that the needed foreign exchange would be made available.

To Make or Buy? Local Production of Drugs

In 1982, production of pharmaceuticals in Africa was estimated to be worth approximately US$750 million, accounting for less than 1% of the world total of US$ 95 billion.(Scrip, May 6, 1985) As much of this was done by local affiliates of foreign companies, with production of active ingredients and research taking place elsewhere, this may overstate the extent of local production. African countries continue to import significant quantities of drugs from Europe, with 96% of imports coming from Europe and only 0.7% from elsewhere in Africa in 1984. Africa is an important market for Europe, with an estimated 12.7% of European exports going to Africa. By comparison, Latin American regional trade is more important, with 32% of imports coming from within the region and only 49% from Europe, and 13% from North America.(WHO, 1988b)

This low level of pharmaceutical production activity in Africa conceals an important fact: virtually all African countries already have some installed capacity for drug formulation, if not production. (Formulation is the final stage in drug production, such as the tabletting, packaging, etc. of pharmaceutical intermediates produced elsewhere.) Yet most of these factories are operating significantly below capacity, and some are closed for long parts of the year. The reasons for this situation are complex

and not amenable to easy solutions. In many cases, countries decided to proceed with "showpiece" pharmaceuticals production, while continuing to import even basic goods such as soap, canned fruit and preserves, bottles and plastic packaging materials, bicycles, and so on. Pharmaceutical production was expected to provide a stimulus to development of ancillary industries, such as chemicals, glassware, packaging, etc. Foreign exchange savings were also expected to be significant and this alone was taken to be justification enough. These views were encouraged by a number of development agencies and financing was relatively easy to arrange; the result is a number of uneconomic factories in need of rehabilitation or closure.

A number of key assumptions were made about local production of pharmaceuticals, which need to be reexamined in the light of experience and changes in the world market for pharmceuticals. First, the economic and financial analyses which were carried out often used the prices of the brand-name drugs which the locally produced ones were expected to replace. But in the last seven or so years, the international trade in generic drugs has increased substantially and the prices have fallen significantly. Feasibility studies carried out in 1980, therefore could not have predicted that drug prices would fall to a half or less of then current prices. But now, given budget constraints when faced with procurement decisions, governments have to prefer the less expensive international generics to locally-made equivalents. The locally-made products were rarely able to compete with imported brand-name drugs and therefore the private market was also closed to them, unless there was heavy tariff protection or an outright ban on import of products made locally. (Foster, 1989)

A second assumption was that foreign exchange savings would be considerable. It appears that raw materials and intermediates would be cheaper imported in bulk. However, even raw materials are not necessarily cheaper than the finished product; often the manufacturers ignore very small orders or charge the price of their smallest packing unit (often 100 kg or more) even if the order is for less than 10 kg; opening and breaking down the package is simply not interesting for them. Large manufacturers order tons of a given material at a time, and enter into long-term contracts; they therefore benefit from significant price discounts, which are not available to small African manufacturers. Payment terms are often not advantageous, since foreign exchange shortages often cause delays in payments which the suppliers factor into their prices. Another problem was the lack of price information for most pharmaceutical raw materials and intermediates, which suppliers were quick to take advantage of. The recent establishment of the Pharmaceuticals Market Intelligence System by WHO should help improve the availability of price information for a limited range of basic intermediates used in production of essential drugs.

Other foreign exchange expenditures need to be taken into account. In many countries, packing materials are imported, as is the machinery used in production and quality assurance; spare parts, repair, etc. must be paid for in foreign exchange. Electricity production and water purification may require imported fuel. Training of staff and expatriate management staff are often provided from abroad and paid for in foreign exchange. Technology

may have to be purchased, especially when patents or licenses are involved. An effective export strategy means that a network of distribution points and agents must be developed and maintained; advertising is another expenditure which requires foreign exchange. (Foster, 1989) The case for foreign exchange savings, therefore, has to go well beyond the import of raw materials and intermediates.

A third assumption was that employment would be created. Unfortunately, pharmaceutical manufacture is not labor-intensive; it rather requires small numbers of highly skilled technical workers--the type of worker which is most scarce in developing countries. Management skills are also of capital importance and are very scarce in Africa. Creation of a few hundred jobs may in fact cause the average consumer to be worse off; in Argentina, a survey of the pharmaceutical industry, concluded that "Subsidizing domestic firms through high drug prices can have negative social effects. In a country with ...drugs accounting for about 40% of the personal health budget, a uniformly high price for pharmaceuticals is a burden which falls heavily on the poorer sectors of the population." (UNCTC, 1984.) If it results in higher drug prices, therefore, creation of a few poorly paid jobs can have a negative impact throughout the economy, and especially on those outside of the formal wage-earning sectors.

A fourth assumption was regarding the nature of the market. It was thought that it would be possible to become "self-sufficient" on the one hand, and that it would be possible to export to neighboring countries on the other. The fact that only a small range of less than 40 products (in many cases even fewer) are produced by most factories meant that on the one hand, they were not able to produce the full range of 250-300 drugs needed for health care, and on the other, that their "neighbors" were to a large extent producing the same limited range of simple products. The self-sufficiency argument largely ignores the fact that raw materials and intermediates are imported in any case.

A final assumption made by many firms is that they can become profitable by producing a wide range of products. Since the patents for most essential drugs have expired, profit margins are usually quite low and price competition is stiff. In order to overcome this constraint, a "mixed-product" strategy is often adopted by local firms, which produce both essential drugs and other drugs (and possibly cosmetics) for which demand and profits margins are high. UNIDO has in the past recommended this strategy to countries planning to produce drugs locally. Unfortunately, however, the result is often that the non-essential products made are of little or no use; they may even be harmful. Health goals are therefore sacrificed in favor of industrial development and commercial goals.

How can public health and commercial objectives both be reached? The guiding principle should be a pharmaceutical version of the Hippocratic oath: "do no harm". This leads to several possible "mixes", ranging from the ideal to the unacceptable, as follows:

1. Produce only essential drugs: this strategy avoids wastage of foreign exchange on products without therapeutic benefit. The disadvantage is that profitability may remain low and therefore endanger the existence of the firm.

2. Produce essential drugs and non-drug items, such as cosmetics, hair tonic, toothpaste, skin lotions: If consumers demand these items, some foreign exchange savings may be possible and profitability may be high, permitting subsidization of the essential drugs line by sales of non-drug items.

3. Produce both essential and non-essential drugs: This strategy, in fact in common application, presents a real danger that the non-essential drugs are used as substitutes for appropriate, effective therapy or as expensive placebos. Foreign exchange is also wasted on dubious products. It is particularly unacceptable to produce drugs which are dangerous, either in and of themselves or because of their mode of administration, i.e. injectible vitamins, liver extracts, etc. A number of products which have been removed from the market for safety reasons by their original multinational manufacturers are still being made and sold by African firms--because they are highly profitable. It should be possible to meet both public health and industrial development goals without endangering the health of either the population or the enterprise. (Foster, 1989)

When all the problems and disadvantages of domestic drug production in African countries are weighed, it would be easy to become pessimistic about the future prospects. There is no denying that the obstacles are numerous, and that past experience has been mixed at best. Recent price trends have dealt a severe blow to local production efforts. Yet there are types of production which are likely to be economically and financially feasible in many African settings:

- Local packaging of bulk imports: This is an area which has not received the attention it deserves. It employs unskilled or semi-skilled labor, takes advantage of local packing materials, permits labelling in local languages and packing in preset "kits" or course-of-therapy packages if this is desired. At the same time the country can benefit from low international bulk generic prices.

- Production of intravenous fluids: This may be feasible both economically and technically, especially in view of the high cost of shipping the products and the relative abundance of the main raw material--water. The technology is widely available. Often the main problem is the packaging, since imported plastic bags are very expensive. Problems with quality assurance must not be minimized, however, since in this area more than others, quality problems can easily prove fatal.

- Oral rehydration salts: These can often be produced locally; again the question of high shipping costs relative to the cost of raw materials and packaging makes it likely to be economically attractive in many African settings.

- Formulation of simple preparations such as ointments, creams, syrups, and so on: This can be done locally with semi-skilled staff using widely available technology and possibly some local raw materials as well.

- Bilateral and regional production and quality control: These types of arrangement could be made in many more instances than is the present case. More could be done to rationalize the use of existing production capacity. This, however, requires a high degree of political will and cooperation.

- Procurement of raw materials, intermediates, and packing materials: This could be done, by UNICEF or some similar organization, for sale to developing countries. This combined with raw materials price information now available from WHO would most likely result in significant price reductions for these items, which in some cases, could make existing plants economically viable.

The objective of domestic drug production should be to get good quality, therapeutically useful drugs to the people who need them at prices they can afford. It should not be to enhance national prestige, or to achieve self-sufficiency, or to generate employment, although all of those things might be desirable. If domestic production can provide good quality, low-price drugs, all to the good. If not, it is probably better to buy drugs abroad as cheaply as possible, package them locally--and choose another sector to lead industrial development.

Procurement

Whether there is a local pharmaceutical industry or not, procurement of imported drugs will have to be carried out for at least part of the drug requirements. Experience has shown that procurement is the area in which the greatest savings are to be made. A procurement evaluation in Mozambique for the ten drugs on which the most foreign exchange was spent showed that the difference in total acquisition cost represented by the price differentials quoted was more than $3 million, or 25% of the total annual expenditure on pharmaceuticals. (Marzagao and Segall, 1983) Similarly, bulk purchasing of carefully selected essential drugs was estimated to be able to save nearly 40% of the annual drug bill for church health institutions in Kenya--a total of $700,000 in 1985. (Hogerzeil and Moore,

1987) In Central America, an Essential Drugs Revolving Fund (FORMED) financed the joint purchase of drugs valued at US$1.3 million, which would have cost US$3.8 m at prices previously paid by those countries; the average saving was 64% and the range was from 26% (Costa Rica) to 75% (Guatemala). (Anon., 1988a) In the Yemen Arab Republic, an estimated 20-30% could have been saved by improved procurement and drug quantification. (Van Haperen, 1988) And when six Eastern Caribbean states established the Eastern Caribbean Drug Services (ECDS), prices of the top 25 pharmaceuticals in the region were reduced by an average of 44%, with reductions for some countries as great as 66%. (Management Sciences for Health, 1988)

A carefully designed procurement strategy can free up very significant funds which can then be applied to the purchase of more drugs. In the discussion which follows, only drugs are considered; however, in a number of countries non-drug items (dressings, radiological supplies, etc.) take up as much as a third of the total drugs and supplies bill. Special care is also called for in procuring and using these supplies.

In developing a procurement strategy, a quantification of drug needs can be very useful. A ranking by value will probably show that about 25-30 essential drugs account for half or more of the drugs bill. Therefore, if experienced procurement staff are scarce, procurement efforts should concentrate on getting the best price possible for these high-value, high-priority items, and in making sure that the quantities are appropriate.

A number of possible procurement methods are available, and most procurement strategies will use a mixture; it is in getting the mixture right that significant savings are possible. Possibilities range from direct purchase of brand name drugs from the manufacturer to international competitive bidding for generic drugs. Decisions must be made regarding the following:

- whether to purchase by brand name or generic name (international non-proprietary name, INN)
- whether to purchase directly from the manufacturer, through competitive tendering (either local or international), or from an international procurement agency
- whether to purchase locally, either from a local importer or a local factory, or to import.

Each has advantages and disadvantages, which are reviewed below.

Brand Name or Generic?

Generic drugs are significantly less expensive than their brand-name equivalents. Furthermore, quality need not be sacrificed in order to take advantages of these lower prices. A study comparing prices indicated that the brand names were about 5 times more expensive than the generic

equivalents. (Szuba, 1984) Similarly, a study of the pharmaceutical market in Thailand showed that for 18 commonly-used pharmaceuticals, the average brand name drug was 5.4 times more expensive than the generic equivalent; for ampicillin, the range was 17.5 times more expensive, and for reserpine, 275 times more expensive. (Sepulveda-Alvarez, 1985) Sri Lanka procurement authorities found price ratios of brand name drugs to generics of 2.2 for cotrimoxazole, 10.2 for propranolol, and 62 for diazepam. (Jayawardene, 1980)

Another experience, from Mali, shows the potential gains from concentrating procurement improvements on high-value, high-priority drugs and from buying generics. Injectible ampicillin represented about 30% by value of drugs consumed at a large health center, and was widely used throughout Mali. The price being paid for a brand name ampicillin was 2.5-3 times the international price. As a result, if the procurement strategy could be changed for this one drug alone, it would be possible to save from 15-20% of the drugs budget. (WHO, 1985) A similar result was found in another African country, where one author estimated that use of generics could save 30% of the total drug budget. (Yudkin, 1978)

Competitive Bidding, Direct Purchase, Or Purchasing Agency?

International competitive bidding is often thought of as the most efficient and cheapest way of procuring drugs. For large countries, and depending on the volume involved, this is probably correct. However, organizing competitive bidding requires special administrative skills and a knowledge of the international pharmaceuticals market which many of the smaller countries lack and cannot be expected to develop. A solution, especially for smaller amounts of essential, generic drugs, is to use a not-for-profit international procurement agency (UNICEF Supply Division, International Dispensary Association, ECHO, etc.) which does have the specialized skills required, and which uses international competitive bidding for its own purchases. These agencies buy such large quantities of drugs that they obtain very low prices, and their operating margins are very modest. They provide an attractive alternative to international competitive bidding. Their main drawback is that they require payment in foreign exchange either upon delivery, or in some cases, upon placement of the order.

Direct purchase from the manufacturer is rarely the most economic type of procurement, and should probably be used only for drugs which are absolutely essential and available from no one else. Less than 10% of the drugs on the WHO Model List of Essential Drugs fall into this category. It may be possible to drive prices for brand name drugs down by using

competitive tendering rather than direct purchase; a tender issued by Mali resulted in reductions of about 40% for the same brand name drugs it had been purchasing for years. Negotiations are also possible, and a few of these essential drugs still under patent (praziquantel, for example) are available at preferential prices through WHO and UNICEF. If a country is doing significant amounts of direct purchase, it seems likely that as much as 10-15% could be saved.

Special mention needs to be made of the credit facilities offered by some brand-name manufacturers to very poor countries with poor repayment records. This credit is sometimes offered with the backing of the exporting country's government and the promise of a "bail-out" if payment is never made. This credit is extremely expensive, and can add as much as 200-300% to the already high prices of brand-name drugs. A number of countries are using this type of source because they have no choice since no one else will sell to them; but this is rarely economical. Few will ever be able to pay off their accumulated debts to these suppliers. Countries which are in such poor financial shape that this is the only type of supplier which they can use need special assistance in getting their finances straightened out and in rationalizing their drugs policy.

Drug donations and tied supplier credits another set of problems. Donations are often made of useless drugs, or drugs near expiration. In almost all cases they are overvalued. In some countries the drug importing agency must pay customs fees (as much as 35% in some countries) and port handling charges (typically 5-10%) on the declared value of the donations. Tied credits impose limitations on which products may be purchased and what prices are paid; and prices are often excessive. In one West African country which relies heavily on donations and tied credits, donated drugs and those purchased with tied credits cost up to 9 times the prevailing international prices. In addition, in this country, some 40% of the drugs budget is transferred to other parts of the government in the form of port fees, bank fees, and customs duties.

Local Purchase Or Import

In some cases, purchase of locally produced drugs from a domestic manufacturing plant can be economically attractive, especially if they compete with foreign manufacturers and win competitive tenders. Some countries allow local producers a 5-15% price differential in tenders; World Bank tender procedures allow a 15% margin to local suppliers of most goods. At price differentials above 15-20%, however, the tradeoff between encouraging local industry and treating 15-20% less patients with a given drugs budget begins to be troublesome. The number of people provided local employment is usually insignificant compared to the number of patients denied proper treatment due to higher prices.

Local purchase of imported drugs poses a completely different set of problems. Price differentials are often significant and represent primarily

the profit margin of the importer. In some countries, private importers have better access to foreign exchange than the government drug procurement agency. Failure to allocate foreign exchange, and poor estimation of needs may result in costly local purchases of imported drugs. In Liberia, local purchases accounted for up to 75% of total purchases, and on average, they cost 13% more than imported goods. The extra cost was estimated at $150,000 over three years on a total drug purchase of about $3,230,000, or about 5% of the total. (MSH, 1984) Similarly, in the Yemen Arab Republic, a review of procurement concluded that locally produced drugs were 2-5 times more expensive than the imported equivalents, but that due to foreign exchange shortages, the government had nevertheless been obliged to purchase locally. (Van Haperen, 1988)

In Sierra Leone, local purchases were even more costly. A comparison of local prices with overseas prices for a specific range of drugs revealed that the local purchases would be 2.3 times the cost of the identical drugs, imported. Some drugs were as much as 10 times more expensive locally. Similarly, local purchases of Le 2.4m could have been bought internationally for Le 883,500; local purchases result in payment of a premium of 2.8 times the import price. (Africare, 1984) Savings of 5 to 15% are frequently possible, and depending on the local price levels and the amount of the drugs which are being purchased locally, could be significantly higher and possibly as much as 50-60%.

Storage and Distribution

Drugs are wasted during storage and distribution in three main ways:

- they deteriorate due to poor or storage conditions (excessive heat, moisture, light, etc.)
- they expire due to poor needs estimation or poor inventory control and management
- they "grow wings" and disappear either through pilferage by employees, theft by outsiders who break in (or simply walk in due to lax security), or are lost during distribution to lower level facilities.

The typical structure of a drug import and distribution system involves all drugs transiting a central warehouse (often called "Central Medical Stores" or CMS)from where they are distributed either to regional stores or to depots at regional hospitals. From there, the drugs are typically distributed to lower level health facilities. The potential losses are greater at higher points in the system, and highest at the central medical store. If all drugs pass through the CMS, and if losses are significant at this

point, then fewer drugs are available for distribution to lower levels, whose importance (and responsibility) is correspondingly diminished. One author estimates that in Cameroon, 35% of the medicines are lost from the central medical stores due to poor storage conditions and expiration due to poor inventory control. (Van der Geest, 1982) The importance of a well-managed, efficient, secure Central Medical Store, therefore, can hardly be overstated. The CMS is the place to begin if one wants to have a major impact on the drug supply situation.

Drugs are fragile chemical substances and as such need special care and handling. They must be protected from excessive heat and moisture, and from infestation by insects and other pests. It is surprising how many medical stores have leaking roofs, and no ventilation, or are otherwise unsuitable. Some countries are forced to store their drugs outdoors. This state of affairs is all the more surprising when one considers the value of the drugs which are stored at any given time; if a country's annual drugs budget is $5 million, then at any point in time, it is likely that as much as $2-3 million worth of drugs is stored in the central medical stores. Investment in creating proper storage conditions could under some circumstances repay itself virtually overnight through reduction of waste due to poor storage. Under the worst imaginable conditions, wastage may run to 25% or more.

Losses due to expiration of excessive stocks are another matter. The remedies are better inventory control and proper quantification of drug needs, and in some cases, removal of a corrupt official. The range of potential losses due to expiration is quite significant, with as much as 25-30% having been reported. Excessive and repeated losses and write-offs due to expiration should lead the authorities to look for possible fraud in procurement, specifically, for a pattern of over-ordering of certain drugs, perhaps from the same manufacturer. In such a case the loss is double; first, the country pays much too high a price for the drugs, and secondly, the drugs cannot be used and expire, so the money spent is completely wasted. In a country with a limited drugs budget, this will cause many people to be deprived of needed drugs.

Security problems are difficult to resolve. Drugs are highly portable, easily concealed in clothing, and they have a high market value. The incentive to steal is great, and where there are no counter-balancing security measures or penalties for infractions, it is not surprising that very high percentages of drug stocks are pilfered. The theoretical upper limit to the losses is 100%--it is possible for all of the drugs to be stolen. More typically, losses from central stores are estimated at 20-25% but it is difficult to get accurate estimates. Losses from lower level health facilities are also great; estimates have been made that in Cameroon, as much as 30-40% is withdrawn for private use by health staff. (Van der Geest, 1982) In Kenya, implementation of the "kit system" whereby drugs were packed in sealed boxes for distribution to lower level facilities, resulted in a reduction of losses during distribution from an estimated 25% to less than 5%. (Ministry of Health, Kenya, et al, 1984).

Improving Prescription

Major savings can be made by improving prescription practices, but progress in this area is slow. Prescribers have strong opinions about drugs which are influenced by their medical training and colleagues, patient expectations, and not least, the efforts of the pharmaceutical industry to encourage them to prescribe newer, more expensive drugs. There are, however, indications that if the prescribers are fully involved in the selection and quantification process, and if they have experienced a situation of helplessness due to lack of even basic essential drugs, they are often willing to change their prescribing behavior.

The potential gains from improved prescribing are enormous. Much of what has been said about selection above applies to prescription; whereas selection is done collectively, by a group of prescribers who have both the health of patients and the collective health of the community in mind, prescription is selection of drugs done on an individual basis by a single prescriber. Yet too often the prescriber fails to take account of the economic circumstances of his patient and of the community.

Reducing overprescription may be a major field for potential savings. In Mali, for example, a survey found that the average prescription contains 10 drugs; it may include duplication in the form of the same antibiotic under different brand names. In most cases the patient in question really needs only one or two drugs, and if the average price of all the drugs is roughly equivalent (which is not usually the case, but for the sake of illustration we will assume it to be so), then a 10-drug prescription represents a potential waste of 80-90%. In fact, however, the patient seldom receives all 10 drugs since neither the health services nor his own financial situation permit this extravagance.

Experience shows that a realistic figure for savings from improved prescription may be on the order of 60-75%. A study in Ghana in 1980 examined prescriptions at several health centers and found that 96% of visits were treated with at least one injection, and that an average of 3.9 items was given on each prescription. When actual prescriptions from a number of health centers were compared with "best practice" for the condition as established by the health authorities, the drugs cost would have fallen by 70%. (Barnett, Creese, and Ayivor, 1980) Alternatively, approximately 3 times as many patients could have been treated for the same budget.

Similarly, in Nigeria, of 299 cases of diarrhea, poor prescription and overuse of antibiotics resulted in a wastage of N2526, or 97% of the amount spent on treating the cases. Similarly, prescription of a brand name antibiotic which was three times more expensive than a generic which was also available, resulted in an estimated over-expenditure of 78%. Despite the fact that 7 of the 11 doctors at the hospital knew that the brand name was more expensive, they prescribed it in 77% of cases. Curiously, the

brand name drug was judged to have been used unnecessarily in 82% of cases, while the generic was used unnecessarily in only 13% of cases. (Isenalumhe and Oviawe, 1988).

Other possible savings would result from the use of fewer injections; not only are injectible forms significantly more expensive, they also require the purchase of syringes and needles. Sterilization of injection equipment requires fuel and takes up time of the health staff. Inadequate sterilization now carries the added risk of transmitting AIDS; the costs to the patient and his family, and to society of a case of AIDS are difficult to calculate at this point.

In recognition of the fact that private sector drug sellers are de facto prescribers of drugs as well as sellers, there have been a number of initiatives to improve their prescribing skills. In Nepal, a training programme was provided for the drug sellers and a prescribing manual was produced. Initially there was some resistance and suspicion on the part of the drug sellers, but eventually they came to appreciate the programme and to take an active part. In Ghana, a contraceptive social marketing project (SOMARC) provided training for drug sellers in the prescription of contraceptives, including the oral contraceptive pill, and similarly a manual was produced. Such programmes could be a viable way of improving the prescription and use of drugs in Africa. However, the question of the illegality of these activities might need to be addressed prior to actual implementation of such programmes.

Overprescription and inappropriate prescription, including excessive use of injectables and antibiotics, can represent a major source of wastage in drug supplies. Efforts to involve prescribers in drawing up and using standard treatment schedules can be effective in reducing overprescription, and can save as much as 50-70% of the drugs bill.

Patient Information and Compliance

When the patient finally gets his drugs, does he take them as intended by the prescriber? Evidence from industrialized countries shows that compliance is, on average, about 50%--only half of patients take drugs as intended. There is reason to expect that the situation is worse in developing countries, given the lack of instructions, low literacy, dispensing practices which may involve simply handing the patient some pills without explanation, and so on. Efforts to improve dispensing practices and provide information to patients regarding dosage, mode of administration, and so on are being undertaken in various countries and although most have yet to be fully evaluated, it seems that they can make a difference in the way the patients use their drugs. Too often this last link in the chain is forgotten; the prescriber and dispenser breathe a sigh of relief that the drugs have reached the hands of the patient, only to learn that he has thrown them away upon leaving the pharmacy or simply stashed them for another illness.

Efforts at building trust between prescriber and patient, and in explaining the use and administration of drugs, and in improving patient information and dispensing practices, can be useful in improving patient compliance.

The impact of the price of drugs on compliance should not be underestimated. In a study in Nigeria, it was found that when the cost of a prescription was N1-9, it was filled in 83% of cases. But when the cost exceeded N20, the rate of filling dropped to 21%. (Isenalumhe and Oviawe, 1988)

Table 5. Estimated Potential Savings from Rational Drug Use

	Average (Percent)	Highest (Percent)
1. Selection using cost-effectiveness criteria	10	60
2. Quantification as basis for ordering	15	30
3. Procurement:		
a) use of generic names	25	30
b) use of competitive bidding procedures	10	15
c) direct import from low-price sources	5	15
4. Storage and distribution:		
a) proper storage conditions	10	25
b) good inventory mgt. and low expiration	15	20
c) reduction of theft and pilferage	20	60
5. Rational prescription	50	70
6. Improved patient compliance	20	25

Sources: See text.

Summary of Potential Savings from Improving Efficiency

The previous discussion has pointed up possibilities for significant savings in most areas of drug supply management and use. Potential savings from individual rationalization measures (summarized in Table 5) range from 10-60% or more. The biggest gains appear to come from better procurement and better prescribing.

Each sub-optimal decision has a cost, and as drugs flow through the system, poor decisions successively reduce the value of drugs left in the system. The most costly decisions are made at the top. A procurement official can make a decision, for example to purchase using brand names, which costs $5 million. A decision made by any one of 5,000 individual prescribers will have only a limited impact by itself. Cumulatively, of course,

if all prescribers make the same poor decision, the effect is the same as a poor decision at the top.

Special Issues in Drug Supply in Africa

Geographic Factors

Comparisons are often made between African countries and such countries as Thailand or India, with the implication that what is feasible in Thailand should be feasible in Africa. But the geographical situation of much of Africa is quite different and such factors as land use patterns, the distribution of the population, and their income levels clearly have an impact on service delivery and logistics. The average cost per person of providing services rises quickly as more remote areas are reached. (Over, 1986) This is often a particularly strong constraint in African countries where low rainfall and consequently extensive agricultural techniques have produced low population density.

Table 6 shows the differences in population density between several countries. Assuming that 90% of people said to be part of the agricultural work force are living in areas designated as agricultural areas (the remaining 10% are assumed to be living on marginal lands not designated as agricultural), in Mali, for example, population density would be about 20 persons per square kilometer in agricultural areas. In Zambia, it would be 12. Kenya, with 263, is atypical of Africa in many ways and is more like some of the Asian countries, its agriculture is in general more intensive, some of the land is very fertile, with abundant rainfall, and much of the agriculture is on plantations or large cooperatives.

By comparison, in many Asian countries, such as Bangladesh, agriculture is highly intensive with very small plots farmed by an individual farmer, perhaps with landless laborers as well, resulting in a high density per square kilometer even in rural areas. In Bangladesh rural areas have a density of over 720; in Thailand the density in agricultural areas is about 183, and in India and Indonesia, about 270. Clearly the costs per person served

Table 6. Population Density in Agricultural Areas in Several Countries

	(a) Total Pop (1986) (millions)	(b) GNP/ capita (1986) (US$)	(c) Pop. density overall (pop/ sq km)	(d) Area (000 sq km)	(e) % urban (1986)	(f) % of land in agric	(g) % of labor in agric	(h) Density in agric areas
Zambia	7	300	9	752	48	53	73	12
Mali	8	180	6	1240	20	25	86	20
Mexico	80	1860	41	1973	69	50	37	27
Thailand	53	810	103	514	18	36	71	183
Kenya	21	300	36	583	20	10	81	263
India	781	290	238	3288	25	55	70	272
Indonesia	166	490	87	1919	25	16	57	277
Bangladesh	103	160	715	144	18	67	75	721

NB: The assumption made was that 90% of the labor force working in agriculture lives on the part of the land designated as agricultural, e.g. (a x g x 0.9) - (d x f).

Source: Data from World Development Report, 1988.

are much higher in an area with only 12 persons per square kilometer than in an area which has nearly 700. An area with high population density is also more likely to have a well-developed road system and transportation infrastructure; taxis, private trucking firms, and other transportation is more often found where a population exists to support these businesses.

The implications of population density for costs of service delivery are significant as well. If for example one wanted to distribute antimalarial drugs to people in agricultural areas, in Bangladesh about 9000 people would be found within a radius of two kilometers from a central point (3.14×2^2 km x 721 persons/sq km). In India, Kenya, and Indonesia, one would find about 3200 people; in Thailand, about 2400. But in thinly populated rural Mexico one would find about 300, and in Mali and in Zambia, less than 200. Therefore, to reach 10,000 people with antimalarial drugs within a 2 km distance of their home, one would have to establish 45 times as many distribution points in Zambia as in Bangladesh. Delivery costs per person reached would of course be 45 times higher. More likely, one would hold down costs by expecting people to walk a greater distance, for example 5 or 10 km to the distribution point in less densely populated areas. The success of the intervention would then be highly dependent on the value people place on the intervention, and the time and travel costs they incurred in travelling the extra distance. (Foster, 1987)

For Africa, this means that costs of drug supply (and of other services) are significantly higher in rural areas, and many of the models tried

in other parts of the world will be too costly. The Thai drug banks, for example, require an intensity of supervision and supply which is not feasible in Africa due to the higher costs of transportation. Training of mothers to use ORS by health educators travelling on foot, as was done in the BRAC project in Bangladesh, would not be feasible in rural Africa. Other modes of transportation need to be envisioned; for example, motorcycles with small trailers might be suitable under certain circumstances. Paying individuals to use their private transportation to come to a central point to collect drugs may be more cost-effective than maintaining an outward-reaching delivery capability. The cost of collecting money recovered through user charges will be much higher than would be the case in Asia, and might prove prohibitive. Other types of service delivery need to be developed for rural Africa, and the constraint of low population density needs to be taken into account when planning health services in general.

Counterfeit drugs

Counterfeit drugs are a growing concern in a number of countries around the world, including several in Africa. A counterfeit (or "spurious" or "fake") drug is one which is not what it is claimed to be. It may contain too little of the active ingredient, no active ingredient at all, or be a different drug entirely from what it is purported to be (chloroquine labeled as quinine, etc.) Such products are often imitations of well-known brands, using the same "trade dress", i.e. packaging, capsule color, etc.; faking the drug takes advantage of the market share and promotional success of the original drug. In other cases, they are substandard copies of established products, which fail to meet the requirements of the established product. The most dangerous type of faking, however, is when the drug in question contains substances completely different from what they are purported to be. They may contain starch, baby powder, etc. Another type of faking is the fraudulent alteration of expiry dates on expired drugs. (Igboechi, 1988) Typically they are distributed by unregistered drug sellers and through market traders, although registered premises have also been found stocking and dispensing such products, sometimes unwittingly. (Atueyi, 1988)

Counterfeit drugs are manufactured in many parts of the world, including developing Asia and Africa; and there are European sources as well. One investigation agency estimated in 1985 that "fake drugs are now a billion-dollar industry." (Hall, 1985) Within a few hours of his arrival in a European city, an investigative reporter was able to establish contact with three companies supplying counterfeit drugs. The sources offered to fill capsules with inactive ingredients to look like the real products; they produced samples and a price list, and stated that they could provide one million tablets of several drugs within six weeks. Prices were approximately one-fifth to one-tenth those of the real products. A sample which was later analysed was found to contain 232 mg of the active ingredient, not 400 mg as stated on the label; and it took 105 minutes for the tablets to dissolve compared with 15 minutes for the original product, making the product ineffective. (Mahmood, 1987)

At the World Health Assembly in May 1988, a number of countries expressed concern about counterfeit drugs which were circulating on their markets. These are primarily "drugs which are manufactured clandestinely and marketed with the connivance of unscrupulous retailers". (WHO, 1988c) In many cases, those involved in such practices are not breaking any laws in the countries concerned; and it is difficult to bring these practices under the law in view of the international basis of such transactions and the segmentation of operations, whereby a drug might never transit the country to which the money was ultimately sent. It is hoped that the WHO certification scheme might improve the situation, which will be kept under review; guidelines are to be developed. (WHO, 1988c) Concern was also expressed by the European Economic Commission, and the International Chamber of Commerce. Pharmaceutical companies whose products have been copied have undertaken legal proceedings in several countries to put a stop to the practice. (Scrip, July 29, 1985) In Nigeria a number of companies have been blacklisted for the production and distribution of fake or adulterated drugs and are no longer eligible to supply drugs to any public institution in Nigeria. (Anonymous, 1988c)

The measures which can be taken against counterfeiting include improving the legislative framework, increasing quality control inspections, and prosecuting offenders. A first step is to make sure that laws exist to enable the prosecution of counterfeiters if they can be caught. Catching them requires reinforced quality control capabilities. But customs officials, quality control inspectors, and police and legal authorities are susceptible to corruption, and the problem is likely to persist for some time. (Atueyi, 1988) Unfortunately an African country is often powerless against counterfeiters operating from another country, and while the local offenders are caught and punished, their overseas correspondents are untouchable. A more likely outcome would be that pharmaceutical companies whose products are being copied will take measures to halt the traffic in counterfeit drugs which is clearly against their interests.

Financing Essential Drugs

The simple response to the complex problem of shortage of drugs in rural areas has recently been to propose that people in rural areas pay for drugs. In particular, UNICEF's Bamako Initiative has proposed that MCH services would be financed in rural areas by sale of essential drugs at two or three times the cost price. (Anonymous, 1988b) There are many problems with this proposal. Equity would in all likelihood fall by the wayside, as services would be priced well beyond the means of the poorer income groups. A recent epidemic of malaria in Madagascar is reported to have killed a large number of people (as many as 100,000 according to some reports) and although there was chloroquine available, it was out of reach of some of the poorest segments of the population. (Anonymous, 1988d)

The management implications of cost recovery schemes are considerable and there is little evidence that they have been studied in the necessary depth. The schemes would generate only local currency; how would this be converted into foreign exchange after the inevitable departure of the external donors? In all likelihood, the scheme would encourage inappropriate use and overprescription of drugs as availability of funds for MCH and preventive care would be closely tied to the level of drug use. The scheme would do little to improve the efficiency of the drug supply system.

Participants in a WHO workshop on financing essential drugs, held in Harare, Zimbabwe in March 1988 came to three main conclusions. First, there was agreement that considerable savings are to be found within the drug supply system. As has been shown in the discussion above, the typical drug supply system has many inefficiencies which can be corrected, with significant savings to be made. The first step in increasing availability of drugs should be to rationalize procurement and use. Another possibility is to increase resources for drugs through reallocation of health sector expenditures. (WHO, 1988d)

A second conclusion was that "cost recovery" brought with it hidden costs, both in terms of decreased utilization of health facilities, and in terms of the administrative costs such schemes entailed. Giving drugs away free was much easier than charging for them. Special care would need to be taken to ensure that the fee system did not discourage vulnerable groups most in need of care, but least able to pay. Management of the funds was a concern; and when the costs of improved accounting, transport and supervision, etc. were taken into account, the ratio of administrative costs to actual funds recovered was likely to be less favorable in rural areas.

The inequity of charging the rural poor while urban dwellers continued to receive free care was of concern as well. A recent World Bank study suggested that a "modest" fee would be 1% of annual income, which should suffice for two annual visits. (World Bank, 1987) But the significant inequality of income distribution patterns in many African countries, with income highly concentrated in the upper 10% or 20% of the population, is another cause for concern when setting a fee. Data for nine low-income countries showed that on average, the top quintile had about 52% of income; the second quintile, 20%; the third quintile, 12%; the fourth quintile, 10%; and the lowest quintile, 6% of income. (World Bank, 1985)

In Guinea-Bissau, for example, average per capita income was estimated at $170 in 1986; yet if income distribution followed this pattern, the lowest income quintile would have an average per capita income of about $50. Roughly half of the population would have less than $100 per year, and the highest quintile would have about $425. If the World Bank proposal were adopted in setting the fee, the level might be set at $1.70 for two visits. Such a fee would represent over 3% of per capita income for the lowest quintile, but only about 0.4% for the highest quintile. Furthermore, per capita income usually counts goods which are not traded (such as home-consumed produce) and thus not converted into cash; and

lower income groups have only about 25% of their income in actual cash. (P. Gertler, personal communication) Time costs, travel expenses, and lost income are other costs which are often not taken into account. Each visit for which a theoretical 0.5% of income would be charged, could easily represent a much higher percentage of income when travel costs, loss of a day's wages, and other factors are taken into account.

The statement is often made that "people are willing to pay for drugs," the point of reference being what people have paid in the past, and thereby demonstrated themselves "willing" to pay. But people often make expenditures on drugs in what are perceived (rightly or wrongly) to be life-or-death situations. Since economic barriers to seeking care are greater for poor people, they may tend to delay seeking care until the situation really is life-threatening. They may go into debt or sell important possessions (cattle, etc.) to be able to purchase drugs and medical care in an emergency situation. "Willingness to pay" data, therefore, must be used carefully, with the understanding that the poorer the person, the more likely it is that the expenditure recorded reflects an extraordinary situation--and cannot be taken to represent an amount they would be willing (or able) to pay on a regular basis. Special caution must be exercised when using such data to predict revenues from or utilization of routine health services.

Finally, the workshop participants concluded that in view of the very low income levels in much of rural Africa, charging people for drugs would be more useful as a rationing mechanism than as a major source of revenue. It was important to be realistic about the potential of cost recovery; experience with user fees has shown that in many low-income countries, such fees do not contribute greatly to revenue. Even full cost recovery for drugs has not been possible to achieve in many countries. (WHO, 1988d) The Bamako Initiative, which proposes to recover 2-3 times the base cost of drugs, could disqualify a considerable proportion of the poor inhabitants of rural areas. (Anonymous, 1988b)

Impact of the AIDS epidemic on drug supplies

In countries with a high prevalence of HIV infection, the epidemic represents significant additional morbidity and mortality in a group of primarily young adults who were not previously ill. It will make demands on all health resources including hospital beds, staff care, and drugs, and will make it difficult to maintain present levels of care for other illnesses. There is already some indication that other non-HIV positive patients are being crowded out of the health care system in some countries. As HIV seropositivity often causes a longer hospital stay, the overall number of admissions may stagnate or decline as occupancy rates reach or surpass 100%. The intensity of care may also increase since only very sick people will be able to be admitted to hospital, and more care will have to be provided on an outpatient basis; this in turn can be expected to result in an overall higher cost per admission and per bed/day.

Drugs have an important role to play in the care of HIV-positive patients at all stages of the disease. Many of the symptoms can be managed adequately and much relief and comfort provided with inexpensive essential drugs. As regards specific needs for drugs and supplies, for the most part they are the same essential drugs provided for primary health care throughout Africa. In particular, needs are for antibiotics, anti-fungals, antidiarrheal and oral rehydration solutions, anti-tuberculosis drugs, analgesics, and antiseptics and supplies, particularly gloves.

The more complex and expensive drugs such as amphotericin B, acyclovir, experimental drugs, and some of the anticancer drugs, require diagnostic, nursing, laboratory, and management skills which are usually available only at the central teaching hospital level. As a result, the overall economic impact of the purchase of these drugs may not be overwhelming, providing they are purchased only in quantities which can be used properly at the appropriate levels of care. The most significant economic impact is likely to be caused by the more routine essential drugs, which will be required in large quantities. In view of the expected numbers of new patients, special effort will need to be made to procure them as cheaply as possible, and distribute them widely. Many sexually active HIV-positive patients are willing to use condoms both as contraceptives and to protect their partners. Provision of adequate supplies of condoms to those who know they are HIV-positive and are willing to use them should be a very high priority. Condoms were added to the WHO Model List of Essential Drugs in December 1987.

Decisions will soon need to be made about what conditions can be cared for at which levels of the health system. The fact that many of the most commonly used drugs for HIV are provided to rural health centers suggests that with the addition of only a few drugs, treatment of some manifestations of HIV could be decentralized to a lower level, provided staff were given guidelines, training, and appropriate quantities of drugs. Management protocols for HIV are urgently needed, to prevent shortages of essential drugs from reducing the quality of care for both HIV-negative and HIV-positive patients alike. They are also needed to prevent the sense of helplessness and frustration on the part of the medical and nursing staff from expressing itself in requests for "high-tech" solutions to the problem and sophisticated drugs and test kits, or in "burn-out" of medical staff. Realistic, feasible treatment guidelines and protocols would do much to reassure staff that they are doing as much as can be expected for their patients. As the epidemic spreads, some consistency of management across hospitals would reduce "shopping" and resultant double counting of cases since management would be approximately the same in most places.

Conclusions

Shortages of drugs in Africa are caused not only by lack of funds, although in many countries this is the major reason. Poor utilization and wastage of drugs in both public and private sectors are also responsible and

can be improved; and the wastage of available foreign exchange can be reduced. While the private sector has a role to play, it is important to be realistic about its ability to serve the whole population and about the quality of the service it provides. Local production of drugs, although a superficially attractive solution, needs to be assessed realistically, taking account of individual country circumstances. In some cases, rehabilitation of existing factories is a promising avenue. Specific measures to improve selection, quantification, procurement, storage and distribution, and prescription and use of drugs have been implemented in a number of African countries, resulting in significant improvements in the availability of drugs. Policymakers need to realize that techniques and experience exist to solve or at least improve most of the drug supply problems in Africa, but that the ingredient which makes the difference is political will and support.

Issues for the future in drug supply for Africa, for which clear answers do not yet exist, include finding ways to overcome Africa's geographic constraints; taking steps to deal with the problem of counterfeit drugs; improving the financing of essential drugs without discouraging utilization by the groups most in need; and planning for the provision of drugs during the AIDS epidemic. A spirit of openness and willingness to discuss all available options on the part of governments and donors alike will facilitate the search for solutions.

References

Africare (1984). Feasibility Study Report and Recommendations: Improved Management and Distribution of Pharmaceuticals in Sierra Leone, Washington, DC.

Anonymous. (1988a) "Essential drugs revolving fund for Central America and Panama". PAHO Bulletin, 22(3).

Anonymous. (1988b) "The Bamako Initiative." Lancet, 19 November, pp. 1177-78

Anonymous. (1988c) "Health Minister on counterfeit and fake drugs." Pharmacy World Journal, Lagos, 5:5, May 1988.

Anonymous. (1988d) "Winged Killer." Economist, October 15.

Atueyi, I. (1988) "Sources of fake drugs." Pharmanews (Lagos), 10:4, April.

Barnett, A., Creese, A., and Ayivor, E.C.K. (1980). "The Economics of Pharmaceutical Policy in Ghana," International Journal of Health Services, 10:3.

Bessard, G.M., Gnassounou, J.P., Coquelle, D., and Boutros Toni, F. (1985) "Enquete sur les ordonnances medicamenteurses dans une metropole d'Afrique noire francophone." Therapie, 40: 481-3.

Bledsoe, C.H., and Goubaud, M.F. (1985) "The Reinterpreation of Western Pharmaceuticals among the Mende of Sierra Leone." Soc.Sci.Med. 21(3), 275-282.

Catsambas, T. and Foster, S.D. (1986) "Spending Money Sensibly: The Case of Essential Drugs." Finance and Development, (23) 4.

Fassin, D. (1988) "Illicit sale of pharmaceuticals in Africa: sellers and clients in the suburbs of Dakar." Trop.Geogr.Med., 40, 166-170.

Foster, S.D. (1987) "Logistics and Supply Aspects". Paper presented to Bellagio Conference on Case Histories in Development: Why Things Work, Italy, October 1987.

Foster, S.D. (1988) "Economic Aspects of Drug Supply in Developing Countries: An Economist's Toolbox for Pharmacists." Pharmaceutisch Weekblad, 123, 1097-1100.

Foster, S.D. (1989) "Economic Aspects of the Supply and Use of Pharmaceuticals: Evidence and Gaps in Research." in Lee, K. and Mills, A. (eds.) Health Economics Research in Developing Countries, Oxford University Press, 1989.

Glucksberg, H., and Singer, J. (1982) "The Multinational Drug Companies in Zaire: Their Adverse Effect on Cost and Availability of Essential Drugs." Int.J.Hlth.Serv., 12 (3).

Gould, D.J., and Amaro-Reyes, J.A. (1983) The Effects of Corruption on Administrative Performance: Illustrations from Developing Countries. World Bank Staff Working Paper no. 580, World Bank, Washington, DC.

Haak, H., and Hardon, A.P. (1988) "Indigenised pharmaceuticals in developing countries: widely used, widely neglected." Lancet, Sept. 10, 1988.

Haak, H. (1988) "Pharmaceuticals in Two Brazilian Villages: Lay Practices and Perceptions." Soc.Sci.Med. 27:12, 1415-1427.

Hall, R. (1985) "Wave of killer capsules sweeps third world." Observer (London), 28 March.

Hogerzeil, H.V. and Lamberts, P.J.N. (1984) "Supply of essential drugs for church hospitals in Ghana." Trop.Doct. 14:9-13.

Hogerzeil, H.V., and Moore, G.D. (1987) "Essential Drugs for Church-Related Rural Health Care," World Health Forum, 8, pp 472-473.

Igboechi, C.A. (1988) "The place of routine analysis and quality control in checking and eradication of fake drugs." Pharmacy World Journal, 5(1), January 1988, Lagos.

Igun, U.A. (1987) "Why we seek treatment here: retail pharmacy and clinical practice in Maiduguri, Nigeria." Soc.Sci.Med. 24(8), 689-695.

Isenalumhe, A.E. and Oviawe, O. (1988) "Polypharmacy: Its cost burden and barrier to medical care in a drug-oriented health care system." Int.J.Hlth.Serv., 18(2).

Ityavyar, D.A. (1988) "Health services inequalities in Nigeria." Soc.Sci.Med. vol. 27, no. 11, 1223-1235.

Jayawardene, L.G.(1980) "The Role of the State Pharmaceuticals Corporation of Sri Lanka." Ceylon Medical Journal, 25.

Kaseje, D.C.O., Sempebwa, E.K.N., and Spencer, H.C. (1987) "Community-based distribution of family planning services in Saradidi, Kenya," Ann.Trop.Med.Parasit., (81) suppl no. 1, 135-143.

Mahmood, M. (1987) "Doctors blame fake medicines for deaths." The Sunday Times (London), 1 November.

Marzagao, Carlos, and Segall, Malcolm (1983). "Drug Selection: Mozambique". World Development, 11:3.

Management Sciences for Health. (1982) Managing Drug Supply, Boston.

Management Sciences for Health (1984) Improving the Availability of Pharmaceuticals in the Public Sector. Boston.

Management Sciences for Health (1988) "Eastern Caribbean Drug Service" (press release). Boston.

Mburu, F.M., Spencer, H.C., and Kaseje, D.C.O. (1987) "Changes in sources of treatment occurring after inception of a community-based malaria control programme in Saradidi, Kenya." Ann.Trop.Med.Parisit. (81) Supp. 1, 105-110.

Ministry of Health, Kenya, DANIDA, SIDA, and WHO. (1984) Evaluation of Management of Drug Supplies to Rural Health Facilities in Kenya..

Over, M. (1986) "The Effect of Scale on Cost Projections for a Primary Health Care Program in a Developing Country," Soc.Sci.Med. 22: 3, 351-360.

Scrip World Pharmaceutical News, Various issues. Surrey, United Kingdom.

Sepulveda-Alvarez, Claudio. (1985). "In Search of Pharmaceutical Health: The Case of Thailand." Development Dialogue, 1985:2.

Speight, A.N.P. (1975) "Cost effectiveness and drug therapy." Trop. Doctor, 5, 89-92.

Szuba, T.J. (1984) Cost evaluation of Branded and Generic Drugs. WHO, Geneva (unpublished).

United Nations Centre on Transnational Corporations (UNCTC) (1984) Transnational Corporations in the Phar. aceutical Industry of Developing Countries, New York.

Upunda, G., Yudkin, J., and Brown, G.V. (1983) Guidelines to Drug Usage. Macmillan Press, London.

van der Geest, S. (1982) "The Efficiency of Inefficiency: Medicine Distribution in South Cameroon." Soc.Sci.Med. (16) 2145-2163.

van der Geest, S. (1987) "Self-Care and the Informal Sale of Drugs in South Cameroon". Soc.Sci.Med. 25:3, 293-305.

van Haperen, J.J.M. (1988). "An analysis of drug procurement in Yemen Arab Republic over the years 1983-87." WHO, Action Programme on Essential Drugs, Geneva.

World Bank (1983) Republic of Mali Health Development Project: Staff Appraisal Report. Report no. 4465-MLI.

World Bank (1985) World Development Report 1985. Washington, DC.

World Bank (1986) Pharmaceuticals in the Third World, PHN Technical Note 86-31.

World Bank (1987) Financing health services in developing countries: an agenda for reform. Washington, DC.

World Bank (1988) World Development Report 1988. Washington, DC.

World Health Organization (WHO) (1985). Soutien de l'OMS a la Reforme Pharmaceutique. Action Programme on Essential Drugs, Geneva.

WHO (1986). Rapport de Voyage en Republique Islamique de Mauritanie. Action Programme on Essential Drugs, Geneva.

WHO (1988a). Estimating Drug Requirements: A Practical Manual. doc. no. WHO/DAP/88.2. Action Programme on Essential Drugs, Geneva.

WHO (1988b). The World Drug Situation. Geneva.

WHO (1988c) Provisional Summary Record of the Eighth Meeting of Committee A, 11 May 1988, doc A41/A/SR/8.

WHO (1988d) Financing Essential Drugs: Report of a WHO Workshop. Document no. WHO/DAP/88.10. Action Programme on Essential Drugs, Geneva.

Yudkin, John S. (1978) "Provision of Medicines in a Developing Country." Lancet, 15 April.

Yudkin, John S. (1980) "The economics of pharmaceutical supply in Tanzania." Int.J.Hlth.Serv. 10, 455-477.

Annex 1. Estimated Essential Drugs Coverage in Selected African Countries, 1986.

	Estimated Drug Coverage (Percent)	Total Population (Millions)	Population Not Covered (Millions)
Angola	15	8.6	7.3
Benin	15	4.2	3.6
Botswana	75	1.1	0.3
Burkina Faso	45	8.1	4.5
Burundi	45	4.8	2.6
Cameroon	15	10.5	8.9
Central African Republic	15	2.7	2.3
Chad	15	5.1	4.3
Comoros	75	0.4	0.1
Djibouti	75	0.4	0.1
Equatorial Guinea	15	0.4	0.3
Ethiopia	45	43.5	23.9
Gabon	75	1.0	0.3
Gambia	75	0.8	0.2
Ghana	45	13.2	7.3
Guinea	15	6.3	5.4
Guinea-Bissau	45	0.9	0.5
Ivory Coast	15	10.7	9.1
Kenya	75	21.2	5.3
Lesotho	75	1.6	0.4
Liberia	15	2.3	2.0
Madagascar	15	10.6	9.0
Malawi	45	7.4	4.1
Mali	15	7.6	6.5
Mauritania	15	1.8	1.5
Mauritius	75	1.0	0.3
Mozambique	45	14.2	7.8
Niger	45	6.6	3.6
Nigeria	15	103.0	87.6
Rwanda	15	6.2	5.3
Senegal	15	6.8	5.8
Seychelles	75	0.1	0.0
Sierra Leone	45	3.8	2.1
Somalia	15	5.5	4.7
Sudan	15	22.6	19.2
Tanzania	75	23.0	5.8
Togo	45	3.1	1.7
Uganda	45	15.2	8.4
Zaire	45	31.7	17.4
Zambia	45	6.9	3.8
Total		433.5	287.7

Percent not covered: **66.4%**

Annex 1. Estimated Essential Drugs Coverage in Selected African Countries, 1986.
(Continued)

Notes: Coverage estimates from World Drug Situation, WHO, 1988.
Original document had three ranges, <30%, 30-60%, and 60-90%. These calculations were made using midpoints of the ranges, i.e. 15%, 45%, and 75%.

Sources: World Development Report, 1988, World Bank, and World Drug Situation, WHO, 1988.

PRE Working Paper Series

	Title	Author	Date	Contact for paper
WPS431	Recent Developments in Marketing and Pricing Systems for Agricultural Export Commodities in Sub-Saharan Africa	Panos Varangis Takamasa Akiyama Elton Thigpen	May 1990	D. Gustafson 33714
WPS432	Policy Choices in the Newly Industrializing Countries	Bela Balassa	May 1990	N. Campbell 33769
WPS433	India: Protection Structure and Competitiveness of Industry	Francois Ettori		
WPS434	Tax Sensitivity of Foreign Direct Investment: An Empirical Assessment	Anwar Shah Joel Slemrod	June 1990	A. Bhalla 37699
WPS435	Rational Expectations and Commodity Price Forecasts	Boum-Jong Choe		
WPS436	Commodity Price Forecasts and Future Prices	Boum-Jong Choe		
WPS437	Institutional Development Work in the Bank: A Review of 84 Bank Projects	Cheryl W. Gray S. Khadiagalla Richard J. Moore		
WPS438	How Redistribution Hurts Productivity in a Socialist Economy (Yugoslavia)	Milan Vodopivec	June 1990	J. Lutz 36970
WPS439	Indicative Planning in Developing Countries	Bela Balassa	May 1990	N. Campbell 33769
WPS440	Financial Sector Policy in Thailand: A Macroeconomic Perspective	William Easterly Patrick Honohan	June 1990	R. Luz 34303
WPS441	Inefficient Private Renegotiation of Sovereign Debt	Kenneth Kletzer		
WPS442	Indian Women, Health, and Productivity	Meera Chatterje		
WPS443	The Inflation-Stabilization Cycles in Argentina and Brazil	Miguel A. Kiguel Nissan Liviatan		
WPS444	The Political Economy of Inflation and Stabilization in Middle-Income Countries	Stephan Haggard Robert Kaufman		

PRE Working Paper Series

	Title	Author	Date	Contact for paper
WPS445	Pricing, Cost Recovery, and Production Efficiency in Public Transport: A Critique and Agenda for Reform	Rachel E. Kranton		
WPS446	A Model of Crop and Livestock Markets in Mexico	Gerald T. O'Mara Merlinda Ingco		
WPS447	Analyzing the Effects of U.S. Agricultural Policy on Mexican Agricultural Markets using the MEXAGMKTS Model	Gerald T. O'Mara		
WPS448	Analysis of the Effects of U.S. Macroeconomic Policy on U.S. Agriculturre Using the USAGMKTS Model	Richard E. Just		
WPS449	A Model of U.S. Corn, Sorghum, and Soybean Markets and the Role of Government Programs (USAGMKTS)	Richard E. Just		
WPS450	Portfolio Effects of Debt-Equity Swaps and Debt Exchanges with Some Applications to Latin America	Daniel Oks		
WPS451	Productivity, Imperfect Competition and Trade Liberalization in the Côte d'Ivoire	Ann E. Harrison		
WPS452	Modeling Investment Behavior in Developing Countries: An Application to Egypt	Nemat Shafik		
WPS453	Do Steel Prices Move Together? A Co-integration Test	Ying Qian		
WPS454	Asset and Liability Management in the Developing Countries: Modern Financial Techniques -- A Primer	Toshiya Masuoka	June 1990	S. Bertelsmeier 33767
WPS455	A Formal Estimation of the Effect of the MFA on Clothing Exports from LDCs	Junichi Goto	June 1990	M. T. Sanchez 33731
WPS456	Improving the Supply and Use of Essential Drugs in Sub-Saharan Africa	S. D. Foster	June 1990	Z. Vania 33664