IMPROVING PHARMACEUTICAL SUPPLIES MANAGEMENT IN DEVELOPING COUNTRIES

Jonathan Quick*
Ronald O'Connor**
Norbert Hirschhorn***

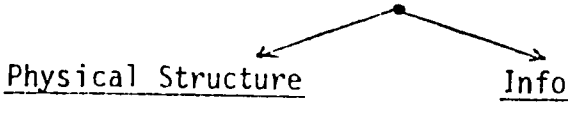
Despite the essential nature of pharmaceutical products in primary health care programs in developing countries, frequent shortages, uncertainty about drug quality and high cost remain chronic problems.

Provision of high quality pharmaceuticals in a manner which makes them accessable and affordable to the public requires a sound logistics system.

Although no single country has been successful in all areas, the collective experience of developing countries around the world indicates that viable mechanisms exist to implement each of the essential components of a pharmaceutical supply system.

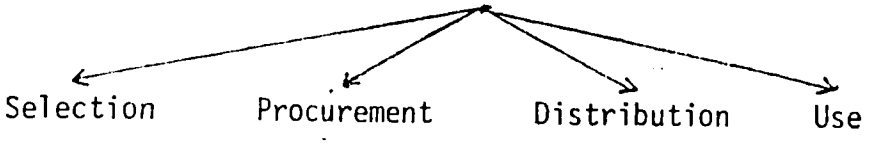
I. Overview of Pharmaceutical Logistics System

A. Structural Components(Figure 1):



Physical Structure	Information System
-warehouses	-inventory control
-vehicles	-forecasting needs
-dispensing points	-selection of drugs
-personnel	-utilization information

B. Functional Components(Figure 2):



II. Optimizing Limited Resources Through Priority-Setting: Three Approaches

Value Analysis-- The ABC System

A -- 20 % of the items accounting for 80 % of the budget
B -- 20 % of the items accounting for 15 % of the budget
C -- 60 % of the items accounting for 5 % of the budget

* Management Sciences for Health, Boston,MA and Family Medicine Resident, Duke/Watts Family Medicine Center, 407 Crutchfield Rd., Durham, N.C. 27704
** President, Management Sciences for Health, 141 Tremont St., Boston, MA 02111
*** Staff Associate, John Snow Public Health Group, 141 Tremont St., Boston, MA 02111

Level of Care Prescribing -- The LOC System, eg.:

1. Medical and Surgical Specialists -- National, Regional Hospitals
2. Generalist Physicians and Surgeons -- District Hospitals
3. Upper Level Medical Auxiliaries -- Health Posts
4. Lower Level Medical Auxiliaries -- Aid Posts

Ranking by Health Impact -- The VEN System

Vital -- potentially life-saving, basic primary health care, significant withdrawal symptoms

Essential -- efficacious against less severe, but significant forms of illness

Normal Use or Non-essential -- symptomatic relief of self-limited disease, marginal therapeutic advantage for high cost, questionable efficacy

FIGURE I

Typical Public Drug Distribution System

FLOW OF DRUGS AND INFORMATION

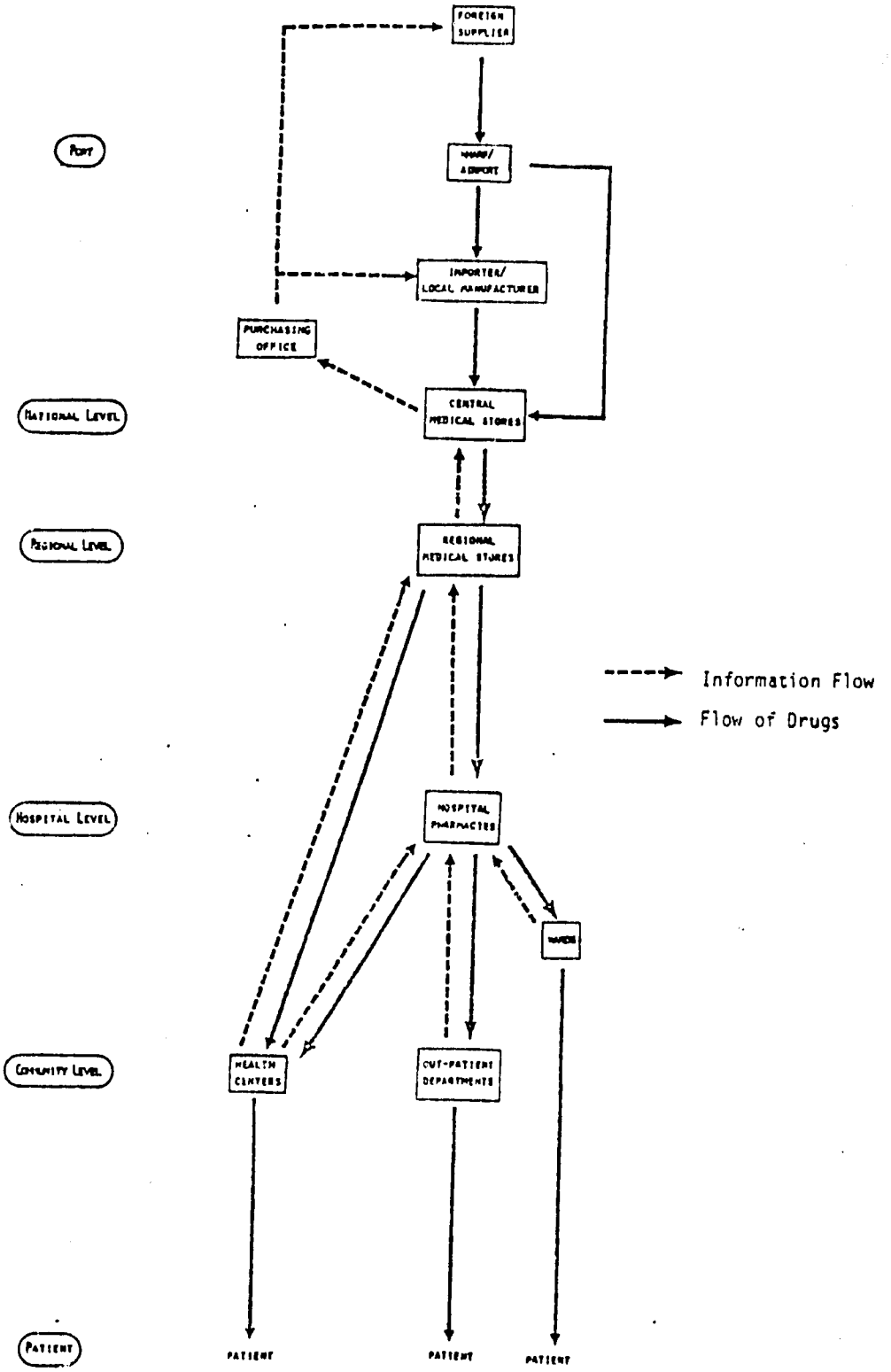


FIGURE 11

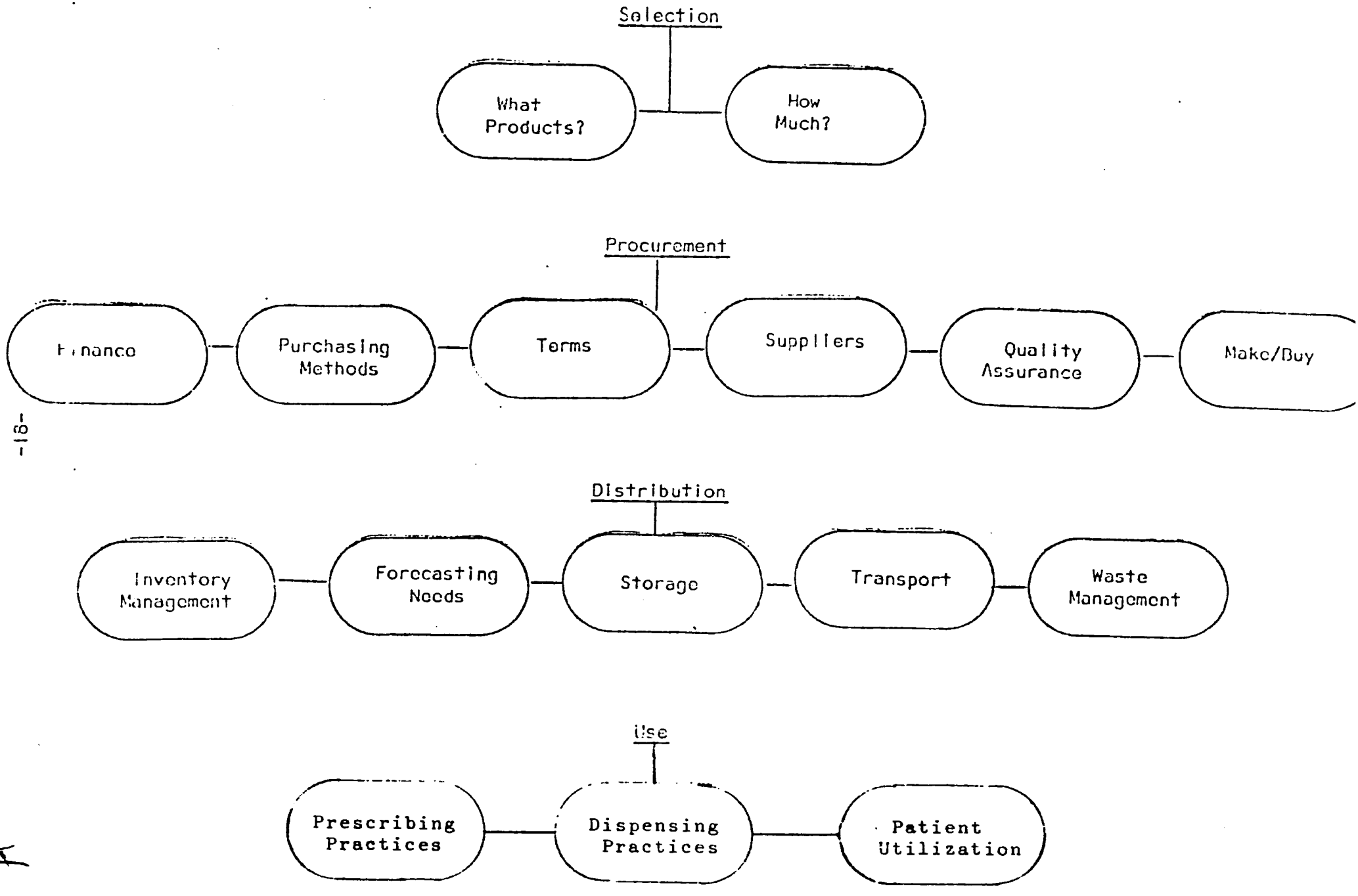
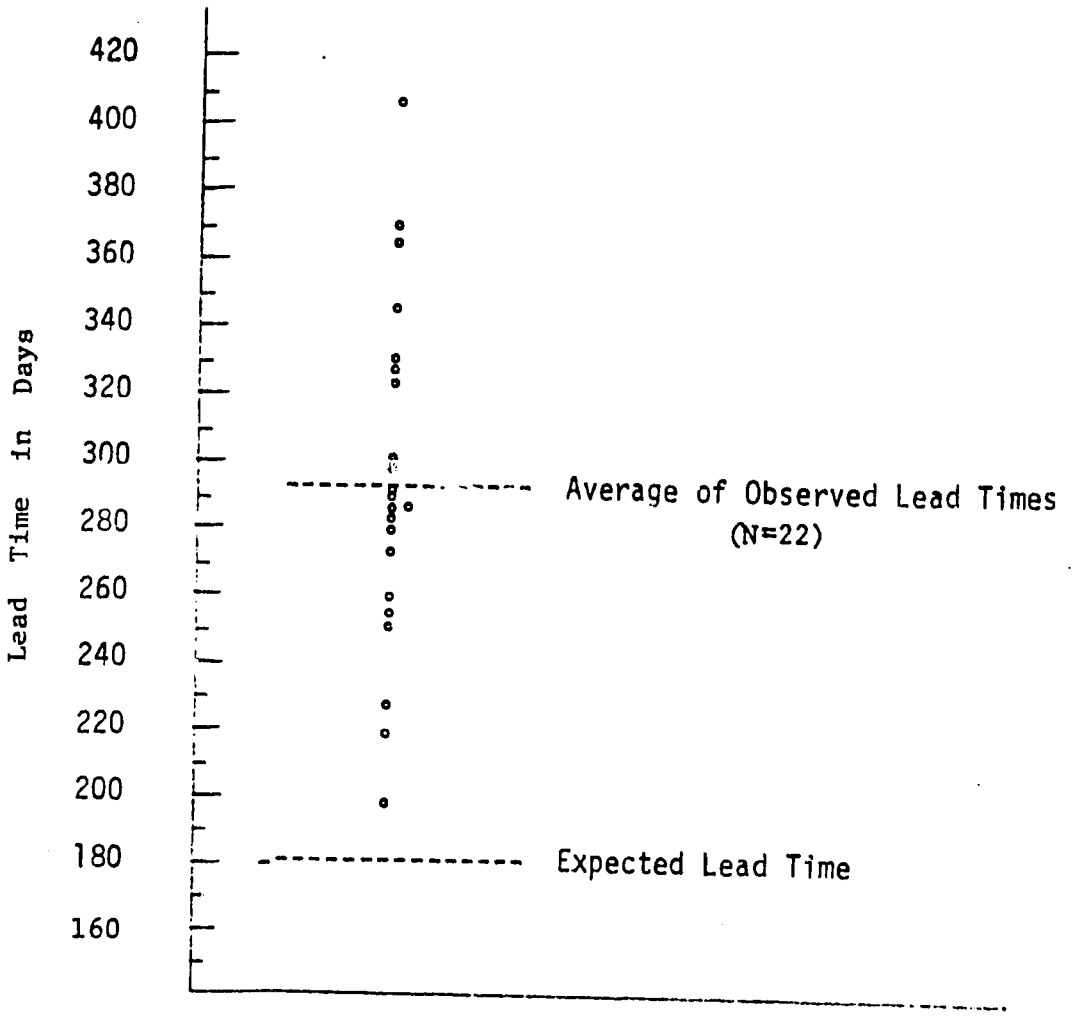

Selection
What Products?
How Much?
Procurement
Finance
Purchasing Methods
Terms
Suppliers
Quality Assurance
Make/Buy
Distribution
Inventory Management
Forecasting Needs
Storage
Transport
Waste Management
Use
Prescribing Practices
Dispensing Practices
Patient Utilization

FIGURE A.3.

SAMPLE OF LEAD TIMES FOR IMPORTS,

SRI LANKA, 1974-1975



° = Observed Lead Time for One Supplier on One Bid

FIGURE C.1.

ANALYSIS OF SECURITY BREACHES

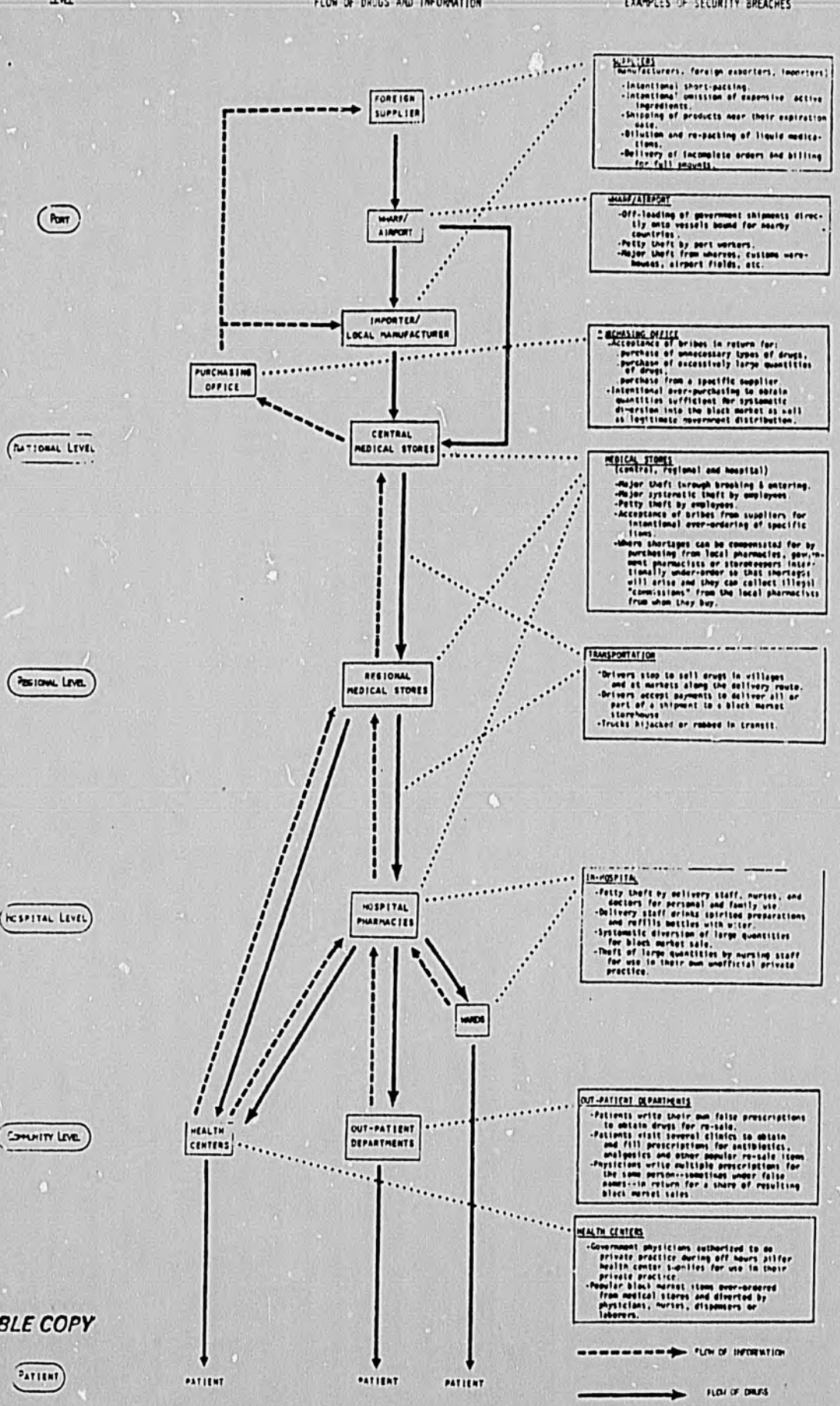


TABLE C.1.

Sampling of Techniques for Theft Control

Point of Theft	Intervention
WHARF	Containerization--if the port is equipped to handle it, reduces petty theft as well as major theft.
	Rapid Port Clearance--inadequate and inefficient port-clearing procedures used by some public drug programs result in long delays in the port, which provides extended exposure to theft in ports with weak security. Increased efficiency in port clearing reduces theft.
MEDICAL STORES (Central, regional, hospital)	Limited Access--access to medical stores is limited to the pharmacist, store manager and store employees. Hospital pharmacies are not accessible evenings, weekends or other times when the pharmacist or dispenser is not present. Limited quantities of extra supplies for emergency room use and ward use are entrusted to medical officers or nurses during the hours when the pharmacy is closed. Distribution of these supplies must be accounted for.
	Secure Locks and Doorways--are essential to good security. Country Study B.V.3. describes procedures for key control.
	Unannounced Searches--of medical stores and hospital personnel. In some countries the pharmacist or medical director personally supervises periodic, unannounced searches.
	Annual Independent Stock-Take--staff from the central pharmaceutical supply office visit all major medical stores to perform either a complete or a sampling stock-take and verification of receipt and issue records.
TRANSPORTATION	Document Verification--Receiving clerk held responsible for checking receipts against packing slip. Separate invoice is sent by mail from issuing store and receiving form is verified against this invoice. Document verification uncovers complete disappearance of shipments as well as losses in transit.

TRANSPORTATION (cont'd.)

Packing Seals--Tape, wax seals, wire seals, etc. used to close cardboard boxes or other transport containers. Do not prevent theft, but make tampering obvious.

Strong Boxes--When large shipments are made to small numbers of facilities, portable strong boxes or built-in compartments with pad locks are used. One key remains at the issuing store and the other at the receiving store.

IN-HOSPITAL

Drug Accounting--by ward and out-patient staff to provide a record of all drugs received and all drugs dispensed. Recording of individual drug orders sometimes restricted to selected drugs (e.g., Country Study V.B.2).

Issue-Consumption Verification--For dangerous and controlled drugs, a consumption report indicating the time, date, patient, patient's number, dose and remaining stock levels must be submitted to the pharmacist with each requisition for additional stocks of these drugs.

Presentation of Prescriptions for Ward Issue--For selected, expensive or frequently abused drugs, the hospital pharmacy requires a copy of the signed prescription to be filed with the pharmacy before drugs are issued to the ward.

Rotating Stock Containers--Wards are issued a limited number of labeling containers for each drug which they stock. When ward staff reports to the pharmacy to replenish their stock, these containers must be presented and drugs are issued into these containers. The containers allocated for each drug should represent a stock sufficient for several days. Frequent replenishment of stock is cause for suspicion. (See Section on the Imprest System.)

Locked Transport Boxes--Drugs are issued by the pharmacy into a wooden or metal box with a pad lock. Each ward has its own wooden or metal pad-locked box into which drugs are issued by the pharmacy. The pharmacits has one key for each of the ward boxes and the head nurse on each ward has the second key for that ward's box.

IN-HOSPITAL (cont'd.)	Up-Grading Transport Staff--Several countries have noted improved hospital security as the transport staff has changed from laborers to nursing students, dispensers or nurses. When the pharmacy establishes a twice or thrice weekly issuing schedule for wards, it becomes more feasible for nursing staff to allocate time to collect drugs from the pharmacy. Up-Grading Pharmacy Staff--Gradual replacement of untrained laborers with trained pharmacists and dispensers has been credited with decreasing theft in some countries. A combination of more careful screening of individuals, professional socialization and higher pay appear to explain this observation.
OUT-PATIENT DEPARTMENTS/ HEALTH CENTERS	Maximum Dispensing Quantities--prevent patients from altering prescriptions to obtain large amounts of drugs and prevent collaborating physicians from writing excessively large prescriptions. Selective Recording of Individual Prescriptions--is required to increase dispenser accountability for selected, "attractive" drugs. P rt of drug accounting system similar to that used for in-patients. Dispensing by Physicians and Auxiliaries--Where the health center aids responsible for dispensing medicines are found to be pilfering certain attractive items, the physician and medical auxiliaries take the responsibility for personally dispensing these selected drugs to patients in their examining room.

APPENDIX E

COUNTRY I DRUG LIST

DRUG	UNITS	ABC*	LOC**	VEN***
ACETAZOLAMIDE	250MG	C	1	V
ACTH	VIALS	C	1	V
ACTIVATED CHARCOAL	KILOGRAMS	C	2	E
ALCOHOLS		C	2	V
ALUMINIUM GLYCINATE	KILOGRAMS	C	2	E
ALUMINIUM HYDROXIDE	KILOGRAMS	C	2	E
ALUMINIUM SALICYLATE	KILOGRAM	C	2	E
AMINOPHYLLINE	AMPULES	C	3	V
AMINOPHYLLINE	100MG	C	4	V
AMMONIUM ACETATE	KILOGRAM	C	2	N
AMMONIUM_CHLORIDE	KILOGRAM	C	2	N
AMOBARBITAL	50MG	C	2	E
AMPHOTERICIN_B	AMPULES	C	1	E
AMPICILLIN	2 OZ SYRUP	C	1	V
AMPICILLIN	AMPULES	C	3	V
AMPICILLIN	250MG CAP	C	3	V
AMYL_NITRATE	PEARLS	C	2	N
ANTAZOLINE	AMPULES	C	3	N
ANTAZOLINE	PINT	C	3	N
ANTAZOLINE	25MG	C	3	N

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* ABC = ABC Inventory Category (see Section IV)

** LOC = Level of Care Category (see Section V)

*** VEN = Vital, Essential, Non-Essential (see Section VI)

FIGURE IV.3.

ABC VALUE ANALYSIS, COUNTRY I

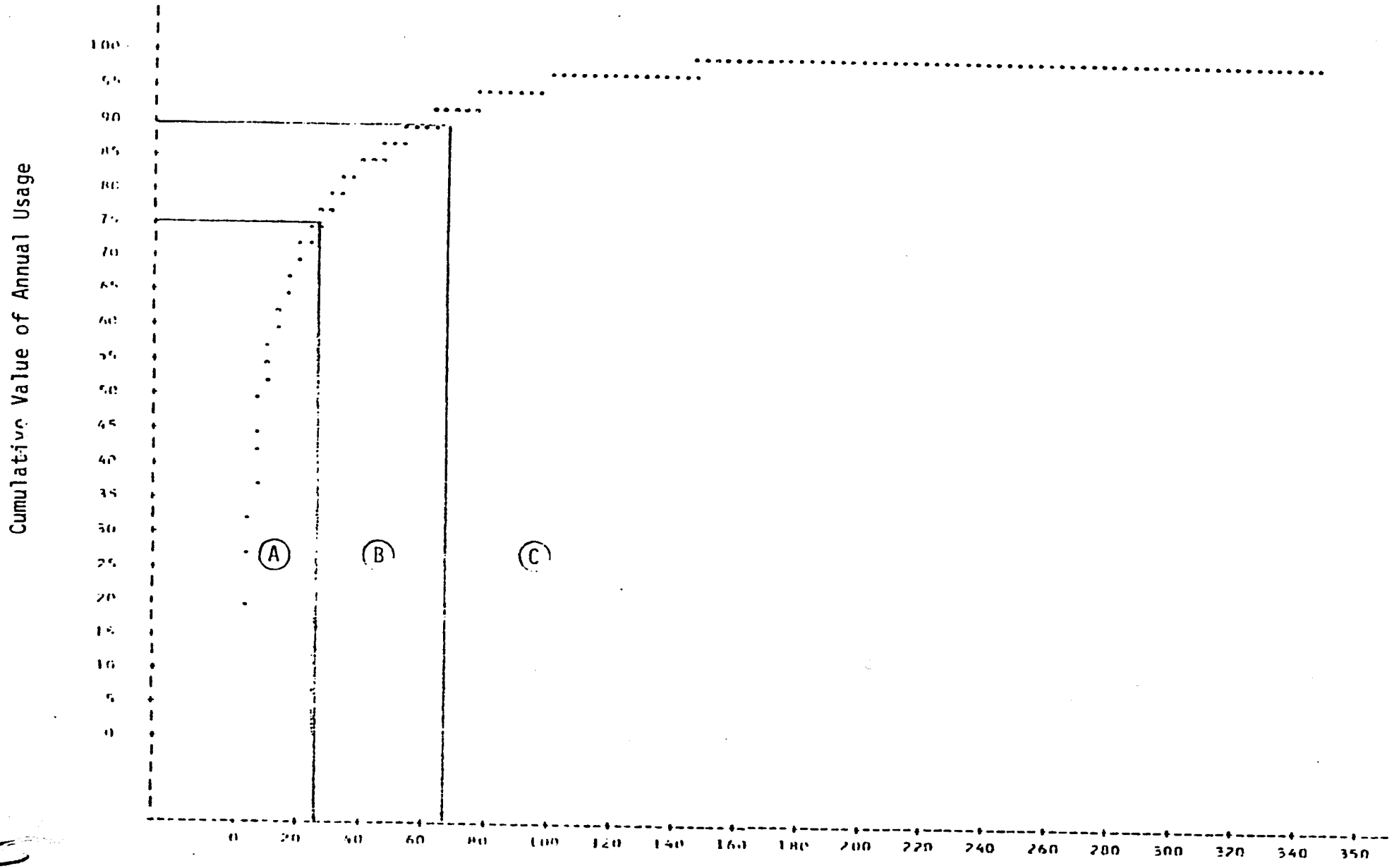
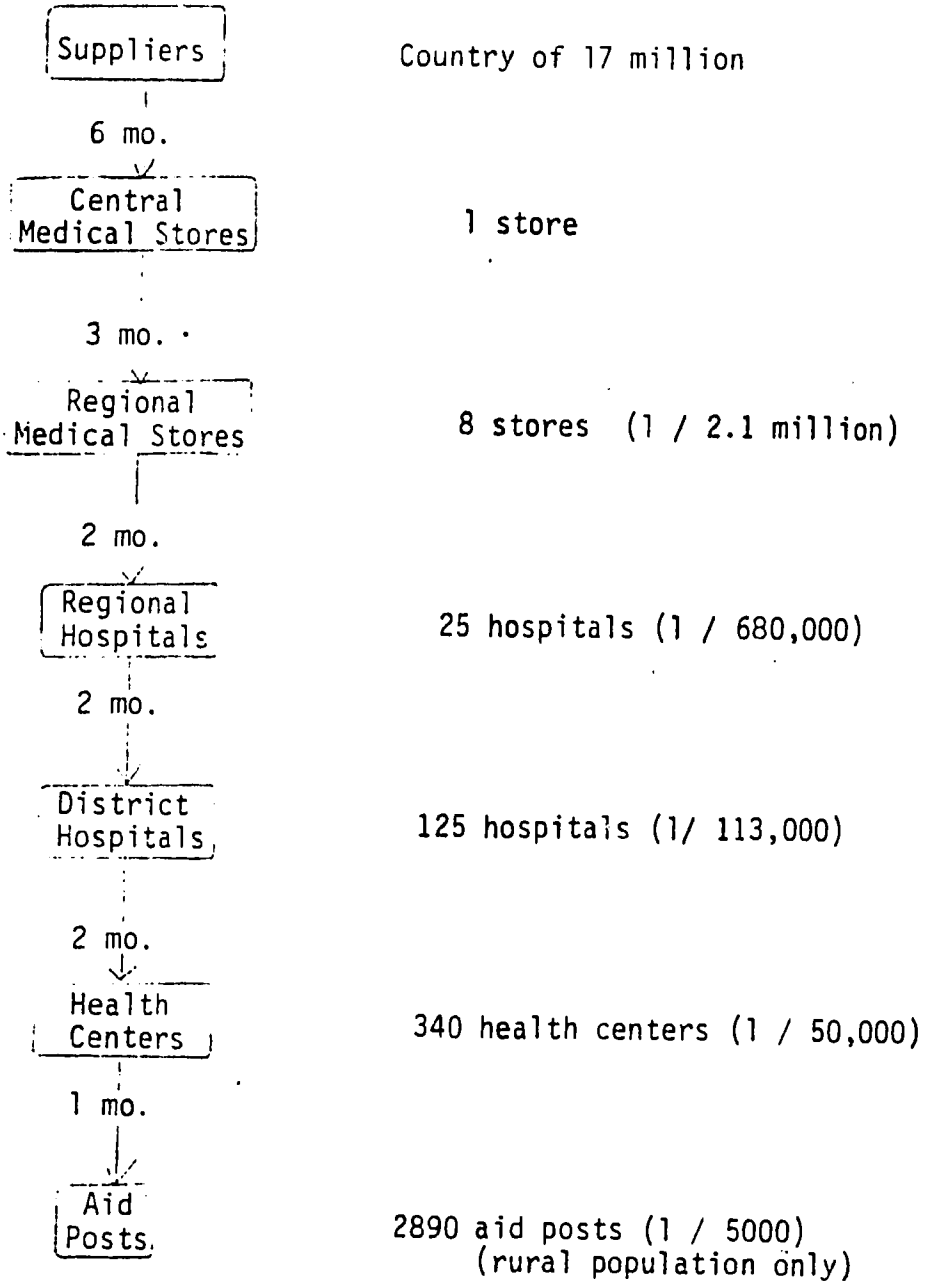


TABLE IV.3.

ABC INVENTORY ANALYSIS OF DRUG LISTS, COUNTRY I AND COUNTRY II

Drug List Characteristic	COUNTRY I ABC Category: A	B	C	TOTAL	COUNTRY II ABC Category: A	B	C	TOTAL
Number of Items	25	34	285	344	34	35	151	220
Percent of All Items	7.3	9.9	82.8	100.0	15.5	15.9	68.6	100.0
Value of Annual Consumption (US $)	$11,151,270	$2,197,600	$1,438,274	$14,787,144	$6,401,593	$1,415,641	$1,401,088	$9,218,322
Percent of Total Annual Consumption	75.4	14.9	9.7	100.0	69.4	15.4	15.2	100.0
Number of Units of Stock	275,844,000	97,990,000	148,678,725	522,512,725	103,858,000	70,511,250	89,063,088	263,432,330
Mean Number of Units per Item	11,033,760	2,882,058	521,680	1,518,932	3,054,647	2,014,607	589,822	1,197,420
Range of Number of Units per Item	100,000-90,000,000	10,000-30,000,000	1-50,000,000	1-90,000,000	8,000-15,000,000	1,250-15,000,000	638-7,500,000	638-15,000,000
Mean Unit Cost per Item (US $)	$.5980	$.4249	$3.1822	$2.7219	$1.1246	$1.0903	$.3733	$.6035
Range of Unit Cost per Item (US $)	$.0025-$3.20	$.0025-$4.50	$.0006-$100.	$.006-$.0025	$.01-$28.3927	$.0020-$24.6483	$.0016-$15.8549	$.0016-$28.3927

Hypothetical Drug Distribution System



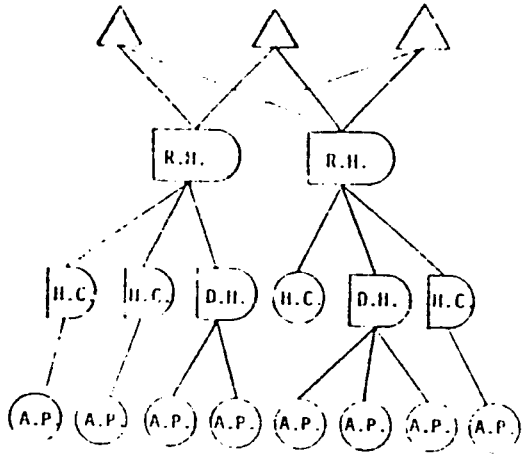
Assumed consumption pattern:

	LC-1	LC-2	LC-3	LC-4
Regional Hospitals	1.0	0.5	0.33	0.1
District Hospitals		0.5	0.33	0.2
Health Centers			0.33	0.3
Aid Posts				0.4

FIGURE V.8.

FOUR ALTERNATIVE DISTRIBUTION NETWORKS

NETWORK A



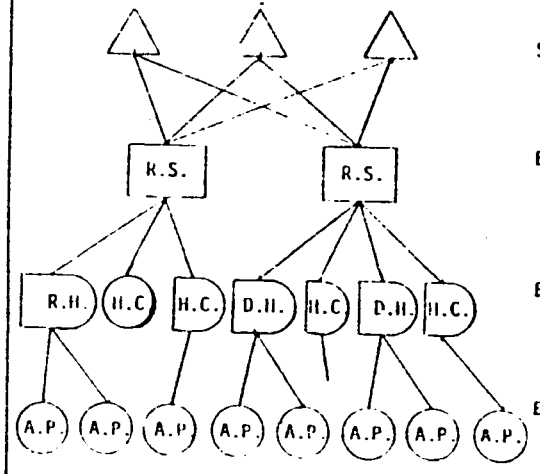
Suppliers

Echelon III:
Regional Hospitals (25)

Echelon II:
District Hospitals (125)
Health Centers (340)

Echelon I:
Aid Posts (2899)

NETWORK B



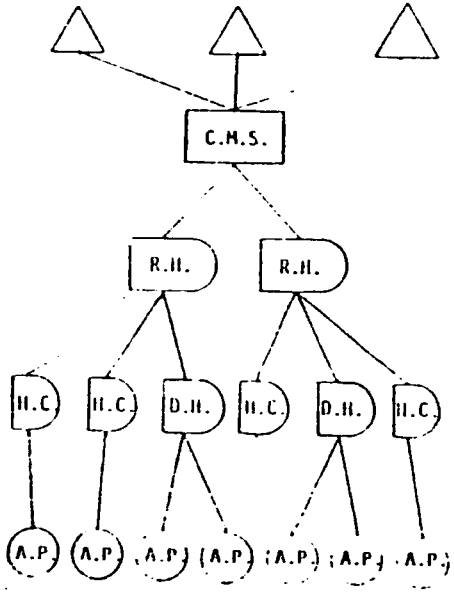
Suppliers

Echelon III:
Regional Stores (8)

Echelon II:
Regional Hospitals (25)
District Hospitals (125)
Health Centers (340)

Echelon I:
Aid Posts (2980)

NETWORK C



Suppliers

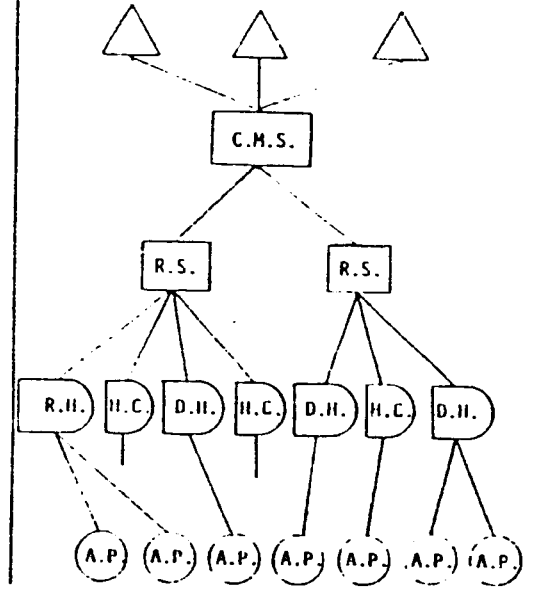
Echelon IV:
Central Medical Stores (1)

Echelon III:
Regional Hospitals (25)

Echelon II:
District Hospitals (125)
Health Centers (340)

Echelon I:
Aid Posts (2890)

NETWORK D



Suppliers

Echelon IV:
Central Medical Stores (1)

Echelon III:
Regional Stores (8)

Echelon II:
Regional Hospitals (25)
District Hospitals (125)
Health Centers (340)

Echelon I:
Aid Posts (2890)

EXHIBIT II.1.

GUIDELINES FOR ESTABLISHING A LIST OF ESSENTIAL DRUGS

Criteria for the selection of essential drugs are intended to ensure that the process of selection will be unbiased and based on the best available scientific information, yet allow for a degree of variation to take into account local needs and requirements. The following guidelines are recommended :

(1) Each country should appoint a committee to establish a list of essential drugs. The committee should include individuals competent in the fields of clinical medicine, pharmacology and pharmacy, as well as peripheral health workers. Where individuals with adequate training are not available within the country, assistance from WHO could be sought.

(2) Drug selection should be based on the results of benefit and safety evaluations obtained in controlled clinical trials and/or epidemiological studies. Guidelines for such trials have been set forth in the report of a WHO Scientific Group.

(3) The international nonproprietary (generic) names for drugs or pharmaceutical substances should be used whenever available. A cross-index of nonproprietary and proprietary names should initially be provided to the prescribers.

(4) Regulations and facilities should be available to ensure that the quality of selected pharmaceutical products meets adequate quality control standards, including stability and, when necessary, bioavailability. Where national resources are not available for this type of control, the suppliers should provide documentation of the product's compliance with the requested specifications.

(5) Cost represents a major selection criterion. In cost comparisons between drugs, the cost of the total treatment, and not only the unit cost, must be considered. In addition, the cost of nonpharmaceutical therapeutic modalities should be taken into account.

(6) Local health authorities should decide the level of expertise required to prescribe single drugs or a group of drugs in a th erapeutic category. Consideration should also be given to the competence of the personnel to make a correct diagnosis. In some instances, while individuals with advanced training are necessary to prescribe initial therapy, individuals with less training could be responsible for maintenance therapy.

(7) The influence of local diseases or conditions on pharmacokinetic and pharmacodynamic parameters should be considered in making the selections : e.g., malnutrition, liver disease.

(8) When several drugs are available for the same indication, select the drug, pharmaceutical product and dosage form that provide the highest benefit/risk ratio.

(9) When two or more drugs are therapeutically equivalent, preference should be given to :

(i) the drug which has been most thoroughly investigated ;

(ii) the drug with the most favourable pharmacokinetic properties, e.g., to improve compliance, to minimize risk in various pathophysiological states ;

(iii) drugs for which local, reliable manufacturing facilities for pharmaceutical products exist ;

(iv) drugs, pharmaceutical products and dosage forms with favourable stability, or for which storage facilities exist.

(10) Fixed-ratio combinations are only acceptable if the following criteria are met :

(i) clinical documentation justifies the concomitant use of more than one drug ;

(ii) the therapeutic effect is greater than the sum of the effect of each ;

(iii) the cost of the combination product is less than the sum of the individual products ;

(iv) compliance is improved ;

(v) sufficient drug ratios are provided to allow dosage adjustments satisfactory for the majority of the population.

(11) The list should be reviewed at least once a year and whenever necessary. New drugs should be introduced only if they offer distinct advantages over drugs previously selected. If new information becomes available on drugs already in the list which clearly shows that they no longer have a favourable benefit/risk ratio, they should be deleted and replaced by a safer drug. It should be remembered that for the treatment of certain conditions, nonpharmacological forms of therapy, or no

Selected References

Overviews

Dunnill, P: The Provision of Drugs by Appropriate Technology. Appropriate Technology 4(2): 16-17, 1977.

Lane, N.S.: A Vital Link: Ensuring Supplier of Medical Equipment and Drug Where Really Needed. WHO Chronicle 31: 404-407, 1977.

Wardell, W.M.: Controlling the Use of Therapeutic Drugs, An International Comparison. Washington, D.C.: American Enterprise Institute, 1978.

Wickremasinghe, S.A. and S. Bibile: The Management of Pharmaceuticals in Ceylon. British Medical Journal 3, 1971.

Yudkin, J.S.: Provision of Medicines in a Developing Country. The Lancet: 810-812 April 15, 1978.

Quick, J: Improving Pharmaceutical Suppliers Management in Developing Countries. Unpublished Master's Thesis. University of Rochester School of Medicine and Dentistry, Department of Preventive Medicine and Community Health, May, 1979.

Drug Supply Logistics

Anmer, D.S.: Purchasing and Materials Management for Health Care Institutions. Lexington, MA: D.C. Heath and Co., 1975.

Attwood, P.R.: Planning a Distribution System. London: Gower Press Limited, 1971.

Bailey, P.J.H.: Purchasing and Supply Management, 2nd Edition. New York: Chapman and Hall, 1969.

Combs, P.H.: Handbood of International Purchasing, 2nd Edition. Boston: Cahners Publishing Co., Inc., 1976.

Gasdia, S.D. and E.C. Brennan: Purchasing Pharmaceuticals on a Competative Basis. Hospital Formulary Management, Aug-Sept, 1968.

Lloyd, J.S.: Improving the Vaccine Cold Chain II; Progress Report December 1977. Geneva: World Health Organization, 1977.

Management Sciences for Health: Procurement and Use of Medicines in Afghanistar. Cambridge, MA: Management Sciences for Health, 1974.

Speight, A.N.P.: Cost-Effectiveness and Drug Therapy. Tropical Doctor: 89-92, April, 1975.

Taff, C.A.: Management of Physical Distribution and Transportation. Homewood, ILL: Richard D. Irwin, Inc., 1972.

Pharmaceutical Industry

Heller, T: Poor Health, Rich Profits: Multinational Drug Companies and the Third World. London: Spokesman Books, 1977.

James, B.G.: The Future of the Pharmaceutical Industry to 1990. New York: John Wiley & Sons, Inc., 1977.

Lall, S.: The Growth of the Pharmaceutical Industry in Developing Countries: Problems and Prospects. New York: United Nations, 1978.

Silverman, S.: The Drugging of the Americas. Berkeley: University of California Press, 1976.

UNIDO: The Establishment of Pharmaceutical Industries in Developing Countries. New York: United Nations Industrial Development Organization, 1970.

Wortzel, L.H.: Technology Transfer in the Pharmaceutical Industry. New York: United Nations Institute for Training and Research, 1971.

References Materials and Annotated Bibliographies

Bainbridge, J. and S. Sapirie: Health Project Management. Geneva: World Health Organization Offset Series Number 12, 1974.

Bisharah, F.S.: Handbook of Instruction for Medical Storekeeping. Alexandria, Egypt: Regional Office for the Eastern Mediterranean, World Health Organization, 1970.

Elliot, K.: The Training of Auxiliaries in Health Care. London: International Technology Publications, Ltd., 1975.

Khan, I.: Selected Bibliography on Evaluation of Traditional Medicines for Safety and Efficacy. Geneva: World Health Organization, 1976.

Mtulia, I.A.T.: Pharmacology and Therapeutics: A Manual for Medical Assistants and Other Rural Health Workers. Nairobi, Kenya: African Medical and Research Foundation, 1977.

Panamerican Health Organization: Guidelines for the Development of a National Drug Control Program. Washington, D.C.: Panamerican Health Organization, 1976.

Westring, G.: International Procurement: A Training Manual. New York: United National Institute for Training and Research, 1977.

World Health Organization: The Selection of Essential Drugs. Geneva: World Health Organization, Technical Report Series No. 615, 1977.

World Health Organization: Reference Material for Health Auxiliaries and Their Teachers. Geneva: World Health Organization, 1976.

Addiction Research Foundation of Canada: The Ethical Pharmaceutical Industry and Some of Its Economic Aspects. Toronto: Addiction Research Foundation of Canada, Bibliographic Series No. 3, 1977.