

CONTROL OF DRUGS IN A UNIVERSITY HOSPITAL SURGICAL WARD¹

Carlos E. Pérez,² Camilo Torres,³ and Pedro Porras⁴

To assess drug use patterns at the Valle University Hospital in Cali, Colombia, two surveys of the women's surgical ward were conducted. This article reports the results of those surveys.

Introduction

The university hospital of Valle University in Cali, Colombia, typically invests over 7% of its annual budget—well over half a million U.S. dollars—on medications.⁵ Despite the significance of this expenditure, very little attention has customarily been paid to the processes of planning, procurement, distribution, and use of these medications.

In 1980 the hospital administration began a consolidation of the Supply Department. During the course of this process a serious effort was made to improve the administrative aspects of procurement, storage, and distribution of all hospital supplies, including medications. It was clear to those in charge of this effort that no action had originally been envisaged for improving the patterns of drug utilization once the medications had left the pharmacy. The decision was simply that priority should be given to the initial phases of the supply process before turning to utilization.

Once the initial goal of defining an organization and a series of processes for the procurement, storage, and distribution of supplies was

duly accomplished, however, it was felt the time had come to conduct an internal study of the various hospital departments in order to determine the actual use being made of these supplies and to devise supervision and control systems for ensuring their proper utilization.

The present article describes an approach that was used to successfully quantify problems relating to the use of medications at the hospital ward level and presents the initial findings obtained by that method. It then sets forth a number of specific recommendations for improvements that were later adopted and evaluates the results of their application.

Methods and Objectives

As noted above, the work performed had two major objectives. The first was to establish the need to devise formal control systems for supervising the use of medications released by the hospital pharmacy; and the second was to assess the impact of implementing specific recommendations advanced on the basis of the initial findings.

The hospital unit where drug use patterns were assessed was the women's surgical ward, a unit with 32 beds responsible for providing hospitalized women with presurgical and postsurgical care.

For purposes of this study, drug use was considered to fall into one of two categories. These categories were (a) use by patients in the ward and (b) other uses. This latter category included medications that had deteriorated, been lost, or been removed from the ward. It should be noted

¹Also published in Spanish in the *Boletín de la Oficina Sanitaria Panamericana* 96(1):38-44, 1984.

²Assistant Professor, Department of Industrial and Systems Engineering, University of Alabama at Huntsville, Huntsville, Alabama 35899, U.S.A.

³Director, Pharmacy Section, University Hospital, Valle University, Cali, Colombia; and Professor of Pharmacology, Universidad Libre, Cali, Colombia

⁴Director, Procurement Department, University Hospital, Valle University, Cali, Colombia.

⁵In 1980 this sum totaled US\$640,000, which amounted to 7.7% of the annual budget.

that the pharmacy customarily issued medications in response to requests made on forms for individual patients. It was not hospital policy to return unused medications to the pharmacy or supply them to discharged patients.⁶

Besides classifying drug use according to whether or not the drugs reached patients in the ward, the study also classified drug use as being either "authorized" or "unauthorized" (i.e., whether records showed the use to have been authorized in writing by a physician). Together, these two sets of criteria provided the basis for constructing the following matrix:

Drugs used for:	Authorization		Total
	Authorized	Unauthorized	
Patients in the ward	AP	UP	P
Other uses	AO	UO	O
Total	A	U	WT

The meaning of the abbreviations within the matrix is as follows:

AP = Authorized consumption by Patients in the ward

UP = Unauthorized consumption by Patients in the ward

P = Patient consumption (total)

AO = Authorized consumption by Other parties or nonuse

UO = Unauthorized consumption by Other parties or nonuse

O = Other parties' consumption or nonuse (total)

A = Authorized consumption (total)

U = Unauthorized consumption (total)

WT = Ward's Total consumption

Because of the variety of medications employed, the figures involved were consolidated by determining the value of each drug used and calculating the total monetary value of the drugs within each matrix category. (This scheme could also be employed to assess individual cases, using either monetary or drug volume figures.)

In addition, the following indexes were used to help assess drug use patterns:

$\frac{AP}{WT}$ = The proportion of the ward's total drug consumption that was used by ward patients with due medical authorization. Ideally, this proportion should be 1, and in the worst possible case it would be 0.

$\frac{UP}{P}$ = The proportion of drug consumption by ward patients that occurred without due medical authorization. Ideally, this proportion should be 0, and in the worst possible case it would be 1.

$\frac{U}{WT}$ = The proportion of the ward's total drug consumption that did not receive due medical authorization. Ideally, this proportion should be 0, and in the worst possible case it would be 1.

The Initial Survey

The data needed to make various calculations were obtained in several ways. To begin with, an initial inventory was made of medications held by the ward on 1 May 1980. Then a final inventory of medications held by the ward on 31 May 1980 was performed, and all releases of drugs to the ward by the hospital pharmacy were reviewed. Obviously, the total amount of drugs consumed by the ward in May (WT) was equivalent to the initial inventory minus the final inventory plus the drugs issued to the ward in the interim.

Additional data were obtained by analyzing the clinical histories of all patients cared for in the ward during the period studied. Information was taken from the "physician's instructions" form to determine the medications authorized by the attending physicians, and also from the "nursing notes" form to determine those administered by the nursing staff. (Because inventories are routinely performed in the hospital, and because the additional information needed was obtained from clinical histories, the nurses in the ward were unaware of the survey.)

The specific data obtained for each patient and each medication were as follows:

1) Date ordered: The date on which initial admin-

⁶At this hospital pharmacists play no part in the prescribing or dispensing of medications. Instead their role is limited to managing the pharmacy, mainly by making purchases and inventorying pharmacy medications.

istration of the drug was prescribed by the physician (from the "physician's instructions" form).

2) Date suspended: The date on which administration of the drug was suspended (from the "physician's instructions" form).

3) Number of days administered (days between "date suspended" and "date ordered").

4) Daily dose recommended by the attending physician.

5) Total amount prescribed (daily dose times days administered).

6) Amount administered by the nursing staff (from the "nursing notes" form).

Initial Findings

There were 91 discharges (including deaths) from the women's surgical ward during the study period; and, in accordance with the methodology adopted, the intention had been to review the physician's instructions and nursing notes for these and all other ward patients. However, it was only possible to locate these documents in 80 of the clinical histories involved, so that in 11 cases they could not be reviewed. In this same vein, during the data-gathering process underrecording came to be suspected, particularly with regard to nursing staff records; however, in this case information available on the physician's instruction forms provided a basis for estimating possible underrecording.

Another point that deserves mention is that medications were at times provided by members of the patients' families. These medications, which were not recorded, tended to raise actual consumption levels above consumption levels reflected in the survey data.

Table 1. Initial survey: Value of drugs used in the women's surgical ward of the Valle University Hospital in May 1980, by use category.

Drugs used for:	Authorization		Total
	Authorized	Unauthorized	
Patients in the ward	391.73 ^a	7.27	399.00
Other uses	0.00	631.93	631.93
Total	391.73	639.20	1,030.93

^aValues in 1980 U.S. dollars.

The findings of this initial survey regarding the monetary value of the medications authorized for use and consumed in the ward are as shown in Table 1.

Initial Analysis

The survey found that 38% of the ward's total drug consumption (WT) was obtained with due medical authorization and was used to treat ward patients. In other words, out of every US\$100 worth of drugs consumed, only US\$38 worth was being properly obtained and properly used. The remaining US\$62 worth was being handled improperly—either because the drugs were not obtained with a duly made and recorded authorization or because they were not used to treat ward patients.

Should this finding be fairly representative of drug use patterns in other departments throughout the hospital, it would imply that of the US \$640,000 worth of drugs consumed in 1980, something like 62% (US\$396,800) were not being properly authorized for use or were being used improperly (as already noted, unused drugs were never returned to the pharmacy).

The survey also found that all but 1.8% of the drugs administered to ward patients were issued with due medical authorization. This appears to indicate that very few drugs were being administered to patients without a doctor's written authorization. However, the aforementioned percentage of ward drugs consumed without medical authorization (62%) indicates a stunning lack of supervision and control over drug use in the ward studied and points up the possibility of similar problems in other hospital departments.

The information gathered also provided a basis for assessing compliance with the doctors' treatment instructions. The relevant data, summarized in Table 2, show that patients of the women's surgical ward received only 54% (US \$391.73) of the US\$726.70 that had been prescribed. There was thus a high rate (46%) of noncompliance in the administration of medications prescribed for patients by their doctors.

Table 2. Initial survey: Compliance with physician's instructions regarding administration of drugs to patients at the women's surgical ward of the Valle University Hospital, May 1980.

Use of drugs	Drugs authorized	
	Value (US\$)	% of total value
Administered to ward patients	391.73	54
Not administered to ward patients	334.97	46
Total	726.70	100

The study also revealed that nine drugs accounted for 89% of the total value of the unexplained consumption in the ward. These drugs were clindamycin, trimethoprim-sulfa, crystalline penicillin, gentamicin, amikacin, procaine penicillin, cimetidine, kanamycin, and dexamethasone.

Initial Recommendations

On the basis of the foregoing findings and observations made during the study, it was recommended that direct responsibility should be assigned to the head nurse of each ward for the administration of medications within that ward. This would require that the head nurse fill out one consolidated pharmacy requisition per day, a requisition incorporating the individual medical instructions for each patient. The head nurse would also have to check the quantities of drugs delivered to ensure they matched those requisitioned, and would need to supervise the daily stocks of the 10 medications consumed in the largest amounts in each department. To facilitate implementation of these recommendations, appropriate steps were taken to prepare the drug storage area in each department for the new procedure.

The Follow-up Survey

To evaluate the results of implementing these recommendations, a follow-up survey of drug use in the women's surgical ward was con-

ducted. This survey covered the period 14 May-14 June 1981. The information was collected by the same methods used in the original study and, as in the previous survey, the ward's nursing staff was not informed of the investigation.

During this second survey period the ward had 102 discharges (including deaths), and all of these were studied. Other hospital conditions were the same as before. The results of this survey are summarized in Tables 3 and 4.

Follow-up Analysis

The figures in Table 3 indicate that 71% of the drugs used by the ward were medically authorized and were administered to ward patients. This is a significant improvement over the 38% found in the records reviewed for the initial survey.

The percentage of drugs administered to ward patients without proper medical authorization was minimal (0.069%). Therefore, nearly all of the remaining 29% was still being used in ways that were both improper and not medically authorized.

Table 4 indicates 60% compliance with treatment instructions, a slight improvement over the 54% compliance found by the 1980 survey.

On the basis of the previously mentioned records and the recommended requisition forms that the hospital had introduced, it was possible to quantify the values of the drugs prescribed, requisitioned, issued, and used (Table 5). For this purpose the following definitions were employed:

Table 3. Follow-up survey: Value of drugs used in the women's surgical ward of the Valle University Hospital between 14 May and 14 June 1981, by use category.

Drugs used for:	Authorization		Total
	Authorized	Unauthorized	
Patients in the ward	659.92 ^a	0.64	660.56
Other uses	0.00	266.62	266.62
Total	659.92	267.26	927.18

^aValues in 1980 U.S. dollars.

Table 4. Follow-up survey: Compliance with physician's instructions regarding administration of drugs to patients at the women's surgical ward of the Valle University Hospital, 14 May-14 June, 1981.

Use of drugs	Drugs authorized	
	Value (US\$)	% of total value
Administered to ward patients	659.92	60
Not administered to ward patients	431.52	40
Total	1,091.44	100

Table 5. The value (in US\$) of the drugs prescribed, requisitioned, issued, and administered to patients at the women's surgical ward of the Valle University Hospital, 14 May-14 June 1981.

	Value of drugs (in US\$)	% of prescribed value
Drugs prescribed	1,091.44	100
Drugs requisitioned	1,303.07	119
Drugs issued	927.17	84
Drugs administered to patients	659.92	60

Quantity prescribed: The quantity prescribed by the doctor, as recorded in the patient's clinical history.

Quantity requisitioned: The quantity requisitioned by the head nurse from the pharmacy.

Quantity issued: The quantity dispatched by the pharmacy.

Quantity administered: The quantity administered to the patient, as recorded in the patient's clinical history.

In addition, the follow-up survey obtained the information needed to provide a detailed breakdown of the major drugs whose use was not properly explained. This breakdown is provided in Table 6.

Overall, the data in Table 5 indicate that despite substantial improvements, there was still an obvious need to introduce controls in some areas. One obvious area was that of drug requisitioning—where controls were needed to ensure that only the required quantity of a drug was requisitioned and to bring about a progressive increase in the percentage of the requisitioned amount that was actually issued. At the same time, of course, the data showed a need for continued efforts to bring the quantities issued into line with the quantities administered.

Concluding Remarks

To sum up, it appears that unexplained drug uses in the women's surgical ward were considerable. If similar patterns were occurring elsewhere throughout the hospital, those unexplained uses represented over half the institution's total consumption of medications.

Table 6. The major drugs whose issuance was not medically authorized or whose use was not explained, 14 May-14 June 1981. (These 10 drugs accounted for 99.6% of the US\$267.26 value involved.)

Drugs	Improperly used or unauthorized amount		% of total value involved
	Units	Value (US\$)	
Gentamicin (80 mg ampules)	113	93.22	34.9
Crystalline penicillin (x 1,000,000 IU)	259	51.80	19.4
Chloramphenicol (ampules)	58	24.17	9.0
Magnesium oxyquinazone (ampules)	57	21.94	8.2
Heparin (vial, x 25,000 IU)	3	20.80	7.8
Procaine penicillin (x 400,000 IU)	105	20.12	7.5
Dextropropoxyphene (ampules)	83	17.45	6.5
Gentamicin (40 mg ampules)	28	12.04	4.5
Kanamycin (0.5 g ampules)	9	3.60	1.3
Vitamin K (ampules)	8	1.20	0.4
Total		266.32	99.6

Typically, the doctors, nurses, and supervisors of the various hospital departments did not exhibit great concern about controlling the use of medications. However, it is possible to conclude that significant improvements could be made in this area by assigning a stronger and more active role to the nursing staff and by taking steps that would establish permanent formal controls over the functions of procurement, storage, and administration of medications in the wards.

The principal specific recommendation derived from these surveys is that a consolidated pharmaceutical requisition form should be introduced into all hospital and clinic settings where control of medications is difficult. In virtually any hospital ward it is common to find many patients receiving the same medications. If a separate requisition form is submitted for each patient, this unnecessarily increases the number of forms and complicates accounting, issuance, receipting, and checking procedures. To reduce such problems, it is recommended that block or summary requisitions be used that will cover all or a large part of the medications requisitioned

by a given ward or department. A copy of one such form is shown in Annex 1.

For convenience, these bulk requisition forms can be preprinted with the names of frequently ordered drugs if so desired; and it may also be necessary for the form to require additional information in order to meet accounting or inventory requirements at the particular institution involved.

These requisition forms are designed to speed the work of the issuing pharmacist and to facilitate checking by the messenger and the head nurse (or whoever receives the drugs in the ward). It also makes the necessary card-indexing work very easy and reduces filing space—as demonstrated by the fact that, after the present study had been completed, the authors consolidated 510 individual patient order forms at the Valle University Hospital onto 20 bulk-order pages. Finally, this procedure greatly facilitates control without requiring any very complex or cumbersome data-processing systems. It can be introduced using manual methods and can be computerized later if computerization is desired.

SUMMARY

Two surveys, an initial survey and a follow-up survey, were conducted at the university hospital of Colombia's Valle University in 1980 and 1981 in order to assess drug requisition and use practices in a hospital ward. The site chosen for this purpose was the women's surgical ward, a unit with 32 beds responsible for providing female inpatients with presurgical and postsurgical care.

The first survey was performed by taking inventories of the medications on hand in the ward on 1 May and 31 May 1980, obtaining an account of all drugs released to the ward on 1-31 May 1980, and reviewing the clinical histories of the patients in the ward during the survey period. This survey indicated that in terms of estimated dollar value, 38% of the drugs issued to the ward were being properly obtained and properly used. The remaining 62% were not being handled properly, because the drugs were not requested by a physician, or the request was not duly recorded and filed, or the drugs were not used to treat ward patients. The survey also found that 46% of the drugs authorized by attending physicians were not used to treat ward patients. In accordance with stand-

ing policy, none of the unused drugs were returned to the hospital pharmacy.

On the basis of these findings and related observations, it was recommended that the head nurse in each hospital ward be assigned direct responsibility for drug administration in her ward, that a daily bulk requisition form be used to consolidate the individual patient requisition forms then employed, and that daily drug deliveries be matched against this form upon arrival at the ward.

These recommendations were implemented, and a follow-up survey covering the period 14 May-14 June 1981 was conducted to see what changes, if any, had occurred. This survey indicated that 71% of the drugs obtained by the women's surgical ward were properly authorized and were administered to ward patients, as compared to 38% in the initial survey. Nevertheless, there were still substantial differences between the values of the drugs prescribed by attending physicians (US\$1,091.44), the drugs requisitioned (\$1,303.07), the drugs issued (\$927.17), and the drugs administered to patients (\$659.92), a circumstance pointing up a need to introduce additional controls in certain areas.

ANNEX 1. A FORM USED FOR CONSOLIDATED REQUISITIONING OF MEDICATIONS

SUPPLY DEPARTMENT

PHARMACY ORDER FORM

PREScribed BY:

WARD:

DATE:

1. GENERIC NAME OF DRUG	2. PARTIAL QUANTITIES	3. AMOUNT ORDERED	4. AMOUNT ISSUED	5. BRAND NAME ISSUED
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				

COST:

MESSENGER:

CHIEF:

BIBLIOGRAPHY

- (1) Abood, R. R. Pharmacist dispensing: Service or sale? *Am Pharm* 20:25-29, 1980.
- (2) Auger, R. A floor stock plan for controlled drugs. *Am J Hosp Pharm* 26:583-587, 1969.
- (3) Berry, J. I., C. C. Pulliam, S. M. Caiola, and F. M. Eckel. Pharmaceutical services in hospices. *Am J Hosp Pharm* 38:1010-1014, 1981.
- (4) Bishop, S. A. Cost-effective pharmacy services. *Top Health Care Finance* 6:75-84, 1980.
- (5) D'Ambola, J. A simplified and effective inventory procedure for drugs. *Am J Hosp Pharm* 26:596-597, 1969.
- (6) U.S. Department of Health, Education and Welfare. *Pharmaceutical Supply System Planning: Guidelines for Analysis of Pharmaceutical Supply System Planning in Developing Countries*. Office of International Health, International Health Planning Methods Series, Publication No. (PHS) 79-50086. Washington, D.C., 1980.
- (7) Oficina Sanitaria Panamericana. Discusiones técnicas de la XX Conferencia Sanitaria Panamericana: Repercusión de los medicamentos en el costo de la salud; problemas nacionales e internacionales. *Bol Of Sanit Panam* 87:471-478, 1979.
- (8) Fefer, E., M. Katatsky, J. Ortiz, and J. Peña. Proyecto de investigación operacional sobre administración de medicamentos en redes de servicios básicos. PAHO/WHO Protocol Pan American Health Organization, Washington, D.C., 1980.
- (9) Helling, D. K., C. D. Hepler, and M. E. Jones. Effect of direct clinical pharmaceutical services on patients' perceptions of health care quality. *Am J Hosp Pharm* 36:325-329, 1979.
- (10) Knapp, D. E., D. L. Crosby, B. M. Brandon, and D. A. Knapp. Can pharmacists influence drug prescribing? *Am J Hosp Pharm* 35:593-594, 1978.
- (11) Lawtos, R. L., and R. B. Stewart. The hospital pharmacist's role in surveying drug prescribing and usage. *Am J Hosp Pharm* 27:666-668, 1970.
- (12) Laver, J., W. Calvert, and K. Aust. Pharmacy computer systems: Is sharing the answer? *J Am Pharm Assoc* 17:624-625, 1977.
- (13) Miller, B. R. Hospital pharmacy in Australia. *Am J Hosp Pharm* 35:673-677, 1978.
- (14) Penna, R. P. Pharmacists as health planners. *Am Pharm* 19:23-24, 1979.
- (15) Pérez, C., and E. Castañeda. Proyecto de investigación de administración de medicamentos en atención primaria: Caso Panamá y caso Ecuador. Pan American Health Organization, Washington, D.C., 1980.
- (16) Pérez, C., and E. Marchant. Proyecto de investigación de administración de medicamentos en atención primaria: Caso Santo Domingo y caso Honduras. Pan American Health Organization, Washington, D.C., 1981.
- (17) Rabin, D. L., P. J. Bush, and N. A. Fuller. Drug prescription rates before and after enrollment of a Medicaid population in an HMO. *Public Health Rep* 93:16-23, 1978.
- (18) Thielke, T. S., and P. H. Ploetz. Primary nursing and pharmacy systems: Are they compatible? *Am J Hosp Pharm* 37:1091-1092, 1980.
- (19) Witte, K. W., N. H. Leeds, D. S. Pathak, K. D. Campagna, D. P. West, and A. L. Spunt. Drug regimen review in skilled nursing facilities by consulting clinical pharmacists. *Am J Hosp Pharm* 37:820-824, 1980.