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Title: THE ESTABLISHMENT AND UTILIZATION OF THE WORK UNIT AS A MEANS OF MEASURING PRODUCTIVITY IN A HOSPITAL PHARMACY

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Historically, patient days were used to assess pharmacy staffing levels at Albany General Hospital. It was the impression of the director of pharmacy that patient days were an incomplete and therefore unacceptable indicator of personnel requirements. Therefore, a study was initiated to: 1) develop a methodology that would document and measure all activities of the hospital pharmacy department, both distributive and nondistributive, for the purpose of assessing monthly staffing levels, 2) evaluate the methodology through a six month trial, and 3) test the results of the six month trial against the previous indicator, patient days, for statistical significance.

Utilizing industrial engineering techniques, time weights, or work units, were developed for 27 predefined pharmacy tasks. Workload data were applied to the work units per task and a productivity index was ascertained. The index was corrected for personal, fatigue and delay time and was then used to assess pharmacy staffing levels. In addition,

an attitude survey was conducted to discover the staff's understanding of the methodology and their opinions as to its usefulness in determining productivity.

Results of the six month trial yielded two months (October 1977 and January 1978) which were overstaffed. The overstaffing in October probably represented under reporting of workload as the staff became familiar with the workload reporting system. In January, pharmacy personnel hours were increased to implement a new service and the resulting overstaffing situation was reflective of the inefficiencies of implementing a new service. In addition, tabulation of the attitude survey indicated that pharmacy personnel felt that the work unit methodology was valuable in assessing productivity and should be an ongoing process. Application of linear regression analysis to data resulted in a statistically insignificant regression between patient days and the calculated productivity; thus, documenting that patient days were an incomplete and, therefore, inadequate indicator of pharmacy staffing requirements.

It is important to realize that no one universal formula will be able to determine the productivity or predict the staffing requirements of every given hospital pharmacy. However, results of the study prove that it is possible to develop a methodology that is more accurate and more complete than gross indicators such as patient days and line items and that such a methodology is applicable to today's hospital pharmacy practice.

THE ESTABLISHMENT AND UTILIZATION OF THE WORK UNIT AS A MEANS OF MEASURING PRODUCTIVITY IN A HOSPITAL PHARMACY

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THE ESTABLISHMENT AND UTILIZATION OF THE WORK UNIT AS A MEANS OF MEASURING PRODUCTIVITY IN A HOSPITAL PHARMACY

Introduction

Application of industrial engineering techniques such as time and motion study and work sample study for the purpose of work measurement is relatively new to hospital pharmacy.[1] Historically, work measurement was not utilized because of the relatively low cost of hospital labor and the smaller department sizes that were required to provide traditional services. However, as new programs such as unit dose and intravenous (IV) admixture have been implemented, manpower needs and costs have increased dramatically. Surely these needs and costs will continue to rise with the evolution of clinical pharmacy in the hospital setting. Coupled with this evolution, hospital pharmacists are faced with the reality of cost containment which forces them to justify their programs not only in the name of better patient care but also financially. Therefore, hospital pharmacy managers are confronted with the challenge of meeting cost containment restraints without jeopardizing evolving new programs or compromising the quality of current services.

This can best be achieved through the efficient utilization of personnel. However, as pharmacists are called upon to evaluate productivity and realistically predict staffing levels, they find they

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1. Work measurement is an objective method of determining the resources required to accomplish the workload. (1)

lack the skills and information necessary to perform these tasks. (2,3) Therefore, in many cases outside agencies have been called upon to develop work measurement systems. Often this occurs with little pharmacist input and the resulting system is not meaningful to the pharmacy director and frequently does not totally reflect department activities. This point is further documented by recent statements in the literature regarding the lack of objective methods for determining optimal pharmacy staffing levels. (3,4,5)

Review of the Literature

Patient days[2] as a work measurement system

In the past, patient days have been utilized to evaluate hospital pharmacy workload. After some investigation, it becomes obvious that hospital patient days fail to document or account for all pharmacy services or activities. In addition, patient days make no allowance for pharmacy automation, changing methods or possible new services. This fact was identified as early as 1965 when the authors of the Hospital Staffing Methodology Manual concluded: "Correlation between admissions or patient days and pharmacy workloads was found to be inadequate for forecasting purposes." (6) Several recent studies have further confirmed this conclusion. (3,7)

The advantage of using patient days as a pharmacy workload indicator is that they are readily available and easily understood by

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2. A patient day is defined as the unit of measure denoting lodging facilities provided to one inpatient between the census-taking hour on two successive days.

hospital administrators.

Hospital Staffing Methodology Manual- MM-1 Pharmacy

The Hospital Staffing Methodology Manual is to date one of the most comprehensive documents for evaluating pharmacy workload and predicting staffing requirements. (6) Using industrial engineering techniques such as work sampling and time study, standard element times were developed for traditional pharmacy services such as inpatient prescriptions and ward stock. (See Appendix 1 for a brief outline of tasks and times.) This methodology provided for the development of allowances for differing types of automation and methods. The major disadvantage of the methodology is that it was published in 1965 and does not include provisions for unit dose, IV admixture programs or newer nondistributive services. However, it does outline a method for estimating time spent in administrative, committee, education, training and drug information activities. The authors themselves state that a great deal of time and effort are required on the part of the user for worthwhile results to be obtained.

In summary, the Hospital Staffing Methodology Manual is very complete in the information it does present and it provides for adaptation to each given hospital pharmacy. The system is somewhat outdated for hospital services today; however, with additional time studies, it could be updated and become a useful and valuable tool in evaluating and expressing to hospital administrators the efficiency and activities of the pharmacy department.

Hospital Administrative Service (HAS) Pharmacy System

Working jointly with the American Society of Hospital Pharmacists, the HAS program of the American Hospital Association proposed a new system for data collection in 1975. (8) This new system based the measurement of productivity on "pharmacy product units" or PPUs which are equivalent to one minute or professional, technical or clerical time directly associated with a drug product. PPU equivalents are delineated for nine distributive functions including unit dose, IV admixture and hyperalimentation. (Refer to Appendix 2 for a complete listing of tasks and PPU equivalents.) The new system also included provisions for estimating the amount of time spent in clinical and administrative areas. However, it did not provide for differences in methods or automation between drug distribution systems. It also neither precisely quantified the time spent in nonproduct related, clinical services, nor completely defined these services, thus rendering productivity measurement and staffing justification incomplete.

Patient Care Unit Methodology

A more recent methodology was outlined by Levin, et al, at the 11th Annual American Society of Hospital Pharmacists Midyear Clinical Meeting in 1976.[3] The Patient Care Unit (PCU) system provided 42 task definitions encompassing almost all distributive and nondistributive tasks currently performed by pharmacy personnel. It established time to perform each task, outlined a workload reporting system and presented a

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3. The PCU system was published in the Journal of the American Society of Hospital Pharmacists, June 1980. (5)

method of accurately measuring productivity and determining FTEs required. However, the PCU system failed to identify the exact elements within the tasks which were utilized in developing the standard times. It therefore lacks the flexibility needed to apply the times to different institutions which is present in the MM-1 Manual. Additionally, while the PCU system acknowledged that different methods and technology existed between institutions for the same or similar tasks and that these methods would affect the times required to perform these tasks, the investigators concluded that a certain amount of inequity would have to be tolerated if a uniform system of measurement was to be developed.

It appears more reasonable that, if work measurement is to be meaningful to each hospital pharmacy, the time standards must be tailored to each given hospital and then the times and methods used to perform the tasks should be reported. This approach would allow a reasonable comparison between hospital pharmacies and also allow identification of inefficiencies or areas where methods analysis might be most profitable. This type of comparison might further promote the standardization of methods and could be utilized to assess the need for and justification of automation.

The following thesis is a report of the development of an individualized work measurement system and its application to a small, nonprofit, nonteaching hospital.

Objectives

The objectives of the study were: 1) to develop a methodology that would document and measure all activities of the hospital pharmacy department, both distributive and nondistributive, for the purpose of assessing monthly staffing levels, 2) to evaluate the methodology through a six month trial, and 3) to test the results of the six month trial against the previous indicator, patient days, for statistical significance.

Methodology

Development of the Methodology

Albany General Hospital (AGH) is a 106 bed, acute care, nonprofit hospital. The pharmacy department is staffed by licensed pharmacists from 7 a.m. to 11 p.m. Monday through Friday and from 8 a.m. to 8 p.m. on the weekend. Pharmacy services include a centralized unit dose drug distribution system providing a 24 hour supply of medications, delivered by pharmacy personnel to locked drawers inside the patients' rooms. In addition, the pharmacy provides intravenous (IV) piggybacks on a 24 hour basis to all nursing units, admixes all total parenteral nutrition (TPN) solutions, provides Pentothal[R] in 20cc syringes for daily use to the anesthesia department and prepares special IV solutions upon request. Pharmacists are also active members of the CPR team and provide discharge consultations with all going home prescriptions. (For a more complete outline of pharmacy services, please refer to Appendix 4.)

In March 1977, patient days were being utilized to determine the productivity of pharmacy personnel and to assess necessary staffing levels of the department. It was felt that this indicator did not accurately reflect the workload of the pharmacy. From the review of the literature a list of criteria was established which would allow the identification of a more suitable methodology. The following is a list of these criteria:

1. The methodology used to determine the productivity of the pharmacy should take into account all activities performed by the pharmacy staff.

2. If statistical parameters are used such as patient days, doses per month or doses per patient day, there should be evidence of direct correlation between the statistical parameter and the activity measured.

3. The methodology used should be easy to implement; not requiring a large time or monetary commitment.

4. The methodology should require as little time as possible for data collection.

5. The methodology should require as little administrative time as possible for evaluation.

6. The data generated from the methodology should be easy to understand and useful in expressing to hospital administrators the activities of the pharmacy and how effectively and efficiently they are performed.

7. The methodology should be flexible and adaptable to changing pharmacy roles.

After the criteria had been developed they were used to evaluate the systems obtained from the literature search. Upon completion of an evaluation of the systems available, it was decided that the methodology reported by Levin, Letcher, de Leon and McCart provided the best framework for Albany General Hospital Pharmacy. (5)

Several guiding principles were gleaned from the above report which assisted in designing the methodology. These principles are:

1. To be meaningful, any system of accountability should relate time spent to the completion of specific defined tasks.

2. Grouping of subtasks into the largest possible major function is essential to minimize the time and effort expended in keeping statistics.

3. Completion of tasks whenever possible should be considered a team effort.

4. The work unit should measure productivity of paid personnel only.

Still another report emphasized the necessity of staff cooperation and involvement if valid results are to be obtained. (4)

With these principles in mind, four basic steps for the establishment of a continuous work measurement system were outlined. These steps were:

1. Evaluation and definition of all tasks currently performed by the pharmacy personnel. When defining pharmacy tasks, it is important to be accurate and complete, including an identifiable starting and stopping point that will allow for time and work sampling studies at a later date.

2. Establishment of a workload reporting system; i.e., some way to count the number of times the above tasks were performed for a given time period.

3. Establishment of standard times based on the task definitions using industrial engineering techniques.

4. Establishment of a system which integrates the standard times with the workload data to evaluate staffing and productivity for a given time period.

Definition of tasks

With examples of task definitions from the literature as a reference, and through direct observation in the pharmacy, 34 initial task definitions were outlined and presented to the AGH pharmacy staff. (3,5,6,9,10,11,12) This number was later reduced to 27 tasks through combination of several tasks. (See Appendix 4.) These tasks were divided into two groups: Distributive and Nondistributive (non-product related). These two major categories were further broken down into several subheadings. Listed under Distributive Functions were: Prescription and Bulk Dispensing, Unit Dose Dispensing, Sterile Product Dispensing, Controlled Substance Dispensing and Inventory Control. Under Nondistributive Functions, two further groupings were delineated:

Direct Patient Care Tasks and Indirect Patient Care Tasks. Such a breakdown was intended to allow billing for Direct Patient Care Tasks at a later date and also delineate the expense of providing such services to the patient.

Workload Reporting System

Once the tasks were defined and adopted, a procedure was needed to quantify the number of times the tasks were completed monthly. By reviewing the statistics maintained by the pharmacy (i.e., patient days, monthly doses billed, prescriptions dispensed), it became obvious that additional data would have to be gathered. Therefore, 3"X5" cards were prepared. Two types of cards were designed; one type for pharmacists and another for interns/clerks. (See Appendix 5.) This allowed pharmacy personnel to keep a running tally of selected tasks completed throughout the day.

The first two weeks of workload reported on the 3"X5" cards was not utilized in the study results in order to allow the staff time to become familiar with the procedure. In addition, monthly workload data for IV piggybacks and TPN solutions was collected by both computer billing and 3"X5" reporting cards to allow a comparison between the two methods and to indicate the accuracy of reporting by the pharmacists. Also, during the first month, spot checks were made to clarify questions and to encourage reporting of workload. Furthermore, it was emphasized that workload and monthly productivity would be considered a team effort and that they would not be utilized to evaluate individual performance. This emphasis was intended to prevent staff members from feeling threatened and thus, encourage more accurate workload reporting.

The grouping of subtasks into the largest possible major, measurable function is essential to minimize the time and effort expended in record keeping. For example, if workload was measured separately for filling, checking and delivering the unit dose carts, then the number of carts checked and the number of patients whose medications were delivered would have required hand tabulation. Whereas the number of unit dose medications dispensed or billed was readily available from monthly computer billing data. By grouping these tasks, which are all related to dispensing a unit dose product, the amount of time required to derive and evaluate the monthly data can be minimized.

Establishment of Standard Times

After the workload reporting had been established, an industrial engineer was consulted to assist in designing time studies for the purpose of establishing standard times for each task.[4] A time study is defined as:

> The stop-watch analysis of an operation to determine the elements of work required to perform it, the order in which they occur and the times which are required to do them efficiently. (6)

Utilizing time study to develop standard times has several advantages. Implicit in time study is the detailed documentation and breakdown of task elements resulting in a standard method of

4. Standard time is the time required by a qualified workman, working at a normal pace, to complete an element or task when following the prescribed method. (13)

performance. In addition, time studies are easier to adapt to minor changes in methods. However, there are also several disadvantages. Time study generally requires a trained observer and as the cycle time of the task becomes longer (e.g., 20 minutes) use of time study becomes more difficult because the length of time required to complete the task is usually more variable and it takes an unaffordable time commitment to make the observations necessary to obtain statistically reliable time standards. In addition, time study is geared for repetitive work in which a worker spends a major portion of his time performing the same task over and over. It was observed that small hospital pharmacies do not provide an atmosphere for repetitive work as an employee may begin one task and be interrupted several times before completing the task or leave the task completely to process an urgently needed medication order. In addition, in order to apply industrial engineering techniques such as time study several factors have to be held constant based on the following assumptions:

1. The observers presence did not significantly influence employee performance during the study period.

2. Current methods of performing pharmacy tasks are efficient given the present design of the pharmacy and available automation.

3. Time that is spent in traveling from one work area to another work area is productive time.

4. The pharmacy clerk and interns accomplish pharmacy tasks with the same efficiency as the pharmacists.

At Albany General Hospital, a continuous read, decimal minute method was used to perform the time studies which were conducted over a five week period. Times obtained during the first week were not utilized in order to allow the investigator an opportunity to gain proficiency in time study techniques and the staff time to adjust to being closely watched. Several employees were observed for a given task to allow for differences in pace among the employees.

The number of necessary observations can be determined from various tables or from the following equations: (13)

$$\sqrt{N} = \frac{Z \cdot T_t}{\epsilon_b \cdot \bar{t}} \qquad \text{(Eq. 1)}$$

Where N is the sample size, Z is the z-statistic for chosen confidence interval, T_t is the sample standard deviation, ϵ_b is the desired relative error and $\bar{t}$ is the sample mean.

OR

$$N' = \left(20 \frac{\sqrt{N\Sigma x^2 - (\Sigma x)^2}}{\Sigma x}\right)^2 \qquad \text{(Eq. 2)}$$

Where N' is the number of necessary observations, 20 is a factor based on the determined precision (10%) and confidence (95%), N is the number of observations in the sample, Σx^2 is the sum of each observation squared and Σx is the sum of all observations.

After the desired number of observations are made and the standard time for each element of the task is calculated, it can be verified by the following formula:

$$\epsilon_b = \frac{Z \cdot T_\tau}{\bar{t}} \qquad \text{(Eq. 3)}$$

Where ϵ_b is the upper bound of relative error, Z is the z-statistic, T_τ is the standard error and $\bar{t}$ is the mean time. (For application of the above formulas to the time study results, please refer to Appendix 6.)

It became apparent throughout the time course of the study that certain long cycled, nonrepetitive tasks did not lend themselves to time study, (e.g., CPR, Nursing Unit Inspection, Drug Information with

Literature Search) and another group of tasks occurred so infrequently that they were difficult to observe (e.g., Committee Involvement, Special Solution Admixture, Cancer Preparations). Therefore, industrial engineers were again consulted and a work sample study was designed for the purpose of quantifying the amount of time necessary to perform those tasks. Work sampling is a statistical method of analyzing work by taking a large number of observations at random intervals. (13)

A work sampling study usually requires a less trained observer,[5] fewer manhours, less equipment and therefore costs less to conduct than a continuous time study. In fact, the cost may be as little as 5% to 50% of a continuous time study. (13) Furthermore, work sampling observations may be taken over longer periods of time to decrease the chance of day to day variations. Most employees prefer work sampling as they do not feel comfortable with the close observation for prolonged periods of time which are required by time study. Therefore, there is less chance of obtaining misleading results with work sampling as the worker is more at ease and will be more likely to follow his normal routine. (13)

The work sample study at AGH was designed for a confidence limit of 95% and an absolute error of 3%. From these limits it was determined that 1,120 observations would be needed on each shift.[6] Two weeks of

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5. Work sampling studies in the literature report the use of senior pharmacy students (10,14,15), hospital pharmacists (3,11,12,16) and senior engineering students (17) to conduct such studies.
6. Ralph M. Barnes; Table 66, p. 528-529. (13)

observations were made to allow seven day shifts (7 a.m. to 3 p.m.) and seven evening shifts (3 p.m. to 11 p.m.) to be observed. The workday was divided into eight blocks of two hours each and a stratified random sampling technique was utilized to ensure that 20 observations occurred during each two hour period.

Personnel activities were recorded according to the predefined tasks already outlined. Prior to beginning the study, the observer spent one eight hour shift recording personnel activities to test forms, verify task definitions and gain skills in assigning personnel activities to the task definitions.

Results of the work sampling were initially tabulated manually and then later key punched and analyzed using the Statistical Analysis System, Version 766.

Results from the work sampling data were converted to standard times based on the following equation:

$$\text{Standard time} = \frac{\begin{matrix}\text{total time}\\ \text{available}\\ \text{in minutes}\end{matrix} \cdot \begin{matrix}\text{working time}\\ \text{in percent}\end{matrix}}{\begin{matrix}\text{total number of times}\\ \text{task performed}\end{matrix}} \qquad \text{(Eq. 4)}$$

(See Appendix 7 for an example of this calculation.)

In addition to their use in developing standard times, work sampling data was utilized to determine the percentage of time the pharmacists spent in Nondistributive activities and to estimate and verify a personal, fatigue and delay (PFD) allowance.[7] A 17% PFD

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7. Personal, fatigue and delay (PFD) allowance is a time allowance applied to the standard time to provide for personal needs, fatigue and minor unavoidable delays. (6)

allowance was established based on data generated and verified through current literature. (4,6,18,19,20)

From the data generated by the time and work sample studies, standard times were established for all tasks. These times were then converted to work units/task on the basis that one work unit (WU) equals ten minutes (1 WU = 10 min.). For example, if a task required four minutes to complete, the WU/task would be four-tenths (0.4 WU/task).

Integration of Standard Times with Workload Data

Once the number of work units/task had been established for all tasks, a six month trial of the methodology was initiated. Then, utilizing monthly workload data, a monthly productivity index was ascertained from the following formulas:

$$\text{Calculated WU/Task} \times \text{Total No. of Tasks/month} = \text{Total WU/Task/month} \quad \text{(Eq. 5)}$$

$$\frac{\text{Total WU/month}}{\text{6 WU/hour}} = \text{Total No. of Productive hours/month} \quad \text{(Eq. 6)}$$

$$\text{Total WU/month} = \text{Sum of Total WU/Task/month for all Tasks} \quad \text{(Eq. 7)}$$

$$\frac{\text{Total No. of Productive hours/month}}{\text{Total available duty hours/month}^{8}} = \text{Ideal Productivity } (P_I)^{9} \quad \text{(Eq. 8)}$$

The ideal productivity was then corrected for personal, fatigue and delay time.

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8. Total available duty hours are the actual paid hours minus sick, vacation and administrative time.
9. Ideal productivity is productivity which does not account for personal time, fatigue and unavoidable delay.

$$\underset{(P_C)}{\text{Corrected Productivity}} = \underset{(P_I)}{\text{Ideal Productivity}} + 17\% \ (P_I) \qquad \text{(Eq. 9)}$$

For example: Ideal Productivity = 80%

$P_C = 80\% + 0.17\ (80\%) = 93.6\%$

The final corrected index was used to evaluate pharmacy staffing levels on the following basis: a monthly productivity index of 90% to 95% was considered acceptable, 95% to 105% was optimal, and a monthly productivity consistently less than 90% or greater than 105% would require review.

Evaluation of Cost Efficiency

In addition, the cost of efficiency of staff mix was assessed by determining the manpower cost of producing one work unit.

$$\text{Manpower cost/WU} = \frac{\text{Productive manpower cost/month}^{10}}{\text{Total monthly WU}} \qquad \text{(Eq. 10)}$$

Evaluation of Staff Attitudes

A survey of staff attitudes and opinions was conducted to determine staff perception of increased workload due to such a methodology, their understanding of the methodology and their opinions as to its usefulness in determining productivity. (Appendix 8 is a reproduction of the Staff Attitude Survey and a summary of responses.)

Test of Methodology against Patient Days

After six months of operation with the methodology, the calculated

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10. Productive manpower cost excludes vacation, sick and administrative time.

monthly productivity indexes and patient days were tabulated and linear regression was performed. Final conclusions were based on the following hypotheses:

1. If the regression was statistically significant, then patient days would be considered a complete indicator of pharmacy workload and thus would be utilized to predict pharmacy staffing.

2. If the regression was not statistically significant, then patient days would be considered an inadequate and incomplete indicator of pharmacy workload and thus the proposed methodology would be considered a more effective means of assessing pharmacy staffing needs.

Results

Standard Times

Table One lists the standard time developed for each defined task and indicates whether it was established on the basis of time study (TS) or work sampling (WS) data. Time studies for some tasks did not provide statistically valid results based on the equations outlined in the methodology. The major reasons for this were the small sample size available during the time study period and the variability in time required to perform the tasks. For these tasks, standard times were verified by the work sampling data and are indicated in the table by both the TS and WS symbols.

Keeping in mind differences in methods, technology and size, the standard times developed at Albany General Hospital appear reasonable when compared to data available from the literature. (5,6,8) (Refer to Appendices 1, 2 and 3 for comparison of AGH standard times with other methodologies.) Tables Two, Three and Four compare reports in the literature for prescription dispensing, unit dose dispensing and IV piggyback preparation.

TABLE 1. Standard Times

TASK	TIME
1. Prescription Dispensing	5.7 min. (WS)
2. Nonprescription Dispensing	1.9 min. (WS)
3. Extemporaneous Bulk Compounding	8.0 min. (WS)
4. Unit Dose Dispensing	1.2 min. (WS)
5. Pricing Patient Unit Dose Profiles	1.3 min. (TS)
6. Unit Dose Packaging	1.2 min. (TS)
7. IV Admixture	3.0 min. (WS)
8. IV Piggyback Admixture - Day IV Piggyback Admixture - Night	4.0 min. (TS) 3.1 min. (WS/TS)
9. Total Parenteral Nutrition	9.1 min. (WS/TS)
10. Special Sterile Solution Admixture	5.4 min. (WS)
11. Product Manufacture	16.7 min. (TS)
12. Controlled Substances	1.2 min. (WS)
13. Central Inventory Control - per line item	4.0 min. (WS)
14. Department Orders - per line item	1.3 min. (WS)
15. Floor Stock Maintenance	1.5 min. (WS)
16. Delivery	1.6 min. (TS)
17. Routine Order Clarification	2.3 min. (WS)
18. Chart Review	3.0 min. (WS)
19. Cardiopulmonary Resuscitation	Actual or 45 min.
20. Patient Medication Counseling	4.0 min. (WS/TS)
21. Education	Actual
22. Committee Participation	Actual or 45 min.
23. Drug Utilization and Review	Reserved

TABLE 1 continued

24.	Drug Information Request	4.7 min. (WS)
25.	Drug Information Request with Literature Search	7.5 min. (WS)
26.	Nursing Unit Inspection	Actual or 45 min.
27.	Checking CPR box	Actual or 15 min.

WS = Standard time was determined by Work Sample study.

TS = Standard time was determined by Time Study.

TABLE 2. Prescription Dispensing (4,5,6,18,19,20,21,22,24)

Prescription Class	Time in Minutes				
Outpatient	4.55,	6.00,	3.19,	5.00	
Controlled Substances	5.13,	3.78			
Medicaid	5.13,	13.00			
Prepackaged	2.98,	2.77,	3.06,	2.69	
Nonprepackaged	3.83,	3.62,	3.08,	4.08,	3.53
Refill	2.80,	2.68,	2.60,	2.61	
Take Home	10.00				
Extemporaneous	5.58				

N = 23; Range : 2.60-13.0; $\bar{x}$ = 4.36 min. (s = 2.50)
AGH Standard Time: 5.7 minutes

Albany General Hospital standard time is based on a composite of all the above prescription types and is reflective of the mix peculiar to the institution. For instance, a large number of the discharge prescriptions were for controlled substances which require additional steps in labeling and record keeping.

TABLE 3. Unit Dose Dispensing (6,18,21,23,25)

	Time in Minutes/Dose				
Unit Dose Dispensing	1.0,	1.60,	1.0,	0.55,	1.16

N = 5; Range: 0.55-1.60; $\bar{x}$ = 1.06 min. (s = 0.3771)
AGH Standard Time: 1.2 minutes

Unit dose dispensing requires the majority of staff time and, therefore, it is imperative that this statistic be accurate. In addition to the elements reported in the literature, the standard time developed at Albany General Hospital includes time for checking the pharmacy patient profile against the nursing medication administration record.

From the time study data, this checking of the profiles requires 0.0725 minutes/dose. When taking into account the time for this additional check, the average standard time from reports in the literature is very similar to the standard time developed at Albany General Hospital.

TABLE 4. IV Piggyback Preparation (24,26,27,28,29)

Type of IV Piggyback	Time in Minutes
Single dose to Minibottle	3.5, 1.592, 1.03, 0.49
Single dose to Minibag	1.29, 1.35
Multiple doses to bottles	0.94, 0.39
Multiple doses to bags	1.01
Premanufactured IV Piggyback	1.0, 0.46

N - 11; Range: 0.39-3.5; $\bar{x}$ = 1.1865 (s = 0.8575)
AGH Standard Time: 4.0 minutes (Day); 3.1 minutes (Night)

The standard time currently utilized at Albany General Hospital Pharmacy for stat and first dose IV piggybacks is 4.0 minutes. In comparison for IV Piggybacks prepared at night (approximately 8 p.m.), for the following 24 hours, the standard time is 3.1 minutes. The difference can be related to the inefficiency of preparing and delivering one dose compared to 40 doses and can be further explained by comparing the single dose times with the multiple dose times in the above table.

The difference in elements within the task of IV Piggyback preparation reported in the literature makes it difficult for a precise comparison. The difference between the Albany General Hospital standard and the literature reports can be accounted for by the additional elements included in the AGH study, such as cleaning the IV admixture hood, maintaining a profile, washing hands, quality control, clean up and delivery to the nursing unit.

Overall, the standard for stat and first dose IV Piggybacks of 4.0 minutes compared quite favorably to the 4.7 minutes allowed by HAS. (23) On the other hand, the 3.1 minutes per piggyback allowed for the evening mix is considerably less.

The diversity of the reports in the literature in conjunction with the different methods available for preparing IV drugs attests to the need for individualized standards for each hospital pharmacy. And if comparison of these standards between institutions is ever to have any meaning, it is evident that they need to be based on a common definition.

Analysis of Staffing Patterns

The results of the work sample study, in addition to being used to develop standard times, were also utilized to assess the task areas in which the pharmacy staff spent the majority of their time as reported in Table Five. The table lists the tasks by classification, the percentage of time spent by pharmacists, interns, clerks and all personnel in the respective task areas; also included are the number of observations made and the absolute error.

From the table, the results indicate that the majority of staff time was spent in Distributive functions (68.11%). It is interesting to note that the pharmacy interns spent more of their time in Indirect Patient Care Tasks (12.68%) than the pharmacists (6.44%). This was due to the assignment of tasks during the work sampling period. During this time, the pharmacy interns performed several nursing unit inspections

Table 5. Results from the Work Sample Study for the purpose of outlining the percentage of time spent by pharmacy personnel in each task classification.

TASK CLASSIFICATION	PHARMACIST % of time	INTERN	CLERK	TOTAL
Distributive				
Prescription and Bulk Dispensing - Tasks 1-3	4.85	6.02	6.64	5.55
Unit Dose Dispensing Tasks 4-6	41.39	39.95	48.38	42.38
Sterile Products Tasks 7-11	14.86	5.12	.59	9.15
Controlled Substances Task 12	2.65	6.53	9.77	5.21
Inventory Control and Delivery - Tasks 13-16	5.38	5.89	6.84	5.82
Total	69.13	63.51	71.93	68.11
Nondistributive				
Direct Patient Care Tasks Tasks 17-20	2.58	.77	0	1.53
Indirect Patient Care Tasks - Tasks 21-27	6.44	12.68	3.71	7.77
Total	9.02	13.45	3.71	9.30
Nonproductive	21.83	23.05	23.83	22.59
Number of observations	1319	781	512	2612
Absolute error at 95% confidence level	3.0	3.5	5.0	2.0

and were required to present two inservices to the nursing staff.

A comparison of the amount of time spent in the defined activities by day and evening shift personnel is reported in Table Six. These results are reflective of the normal work schedule of the pharmacy department. Since the day shift is responsible for filling, checking and delivering the unit dose carts, a larger percent of time in unit dose dispensing appears in the table. On the other hand, the evening shift is responsible for preparing the IV piggybacks for the next 24 hours; therefore, there is a larger apportionment of time to sterile products.

Evaluation of Methodology

After analysis of the time and work sample studies, total pharmacy work units were tabulated on a monthly basis and the corrected productivity was calculated from the methodology. The results of this calculation are reported in Table Seven, Summary of Data. In addition, included in the Summary of Data is the monthly work units for each major group of tasks, the monthly percent of intern and clerk manhours to total manhours, the personnel cost per work unit and total patient days, by month.

The monthly productivity index was less than 90% for two months during the six month trial and thus required examination. The low of 89.3% occurred in the first full month that workload statistics were tabulated by employees and probably reflects under reporting of the actual work. A similar situation was noted by Levin, et al, in their report in which they stated that it took approximately three months before totally acceptable reporting was achieved. (5) The other

Table 6. Percent of Personnel Time spent in Task Classification by Shift

TASK CLASSIFICATION	DAY SHIFT (7am-3pm) Percent of Time	EVENING SHIFT (3pm-11pm) Percent of Time
Distributive		
Prescription and Bulk Dispensing - Tasks 1-3	6.5	4.1
Unit Dose Dispensing Tasks 4-6	47.0	35.1
Sterile Products Tasks 7-11	4.9	15.7
Controlled Substances Task 12	3.5	7.9
Inventory Control and Delivery - Tasks 13-16	5.5	6.2
Nondistributive		
Direct Patient Care Tasks Tasks 17-20	1.6	1.5
Indirect Patient Care Tasks - Tasks 21-27	15.7	4.8
Nonproductive	21.2	24.9
Number of Observations	1589	1023

Table 7. Summary of Data

MONTHLY TOTALS	OCT	NOV	DEC
Prescription and Bulk Dispensing - Tasks 1-3 (WU)	303	325	307
Unit Dose Dispensing Tasks 4-6 (WU)	2048	2174	2248
Sterile Products Tasks 7-11 (WU)	528	466	536
Controlled Substances Task 12 (WU)	300	290	392
Inventory Control and Delivery - Tasks 13-16 (WU)	231	248	234
Nondistributive Tasks Tasks 17-27 (WU)	158	142	210
Total Work Units	2567	3645	3929
Total Manhours[a]	595	608	655
Percent Interns and Clerks[b]	35	35	36
Productivity (%)	89.3	92.3	96.1
Personnel cost/WU[c] ($)	1.71	1.60	1.55
Total Patient Days	2116	2270	2090

a. Total manhours is the actual time available to produce WUs, excluding administrative, sick and vacation time.
b. Percent Interns and Clerks = Total Clerk hours + Total Intern hours ÷ Total Manhours
c. Personnel cost/WU is the cost of staff to produce WUs, excluding administrative, sick and vacation time.

Table 7 continued

MONTHLY TOTALS	JAN	FEB	MAR
Prescription and Bulk Dispensing - Tasks 1-3 (WU)	321	280	363
Unit Dose Dispensing Tasks 4-6 (WU)	2313	2299	2509
Sterile Products Tasks 7-11 (WU)	655	518	628
Controlled Substances Task 12 (WU)	351	434	504
Inventory Control and Delivery - Tasks 13-16 (WU)	219	289	232
Nondistributive Tasks Tasks 17-27 (WU)	174	186	192
Total Work Units	4032	4005	4428
Total Manhours[a]	672	667	738
Percent Interns and Clerks[b]	40	41	40
Productivity (%)	89.7	93.6	97.6
Personnel Cost/WU[c] ($)	1.60	1.58	1.53
Total Patient Days	2310	2202	2402

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a. Total manhours is the actual time available to produce WU's, excluding administrative, sick and vacation time.
b. Percent Interns and Clerks = Total Clerk hours + Total Intern hours ÷ Total Manhours
c. Personnel cost/WU is the cost of staff to produce WUs, excluding administrative, sick and vacation time.

occurrence of a corrected productivity below 90% was in January when it was 89.7%. During January the total manhours increased due to additional clerk and intern hours prior to and during the initiation of a pilot controlled substances distribution system. Thus, the inefficiency, expressed as lower productivity, can be attributed to and is reflective of the learning curve of the hospital staff as the new program was implemented.

Evaluating productivity for the remaining four months resulted in two months falling in the acceptable range; November (92.3%) and February (93.6%) and two months in the lower optimum range; December (96.1%) and March (97.6%). These results were considered acceptable by the director of pharmacy based on variations in demand for pharmacy services.

In addition to examining the productivity index, personnel cost efficiency was evaluated by determining the manpower cost of producing one work unit. The following formula was utilized to calculate the costs reported in Table Seven:

$$\frac{\text{Monthly Personnel Cost[10]}}{\text{Total Monthly WU}} = \text{Personnel Cost/WU} \qquad \text{(Eq. 11)}$$

Personnel cost per work unit is indicative of two factors; 1) the average hourly salary rate, and 2) the productivity of the pharmacy staff. If productivity remains relatively constant, the personnel cost per work unit may be reduced by a decrease in the average hourly salary rate through increased utilization of less expensive personnel. However,

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11. Monthly personnel cost is the cost of staff excluding administrative, vacation and sick time.

there are limitations to the increases in technician hours that are possible in small institutions due to the requirement for pharmacist supervision and the legal limitations of technician activities. Nonetheless, it should be possible, by monitoring personnel cost per work unit, to achieve a staff mix that allows a reduction in the cost without adversely affecting productivity. This indicator was put to test in the last three months of the trial when the percent of intern and clerk hours to total hours was increased from 35% to 40% due to the implementation of the new controlled substances distribution system. Initially, the decrease in productivity offset any savings that might have been realized. However, as the staff became familiar with the new task and productivity increased, the personnel cost per work unit fell to the lowest reported amount ($1.53 in March). Overall, the six month trial was inadequate to establish trends or realistically evaluate the usefulness of monitoring the personnel cost per work unit. However, it is anticipated that further data will evidence personnel cost per work unit as a useful management tool.

With the evolving role of the pharmacist toward providing more nondistributive, clinical services, the rationale for the use of technicians (i.e., clerks and interns), is to free the pharmacist's time to expand these new services. This idea was tested by performing regression analysis on the monthly data to determine if the percentage of clerk and intern help available affected the performance of nondistributive tasks. Statistical analysis revealed that performance of nondistributive tasks by pharmacists was not only independent of the amount of intern and clerk help available, but also independent of of productivity and total personnel hours available. (See Appendix 9 for expansion on the regression analysis of these variables.) Thus it would appear that the performance of nondistributive tasks at Albany General Hospital was based on the demand for such tasks and not on the provision of additional time to staff pharmacists.

Attitude Survey

Results of the attitude survey indicated that the pharmacy personnel realized the purpose and need for the work unit methodology and felt it was more complete and accurate than the method previously used, i.e., total patient days. The staff also indicated that the work unit methodology required little additional work on their part and that filling out their workload reporting cards required only 5-10 minutes per day on the average. Regarding the accuracy of their reporting, the majority of the staff felt that their reporting was accurate but occasionally omissions did occur. Only one individual stated that his reporting was inaccurate due to the many interruptions throughout the work day. When questioned on the overall worth of the methodology, the majority of the staff felt the work unit methodology was valuable in assessing productivity and should be an ongoing process. Significantly, most of the staff strongly felt the methodology could be applied to other hospital pharmacies.

In addition to the questions regarding the methodology, five work satisfaction questions were included to identify job attitudes which might affect the perception of the productivity measuring system. The staff, on the whole, were more satisfied with their jobs than other hospital pharmacy staff reported in the literature. (30,31) (See

Appendix 8 for results of the Staff Attitude Survey.)

Statistical Analysis

Linear regression analysis was applied to the data to determine the significance of patient days to predict the calculated productivity. Implicit in this evaluation is the assumption that the development of standard times and their application to pharmacy activities is a more complete and accurate way of assessing staffing than the use of gross indicators such as line items or patient days. Thus, statistical analysis was acheived by testing the null hypothesis, $H_0:\beta = 0$, against the alternative, $H_a:\beta \neq 0$, at the $\alpha = 0.05\%$ significance level. Acceptance of the null hypothesis indicates that patient days is an unacceptable indicator of the calculated productivity and thus, based on the above assumption, the work unit methodology is adopted as the means of assessing pharmacy staffing levels at Albany General Hospital. On the other hand, acceptance of the alternative, implies that patient days is a complete and adequate indicator of productivity and, therefore, due to the availability of data and ease of evaluation, patient days would be accepted as the pharmacy staffing indicator.

The F statistic was utilized to test the significance of the regression. Table Eight is a summary of the regression analysis.

TABLE 8. Linear Regression of Patient Days versus Productivity

$$H_0 : \beta = 0$$

$$H_a : \beta \neq 0$$

$$r = 0.2343$$

ANOVA TABLE

Source	SS	df	MS
Regression	3.082	1	3.082
Errors	53.038	4	13.260
Total	56.120	5	

$$F^* = \frac{3.082}{13.260}$$

$$F^* = 0.2324$$

$$F_{01}(1,4) = 21.20 \qquad F_{05}(1,4) = 7.71$$

Since F* calculated (0.2324) is less than the critical value of $F_{05}(1,4)$; 7.71, H_a is rejected in favor of H_0 indicating an insignficant regression.

Therefore, as outlined in the methodology, the productivity as determined by work units was accepted as a more effective means of assessing pharmacy personnel needs. In addition, it was concluded that patient days were not totally reflective of pharmacy staffing requirements of Albany General Hospital Pharmacy, and thus, were unacceptable.

Discussion and Conclusion

When considering application of this type of methodology to other institutions, the most important step is to develop complete and accurate task definitions, keeping in mind the need for subsequent workload measurement. Furthermore, it is recommended that a well designed work sample study be utilized to establish standard times in lieu of time studies, especially in small institutions with minimal financial resources, due to the minimal time commitment and minimal expertise required to perform the work sample observations. While this type of study will not be as precise for some tasks, it will still provide objective data upon which to determine productivity and assess staffing levels.

Once the methodology has been established, several limitations or principles should be kept in mind:

1. Standard times developed at one hospital pharmacy should not be applied to another hospital pharmacy unless it can be documented that the methods, procedures, workload, equipment, workflow and layout of the two pharmacies are the same or are not significantly different. (1)

This point is easily illustrated by the literature data for IV Piggyback preparation reported in Table Four in which there is a wide range of times reported based on different methods. However, it is possible to compare standard times developed for one hospital to standard times developed at another hospital. This type of comparison would allow identification of areas which may need method review or may serve as a method for assessing the need for automation.

2. Standard times will require periodic updating as techniques and technology change. (1)

3. Implicit in standard time development is the assumption that caution will be exercised to insure that the efforts to implement productivity measurement will not have an adverse effect on the quality of care provided. (1)

It is important not to place so much importance on standard times that the staff attempts "short cuts" to beat the time developed. This methodology is a management tool developed on a team concept and should not be utilized to evaluate individual personnel performance.

Additionally, from working with the sytem, it became obvious that simplification of workload assessment is a must. Data derived from computer billing is the most feasible method available. As fees for direct patient care, nondistributive services become more prevalent, computer billing will assist in reducing the need for workload reporting cards filled out by the staff and reduce the amount of time required for tabulation.

An added benefit not identified in the development of the methodology is the possible use of total manpower cost per work unit to estimate the cost of providing a nondistributive service and thus provide a means of determining equitable and justifiable fees that can be presented to third party payors.

In summary, a study was conducted in a 106 bed acute care community hospital for the purpose of : 1) developing a methodology that would document and measure all activities of the hospital pharmacy department, both distributive and nondistributive, for the purpose of assessing monthly staffing levels, 2) evaluating the methodology through a six month trial and 3) testing the results of the six month trial against the previous indicator, patient days, for statistical significance. Results of the study prove that it is possible to develop a methodology that is more accurate and complete than gross indicators such as patient days and that such a methodology is applicable to hospital pharmacy practice.

In conclusion, it is important to realize that no one universal formula will be able to determine the productivity or predict the staffing requirements of every given hospital pharmacy. Thus, this methodology offers an individualized approach in that data derived at one hospital pharmacy are used to evaluate that hospital pharmacy only. It is hoped that other hospital pharmacies will find this type of methodology applicable and are able to utilize it in assessing the activities of their departments.

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APPENDICES

Appendix 1

Tasks and Times defined by Hospital Staffing Methodology Manual - MM-1

TASKS	TIME IN MINUTES
A. Administration and Professional Direction	estimate
B. Consultative Pharmaceutical Services	estimate
C. Pharmacy and Therapeutics Committee Participation	estimate
D. Drug Information Services	estimate
E. Assay and Control	estimate
F. Education and Training	estimate
G. Investigation and Research	estimate
H. Participation in other Committees	estimate
I. Inventory Operation	estimate
J. Requisition or Purchase	
1. Interview salesman - per interview	20.0
2. Verbal Purchase - per purchase	10.0
3. Written Purchase - per purchase	15.0
K. Receiving and Storing Operation	
1. Receive the delivery - per item received	0.342
2. Store items on shelf - per item	0.288
L. Prepackage Narcotics	
1. Constant time - per prepack	4.50
2. Variable time - per unit	1.56
3. Check prepackaging Lot - per lot	2.00
4. Check each item - per unit	0.10
M. Prepackage Regular Drugs	
1. Constant time - per prepackaging	5.95
2. Variable time - 15 tabs/bottle	
a. Method #1 - per unit	0.506
b. Method #2 - per unit	0.373
c. Method #3 - per unit	0.487
3. Variable time - 24 tabs/bottle	
a. Method #1 - per unit	0.593
b. Method #2 - per unit	0.493
c. Method #3 - per unit	0.499

Appendix 1 continued

	4. Variable time - 60 tabs/bottle	
	a. Method #1 - per unit	0.943
	b. Method #2 - per unit	0.843
	c. Method #3 - per unit	0.712
	5. Prepackage Liquids - per unit	1.000
	6. Prepackage Ointments - per unit	0.750
N.	Bulk Compounding or Manufacturing	
	1. Bottle washing - per bottle	0.882
	2. Prepare for compounding - per order	2.850
	3. Performing compounding - per bottle	0.070
	4. Set up equipment for filling - per order	0.925
	5. Fill bottles - per bottle	0.592
O.	Pick up and Delivery	
	1. Basket system - per basket	1.000
	2. Dumb waiter system - per pick up or delivery	1.844
	3. Chute or Pneumatic tube - per tube	0.460
	4. Personal Delivery	
	a. To nursing station - per pick up or delivery	3.000
	b. Elevator time - per pick up or delivery	4.000
P.	Inpatient Prescription	
	1. Prepackaged - per prescription	1.357
	2. Nonprepackaged - per prescription	1.855
Q.	After-hours Dispensing - per request	1.700
R.	Special Request Processing	
	1. Special purchase - per purchase	7.000
	2. Prescription for restricted drug - per drug	4.000
	3. Extemporaneously compounded prescriptions - per prescription	8.000
S.	Floor Stock	
	1. Restricted drugs - per unit of issue	1.998
	2. Regular drugs - per unit of issue	1.214
	3. Ward Stocking	
	a. Constant time - per nursing unit	1.676
	b. Variable time - per unit of issue	0.846
	4. Pushing cart - per pace	0.0187
	5. Elevator travel time - per trip	4.000
T.	Processing Return - per return	0.952
U.	Processing Department Orders - per unit of issue	0.714

Appendix 1 continued

V.	Processing IV Issues	
	1. Prepare for issue - per unit of issue	0.555
	2. Inspect - per unit of issue	1.000
	3. Billing - per unit of issue	0.500
W.	Classification of Work Order - per work order	0.165
X&Y.	Employee and Outpatient Prescription	
	1. Prepackaged - per prescription	2.687
	2. Nonprepackaged - per prescription	3.533
	3. Refill - per prescription	2.606
Z.	Satellite Operations (Clinic Orders) - per unit of issue	1.000

Appendix 2

Tasks and Times defined by Hospital Administrative Service (HAS) Pharmacy System

Standard Unit of Measure: Pharmacy Production Units (PPUs)

Counts to be maintained and the associated pharmacy productivity units are listed below. PPUs for unlisted activities should be reasonably estimated based upon production units for other comparable activities, or estimated by qualified personnel.

Data Source: The number of IVs, unit doses, etc. issued shall be obtained from actual counts maintained by the pharmacy. The total pharmacy production units shall equal the above counts multiplied by the respective PPUs.

Activity	Count	PPU*
Hyperalimentation IV	# of IVs	15.0
IV Admixtures	# of IVs	4.7
Floor Stock IVs	# of IVs	0.5
Unit Dose	# of Tablets Dispensed	0.55
Multidose Rx	# of Line items	3.5
Floor Stock Narcotics	# of Line items	1.5
Floor Stock Requisitions	# of Line items	1.0
Floor Stock Drug Order	# of Line items	0.3
Outpatient Prescriptions	# of Prescriptions	6.0

* 1 PPU = 1 minute

Excerpted from the preliminary report of the Hospital Administrative Service Program of the American Hospital Association. 1975.

Appendix 3

Tasks and Times defined by the Patient Care Unit (PCU) Methodology

TASKS	TIME IN MINUTES
1. Routine Dispensing	10
2. Medicaid Dispensing	13
3. Medicaid Dispensing with prior authorization	25
4. Third Party Payor Prescription Dispensing	13
5. OTC Sales	5
6. Routine Order Clarification	3
7. Medicaid Order Clarification	5
8. Hospital NF Order Clarification	5
9. Discharge Medication Central Pharmacy	6
10. Discharge Medication Counseling	4
11. Miscellaneous Medication Dispensing	4
12. Ward or Clinic Stock Bulk Manufacture	120
13. Ward or Clinic Stock Individual Preparation	13
14. Chart Orders Profiled	2
15. Unit Dose Dispensed	1
16. Unit Dose Bulk Packaging	1
17. Unit Dose Extemporaneous	3
18. Credits - Not Unit Dose	10
19. Product Manufacture	100
20. IV Admixtures	10
21. Standard TPN Base	10
22. Individualized Adult TPN	20
23. Individualized Pediatric TPN	30
24. Direct Patient Care	
Pharmacist	15
Student	15
25. Indirect Patient Care	
Pharmacist	7
Student	15
26. Patient Profile with Interview	
Pharmacist	15
Student	10
27. Patient Profile No interview	2
28. Chart Review	
Pharmacist	10
Student	10
29. Cardiopulmonary Resuscitation (CPR)	60

Appendix 3 continued

TASKS	TIME IN MINUTES
30. CPR-Check box	15
31. Drug Information Request	
Pharmacist	8
Student	10
32. Patient Information Request	
Pharmacist	8
Student	10
33. Literature Search Verbal Reply	
Pharmacist	90
Student	20
34. Literature Search Written Reply	
Pharmacist	140
Student	40

TASKS	TIME IN MINUTES
35. Education Conference	
Pharmacist	80
Student	20
36. Rounds Participation	100
37. Central Inventory Control	30
38. Storehouse Order	6
39. Misc. Requisition	1
40. Controlled Substance	4
41. Items transported	60
42. Nursing Unit Inspection	40

Appendix 4

Albany General Hospital Pharmacy Task Definitions

I. Distributive Pharmacy Tasks

A. Prescription and Bulk Dispensing

1. Prescription Dispensing - (Purchaser pays cash or is billed directly.) This task accounts for all the time required to process and dispense a prescription. This task includes:
   a. Telephone calls to prescribers for refill authorization or clarification.
   b. Checking and updating patient profiles.
   c. Completing the accepted procedure for filling a prescription; type label and count medication.
   d. Quality Control; ensuring proper labeling and preparation.

2. Nonprescription Dispensing - This task accounts for each nonlegend drug item or package sold without a prescription. This task also accounts for a legend item sold to another pharmacy or to a physician.

3. Extemporaneous Bulk Compounding - This task encompasses all the work required to prepare extemporaneously a bulk compound to be used by a single patient. This would include items such as special creams or irrigating solutions that are used for one particular patient.

B. Unit Dose Dispensing

4. Unit Dose Dispensing - This task accounts for all activities related to dispensing one unit dose to a hospitalized patient. This includes:
   a. Placing medication into or removing it from (for crediting) a patient's medication drawer, sending doses to the nursing unit prior to cart exchange and maintaining necessary levels in unit dose picking bins.
   b. Maintaining patient profiles (e.g., interpreting and transcribing chart orders, checking for allergies or interactions, renewing or discontinuing orders, late charging (crediting) or entering any other pertinent information in the profile after profile initiation, such as lab values or diet.)
   c. Quality Assurance; checking the medication in one patient's medication drawer against the pharmacy's patient profile, checking the doses prepared by a

technician and sent to the floor prior to medication exchange, and also assuring that the medications are in the proper location to be received by the patient (transfers).

d. Delivering to or removing from the nursing station one patient's medications.

e. Comparing the nursing administration record against the pharmacy profile and rectifying any discrepancies. Also reviewing the patient's profile for the purpose of detecting drug interactions or potential allergy problems.

5. Pricing Patient Unit Dose Profiles - This task accounts for all of the work required by pharmacy personnel to price one patient's profile. This may include:
    a. Determining total number of doses dispensed.
    b. Filling in appropriate code numbers or prices on the patient's profile.
    c. Pricing non-coded items.
    d. Determining total charge to the patient.

6. Unit Dose Packaging - This task encompasses all of the effort necessary to prepare an oral, liquid or solid unit dose package. This includes:
    a. Proper labeling.
    b. Necessary quality assurance.
    c. Necessary record keeping.

    Note: One package shall count as completion of one task.

C. Sterile Products

7. IV Admixture - Any large volume parenteral (LVP) that is transferred, admixed, labeled and inspected or otherwise manipulated so that the result is a new product having different constituents from the original container shall constitute a pharmacy task. Also considered as completion of one task is the transfer of an LVP from one container to another without a change in constituents. This task includes:
    a. Preparation of the label.
    b. Procurement of materials for mixing (such as syringe, needle, or drug).
    c. Actual admixture using sterile technique.
    d. Quality assurance and proper control (e.g., checking label, inspection of bottle upon completion of admixture, and assuring proper functioning of the laminar flow hood).

Appendix 4 continued

8. IV Piggyback (IVPB) Admixture - This task accounts for all the work necessary to prepare an IVPB. This includes:
   a. Preparation of the label.
   b. Procurement of necessary materials.
   c. Actual admixture using sterile technique.
   d. Proper control and quality assurance.

9. Total Parenteral Nutrition (TPN) - All of the steps required for formulation, preparation, inspection and labeling of a TPN solution shall be considered a pharmacy task. Included in this function is:
   a. Preparation of the label.
   b. Procurement of necessary materials.
   c. Actual admixture using sterile technique.
   d. Proper control and quality assurance.
   e. Initiating and maintaining a TPN monitoring document.

10. Special Sterile Solution Admixture - This task accounts for all the time necessary to prepare, under a laminar flow hood, a special solution for irrigation, parenteral or ophthalmic use (e.g., neomycin total hip solution, or special IV products). This includes:
    a. Procurement of necessary materials.
    b. Proper labeling.
    c. Proper control and quality assurance.
    d. Necessary record keeping.

11. Product Manufacture - All of the work that is necessary to compound a parenteral formulation in bulk, with one control number, which is to be repackaged and dispensed in multiple containers is a pharmacy task (e.g., Pentothal[R] for anesthesia or unit dose parenteral). This task is comprised of:
    a. The preparation of an LVP that requires dilution, aseptic transfer or bacterial filtration.
    b. Proper labeling.
    c. Necessary quality control.
    d. Required record keeping.

D. Controlled Substances

12. Controlled Substances - This pharmacy task encompasses all of the activities required to assure proper levels of Schedule II medications are on the nursing units for administration to patients, whether floor stocked centrally or in the patient's room. This task also accounts for all of the work necessary to bill a patient for one dose of a Schedule II medication. Included in this task are:

Appendix 4 continued

a. Filling out medication adminstration control sheets in pharmacy.
b. Delivery of controlled medications to the nursing units.
c. Assurance of proper medication levels.
d. Checking work of technicians.
e. Picking up white slips from the nursing unit and logging them on the patient profile.

E. Inventory Control and Delivery

13. Central Inventory Control - This function includes the ordering, receiving, pricing, stocking and bookkeeping related to maintaining proper pharmacy stock levels. This includes:
    a. Preparing direct orders (purchase orders).
    b. Daily orders placed with wholesalers.
    c. Interviews with drug manufacturer representatives.
    d. Intradepartmental ordering (orders placed with stores or central supply).
    e. Inventory replenishment (e.g., restocking IV admixture area or unit dose filling areas).
    f. Payouts to purchase material from outlets not normally used.
    g. Inventorying pharmacy (each line item inventoried constitutes one task).

    Note: Each line item processed (priced, checked off from invoice and stocked) from a requisition, invoice or packing slip shall count as one task completed.

14. Department Orders - This task accounts for all the time required to fill a hospital department order. This would include orders from the operating room, emergency room, labor and delivery, anesthesiology and other nursing units and hospital departments. Included in this task are:
    a. Attaching the hospital control slip to the unit issued.
    b. Logging the amount dispensed on proper intradepartmental records.
    c. Billing at the end of the month.

    Note: Each line item processed shall count as one task completed.

15. Floor Stock Maintenance - This task encompasses all the work required to maintain proper levels of floor stock on the nursing units. This includes:
    a. Logging on the patient's profile the item used from floor stock for billing purposes.
    b. Replacement of stock.

Appendix 4 continued

16. Delivery - All delivery time not accounted for elsewhere shall be considered here. Each time pharmacy personnel leave the pharmacy to deliver an item shall be considered one task completed (e.g., floor stock delivery or stat order delivery).

II. Nondistributive Pharmacy Tasks

A. Direct Patient Care Tasks

17. Routine Order Clarification - This task encompasses all the activities required to clarify a medication order. This includes:
    a. All communication necessary, including personal contact or telephone calls to the prescriber or agent, relating to a medication order which is unclear, unusual, contra-indicated or otherwise questionable, or not listed in the hospital formulary.
    b. Notifying the appropriate nursing unit of the clarification or change in the order.

18. Chart Review - This task accounts for all the time required to review a patient's chart to clarify orders, monitor a patient's TPN therapy or at any other time when deemed necessary to follow a patient's progress.

19. Cardiopulmonary Resuscitation - This task encompasses all the activities and time required for participation on the CPR team. This includes:
    a. Record keeping activities.
    b. Medication preparation.
    c. Medication administration.
    d. Restocking of the CPR box.

20. Patient Medication Counseling - All of the work required to counsel the patient, following the guidelines established by the American Society of Hospital Pharmacists in 1976, shall be considered a pharmacy task. Information provided should include, but is not limited to, the name and expected action of the medication, usual directions, expected side effects, precautions to be observed, proper storage and other explanations regarding the proper use of the medication.

Appendix 4 continued

B. Indirect Patient Care Tasks

21. Education - This pharmacy task shall encompass all the time required to:
    a. Prepare and present a program or conference to a group of health care providers or patients.
    b. Attend pharmacy staff development meetings.
    c. Attend professional seminars or lectures.
    d. Read professional literature.
    e. Prepare assigned projects (e.g., patient education, protocols or department newsletter).
    f. Maintain a drug information retrieval system.
    g. Review and purchase references.

    Note: In all cases actual paid time shall be used to determine amount of time spent in this task.

22. Committee Participation - This task accounts for all the time spent preparing special reports and attending committee meetings (e.g., Pharmacy and Therapeutics Committee or liaison meetings).

23. Drug Utilization and Review - This task encompasses all of the work necessary to review patient care for the purpose of promoting rational utilization of medications.

24. Drug Information Request - A task unit encompasses any drug information request from a health care provider, concerning information about drugs, which can be answered spontaneously or after minor consultation with available references. This includes, but is not limited to:
    a. IV incompatability
    b. Method of administration.
    c. Rate of administration.

25. Drug Information Request with Literature Search - This task unit includes all drug information requests where additional time is spent researching a question. This unit includes using journal articles, special texts (library), or time spent placing and receiving calls from the Drug Information Service.

26. Nursing Unit Inspection - This unit accounts for all the work required for the monthly inspection of the nursing units to monitor medication inventory, outdating and proper handling and storage of medications.

    Note: Each unit so inspected will count as one task.

27. Checking CPR box - This task includes the routine, monthly check of the CPR box for outdated and proper stock levels.

Appendix 5

Workload Reporting Cards

PHARMACIST DATE/HRS. WRKD				TOTAL
3. EXT. BULK COMP.				
4. PROFILE REVIEW				
6. UNIT DOSE PACK				
7. IV ADMIX.				
8. IV PIGGYBACK				
9. TPN				
10. SPEC. SOLU.				
11. PENTOTHAL				
13. CEN. INV. CON.				
14. DEPT. ORDER				
15. FLOOR STOCK				
16. DELIVERY				
17. MED ORDER CLAR				
18. CHART REVIEW				
19. CPR				

20. PT. COUNSEL				
21. EDUCATION				
22. COMMITTEE				
24. DRUG INFO				
25. DRUG INFO LIT				
27. CHECK CPR BOX				
OTHER				
OTHER				
OTHER				

COMMENTS:

Appendix 5 continued

INTERN/CLERK DATE/HRS. WRKD				TOTAL
1. REFILL AUTHOR.				
3. EXT. BULK COMP.				
4. PROFILE REVIEW				
5. CHARGES				
6. UNIT DOSE PACK				
13. CEN. INV. CON.				
14. DEPT. ORDER				
15. FLOOR STOCK				
16. DELIVERY				
17. MED. ORDER CLAR				
20. PT. COUNSEL				
21. EDUCATION				
22. COMMITTEE				
24. DRUG INFO				
25. DRUG INFO LIT				
26. CHECK NURS UNIT				
27. CHECK CPR BOX				
OTHER				
OTHER				
OTHER				
OTHER				
OTHER				

COMMENTS:

Appendix 6

Application of Equations 1 and 3 to the Time Study.

Example: Task 16. Delivery

Equation 1: Estimating necessary observations from a sample.

	Time in minutes				
Ten observation sample	1.65	1.00	1.20	2.10	1.80
	1.30	1.75	1.45	1.70	1.10

Sample $\bar{t}$ = 1.505
Sample T_t = 0.3523
Z value at 90% confidence level = 1.65
ϵ_b = 5%

$$\sqrt{N} = \frac{Z \cdot T_t}{\epsilon_b \cdot \bar{t}}$$

$$\sqrt{N} = \frac{1.65 \cdot 0.3523}{0.05 \cdot 1.505}$$

$$N = 59$$ (Estimated number of observations needed.)

Where N is the necessary number of observations, Z is the z-statistic for the chose confidence interval, T_t is the sample standard deviation, ϵ_b is the desired relative error and $\bar{t}$ is the sample mean.

Equation 3: Determination of Relative Error

Final sample size = 50 observations
$\bar{t}$ = 1.5966
$\dot{T}$ = 0.1037
T_t = 0.7330

$$\epsilon_b = \frac{Z \cdot T_t}{\bar{t}}$$

$$\epsilon_b = \frac{1.65 \cdot 0.1037}{1.5966}$$

$$\epsilon_b = 10.71$$

The above calculation indicates 90% confidence that the time mean is within 10.71% of the observed mean.

Where ϵ_b is the upper bound of relative error, Z is the z-statistic, T_t is the standard error and $\bar{t}$ is the mean time.

Appendix 7

Application of Equation 4 to Work Sampling Data.

$$\text{Standard time} = \frac{\text{total time available in minutes} \cdot \text{working time in percent}}{\text{total number of times task performed}}$$

Example 1. Prescription Dispensing - Task 1

$$\text{Standard time} = \frac{27735 \cdot 0.0517}{252}$$

Standard time = 5.7 min/task

Example 2. Extemporaneous Bulk Compounding - Task 3

$$\text{Standard time} = \frac{27735 \cdot 0.0023}{8}$$

Standard time = 8.0 min/task

Example 3. Unit Dose Dispensing - Task 4

$$\text{Standard time} = \frac{27735 \cdot 0.3687}{8680}$$

Standard time = 1.2 min/task

Example 4. Total Parenteral Nutrition - Task 9

$$\text{Standard time} = \frac{27735 \cdot 0.0111}{34}$$

Standard time = 9.1 min/task

Appendix 8

Results of the Staff Attitude Survey.

The purpose of this survey is to quantify your feelings about the Work Unit Methodology of assessing productivity.

Please work independently. Read each statement carefully and circle the letter or number which best corresponds to your feelings. Work rapidly. Do not spend too much time on any one statement. If you cannot really decide about a statement, write "No comment," in the Comment section and go on to the next statement. Some of the statements may not be worded exactly the way you would like them to be. However, answer them the best you can and then make comments in the Comment section following each statement. Mark only one space for each statement. Be sure to respond to every statement.

Self addressed envelopes are provided so that you may fill out the survey and then drop it in the mail. Or if it would be more convenient you may wish to leave the sealed envelope in the same blue bin where you turn in your cards.

I would greatly appreciate receiving the surveys by Thursday, April 20th or Friday, April 21st.

Thank you for your time and cooperation.

Appendix 8

Results of the Staff Attitude Survey. The numbers in the right-hand column represent the apportionment of responses by the staff.

1. I find knowing the productivity of the pharmacy:
   6 a. Very satisfying.
   2 b. Nice.
   c. Don't care.
   d. Not necessary.
   e. A nuisance.
   Comments:

2. I feel the Busy Bodies Review should have been distributed:
   1 a. Weekly.
   2 b. Biweekly.
   5 c. Monthly.
   d. Bimonthly.
   e. Forget it all together.
   Comments: Consistently.

3. I found the Busy Bodies Review:
   4 a. Informative.
   4 b. Interesting.
   c. OK.
   d. Waste of time.
   Comments: Informative and interesting.

4. I spend approximately <u>(6.8)</u> minutes/day filling out my reporting card

5 min, 10 min, 5 min, 1 min, 5-10 min, 15 min, 1 min, 10 min

5. I find this time:
   a. Excessive.
   b. More than I expected.
   4 c. Appropriate.
   4 d. Hardly noticeable.
   Comments:

6. I feel that my reporting is:
   1 a. Very accurate and reflective of what I really do in a day.
   4 b. Accurate but occasionally omissions do occur.
   2 c. OK, somewhat reflective of what I really do in a day.
   1 d. Inaccurate, it is very difficult to remember to write down everything I do.
   e. Totally inaccurate.
   Comments: Interruptions, phone time not on card.

7. I feel the overall worth of the Work Unit system of determining productivity is:

Appendix 8 continued

5 a. Very valuable.
2 b. Valuable.
1 c. Helpful.
d. Less than expected.
e. Useless.
Comments:

8. In my opinion the system should:
2 a. Continue as is.
5 b. Continue with modifications.
c. Be dropped in favor of other methods.
d. Be dropped with no replacement.
Comments: Simplification.

9. How often do you leave work feeling you have done something well?
1 a. Very often.
5 b. Often.
2 c. Once in a while.
d. Rarely.
d. Never.
Comments:

10. After working with the Work Unit methodology of assessing productivity at AGH Pharmacy, I feel I understand the need and purpose of measuring productivity of the Pharmacy.
Strongly Agree - Agree - No opinion - Disagree - Strongly Disagree
4 3 1
Comments:

11. In my opinion, using time studies and establishing Work Units is a much more accurate method of measuring productivity than the previous system. (Scanlon Plan - based on patient days.)
Strongly Agree - Agree - No opinion - Disagree - Strongly Disagree
6 2
Comments:

12. I feel the Work Unit methodology of assessing productivity is much more complete than the previous system.
Strongly Agree - Agree - No opinion - Disagree - Strongly Disagree
7 1
Comments:

13. I would like to see a graphic reproduction of productivity posted on the bulletin board, so that I could compare productivity from month to month.
Strongly Agree - Agree - No opinion - Disagree - Strongly Disagree
3 5
Comments:

Appendix 8 continued

14. In my opinion, the Work Unit methodology required little additional time on my part.

Strongly Agree - Agree - No opinion - Disagree - Strongly Disagree
2 5 1

Comments:

15. In my opinion, this type of system could be applied to other hospital pharmacies throughout the State of Oregon.

Strongly Agree - Agree - No opinion - Disagree - Strongly Disagree
5 3

Comments:

16. I feel there should be more feedback on the results of the study than there has been in the past.

Strongly Agree - Agree - No opinion - Disagree - Strongly Disagree
1 4 2 1

Comments: In terms of posting info because I'm here so seldom, never get to hear results. I feel info we have been getting is good and satisfactory, but if there is more that we haven't been getting and don't know about and is interesting, that would be nice to get, too.

17. I enjoy my work.

Strongly Agree - Agree - No opinion - Disagree - Strongly Disagree
7 1

Comments:

18. I find my work rewarding.

Strongly Agree - Agree - No opinion - Disagree - Strongly Disagree
6 2

Comments:

19. I would recommend AGH Pharmacy to others seeking employment.

Strongly Agree - Agree - No opinion - Disagree - Strongly Disagree
8

Comments:

20. There are times when I get so wrapped up in what I am doing at work that I lose track of time.

Strongly Agree - Agree - No opinion - Disagree - Strongly Disagree
4 3 1

Please comment on any aspect of the Work Unit methodology that you feel was not covered by the survey.

1. Telephone calls and phone call time.

2. Playing detective to find lost doses or missing doses.

Appendix 8 continued

3. Place on reporting card to indicate whether the day has been slow, average or busy. Account for phone calls and other unquantifiable things.

Appendix 9

Linear Regression of Total Intern and Clerk Hours with Nondistributive Work Units

ANOVA TABLE

Source	SS	df	MS
Regression	983	1	983
Error	2007	4	502
Total	2990	5	

$$r = 0.5734$$

$$F^* = \frac{983}{502}$$

$$F^* = 1.9597$$

$$F_{.05}(1,4) = 7.71$$

$$H_0:\beta = 0$$

$$H_a:\beta \neq 0$$

Since F* calculated is less than the critical F (7.71), accept H_0:B = 0 and conclude that the regression is not statistically significant.

Linear Regression of Productivity with Nondistributive Work Units

ANOVA TABLE

Source	SS	df	MS
Regression	1410	1	1410
Error	1580	4	395
Total	2990	5	

$$r = 0.6868$$

$$F^* = \frac{1410}{395}$$

Appendix 9 continued

$$F^* = 3.5696$$

$$F_{.05}(1,4) - 7.71$$

$$H_0 : \beta = 0$$

$$H_a : \beta \neq 0$$

Since F* calculated is less than the critical F (7.71), accept H_0:B = 0 and conclude that the regression is not statistically significant.

Linear Regression of Total Manhours with Nondistributive Work Units

ANOVA TABLE

Source	SS	df	MS
Regression	1272	1	1272
Error	1718	4	430
Total	2990	5	

$$r = 0.6524$$

$$F^* = \frac{1272}{430}$$

$$F^* = 2.9616$$

$$F_{.05}(1,4) = 7.71$$

$$H_0 : \beta = 0$$

$$H_a : \beta \neq 0$$

Since F* calculated is less than the critical F (7.71), accept H_0:B =0 and conclude that the regression is not statistically significant.