

AN ABSTRACT OF THE THESIS OF

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UNIT DOSE DRUG DISTRIBUTION SYSTEMS

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Unit dose drug distribution systems have been established in a number of hospitals during the past several years. Such systems show promise in providing better and safer patient care. They also seem to minimize the non-professional aspects of drug handling by nurses, thus enabling them to spend more time with their patients.

Many hospital pharmacists have become interested in unit dose systems, but have been overwhelmed with the problems of collecting all the operational details and procedures which have been published. The present study is intended to help hospital pharmacists by providing guidelines and procedures for the establishment of unit dose drug distribution systems in smaller hospitals.

In order to lend validity to the guidelines, an experimental system was developed and implemented on a 30 bed unit in a 185 bed hospital. Considerable detail is presented regarding the operational problems and varieties of forms and equipment.

An evaluation of the experimental system indicates that it reached the desired objectives for pharmacists, nurses, patients and the hospital administration. The guidelines and procedures based upon this study should be of considerable help to other hospital pharmacists contemplating unit dose drug distribution.

Development and Evaluation of Guidelines  
for Unit Dose Drug Distribution Systems

by

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# DEVELOPMENT AND EVALUATION OF GUIDELINES FOR UNIT DOSE DRUG DISTRIBUTION SYSTEMS

## I. INTRODUCTION AND STATEMENT OF THE PROBLEM

The unit dose medication principle has been part of the hospital scene for a long time, but to individuals involved with medications, it was always accomplished in a fashion that is not recognized when compared to the present day connotation of unit dose. Under traditional drug distribution systems, all medications are reduced to a specific unit dose prior to administration. Nursing personnel have inherited this function by default, and due to time-honored traditions, have accepted it as one of their responsibilities. It can be concluded that unit dose is nothing new, since all drugs prior to administration are reduced to a unit of use form. However, drug distribution systems that have evolved from this concept are revolutionary. Fortunately for the pharmacy profession, there were a number of foresighted individuals who were aware of deficiencies and inherent dangers in traditional systems and continually sought to correct or completely revamp existing procedures to provide patient safety, efficiency and economy.

The primary objective of this research was the development of guideline procedures for the implementation of a centralized unit dose drug distribution system. In order to impart authenticity to the text of the guideline, it was considered essential that a unit dose pilot study

be conducted. Hence, the pursuit of the primary goal led to involvement in the areas of planning, implementation and evaluation of a unit dose system on a thirty bed medical-surgical floor. Data from all phases of the project were gathered, consolidated and augmented with available information from other sources. These data were then edited and arranged in a chronological format, to provide the hospital pharmacist with a rudimentary guide to lend assistance in establishing a centralized unit dose drug distribution system. The project also led to the consolidation of available literature, relating to unit dose distribution, into a comprehensive format to provide the hospital pharmacist with a basic understanding of the theory.

The unit dose concept was first attempted many years ago by hospital pharmacists trying to prepare medications for direct administration to the patient. St. Mary's Hospital in La Salle, Illinois reported in 1940 that:

all medicines, including that intended for hypodermic use, are prepared for final use in the Pharmacy... Each patient has an assigned number or supply of medicine glasses and pillcups, according to the amount or quantity of medicine prescribed. Medicine glasses are provided with covers on which is hand printed the patient's name, room number, and prescription number (16, p. 105).

The advancement of the concept, coupled with modern technological applications, has led to revolutionized hospital drug distribution methods within the last decade. Investigators have challenged traditional dispensing methods and have completely converted procedures

that are presently used in many hospitals throughout the country (18). Their common objective has been to find ways of relieving the nurse of the responsibility of preparing medications, to reduce medication errors, and to develop a system that possesses a high degree of efficiency.

Basically, this revolution came about in two ways, namely, the development of the decentralized pharmacy, and the development of the centralized unit dose dispensing method (18).

Studies indicate that 20 to 50 drugs account for more than 90% of drug orders written at one particular nursing station and that the manual recording and dispensing of these drugs is costly (18). An estimate of the average cost of administering and recording a single dose was calculated to run as high as \$8.33 (38). This cost takes into consideration the time required of the physician, nurse, and pharmacist, medication errors, wastage, and pilferage. It is clearly obvious why investigators have made concerted efforts to improve the methods of ordering and dispensing drugs (18).

With the innovation and numerous variations of the basic revolutionary methods, the pharmacist is the mainstay of any system. He is the individual who carries the burden of responsibility when it concerns the identity and quality of medication dispensed and the patient's safety (18).

Present evidence leaves little doubt that unit dose distribution in

various forms has established a trend and that its impact and significance will increase considerably in the immediate future (29).

### Drug Distribution Revolution

The responsibility of medication preparation in the hospital traditionally has been that of the nurse. The pharmacist has basically functioned in the capacity of drug purchasing, reading transcribed drug orders, reducing the contents of commercial packages to smaller quantities, and passing completed orders to the nurse for administration (22). Except for situations requiring compounding, little of the pharmacist's education is employed in these routine functions.

Many members of the nursing profession admit to being deficient in pharmaceutical mathematics, interpreting physician's orders and other aspects of pharmacy practice (15). However, the responsibility for the preparation of individual dose medications, in most hospitals, is left to the nurse. This function must be accomplished under detrimental, antiquated drug distribution systems (22). It is time for the pharmacist to assume complete responsibility for medications to the point of actual administration. Liason and communication with physicians and nurses requires improvements that will allow him to use his professional knowledge and unique skills. Furthermore, moral, ethical, and legal responsibilities must be carried out in a manner that conforms to the standards of the profession and the specialty of

hospital pharmacy (24).

A concentrated effort has been made to help alleviate these conditions within the last ten years. The development of the non carbon reproduction physician's order form--pharmacist receives a copy of the handwritten order--is one example of this effort. Essentially, this operation minimizes the chance of error when a ward clerk or a nurse transcribes the physician's order onto a kardex or medicine card and in turn orders drugs from the pharmacy. This method places the pharmacist in the center of hospital drug distribution. By doing so, greater patient safety is provided since the pharmacist now assumes responsibility for initiation and maintenance of most clerical aspects for the control of drug administration.

This approach leads directly to the concept of centralized unit dose distribution where the pharmacy prepares each dose and forwards it to the nurse prior to administration. By placing the pharmacist in direct contact with the physician, new direct lines of communication are established. Unlimited opportunities are available with this concept, since it provides an opportunity for the pharmacist to deal with the physician on a professional level. Unnecessary confusion, delay, and cost can be eliminated, and most of all, the safety of the patient is given prime consideration. The physician and pharmacist can discuss, first hand, dosage, form, availability, pharmacology and other related circumstances pertaining to the patient and his medications.

Centralized unit dose distribution, in addition to improving patient safety and furthering professional relationships, could be the tool sought by nursing personnel to reduce their workload. Modern health care concepts dictate that alternatives be developed to shift the responsibility of handling medications from the nurse to the pharmacist. In doing so, the pharmacist will not have transferred his responsibility to others as is the situation with the traditional drug distribution system. The shortage of nurses further justifies the development of efficient drug distribution systems. The promotion of unit dose distribution is not one-sided since the nursing profession has desired relief from the many responsibilities which prevent them from spending time with the patient (24). The nurse's administrative workload under traditional drug administration systems increases daily and continues to be the foremost reason why she spends time away from the patient. The nurse's training does include administrative responsibility associated with drug distribution, but the primary purpose of this training is total patient care rather than preparation for administrative responsibilities. Understanding the nurse's administrative functions and the consequences (described in medication error section, page 8) that could occur further justifies the premise being pursued.

When ordering from the pharmacy, drugs are obtained as floor stock or non-floor stock, and with each method clerical requirements

exist and must be accomplished by nursing personnel. Narcotics, barbiturates, and other restricted drugs require additional record maintenance to include special ordering, maintaining perpetual inventory, and patient administration records. All this is accomplished in addition to the routine procedures commencing with patient admission. The preceding clerical procedures can be classified as supplemental to the routine procedures initiated by the physician's drug order.

Multi-colored medication cards indicating time and route of administration serve as the starting point in setting up medications. The dose is prepared and the card is utilized to provide drug identification until administration. After drug administration, these cards are used to chart the medication in the kardex and nurses' notes to establish that medications were given. This cycle is continuous with each scheduled dose of medication and is time consuming for the nurse.

By placing the pharmacist in the strategic position of receiving direct copies of drug orders and preparing centralized unit doses, the nurses' administrative responsibilities, time consuming preparation and setting up of medications would be alleviated. Most importantly, by utilizing the pharmacist's professional knowledge and skill, the patient's welfare is enhanced (22).

### Medication Errors

The necessity of developing modern drug distribution systems can well be founded on the findings of published medication error studies (1, 8). One widely quoted study revealed that medication errors were made by nurses at the rate of one out of every six medications given (8). The study involved 18 registered nurses and data were collected by registered pharmacists observing the preparation and administration of medications. This study defined a medication error as:

the administration of the wrong medication, drug, diagnostic agent, chemical or treatment requiring the use of such agents to the wrong patient or at the wrong time, or the failure to administer such agents at the specified time or in the manner prescribed or normally considered as accepted practice (8, p. 95).

To further elaborate on this definition, error categories were established and specific criteria were set up for each, as follows:

#### Working Definitions for Errors (8, p. 95)

1. Omissions - any dose not given by the time next dose, if any, is due.
2. Wrong dosage - any dose either above or below the correct dosage by more than five percent.
3. Extra dose given - any dose given in excess of the total number of times ordered by the physician.
4. Unordered drug given - the administration to a patient of any medication not ordered for that patient.
5. Wrong dosage form - any dosage form which is not included

in the generally accepted interpretation of the physician's order.

6. Wrong time - any drug given thirty minutes or more before or after it was ordered, up to the time the next dose of the same medication was ordered.  
"PRN" orders are not included.
7. Wrong administration - administration of a drug by a different route than was ordered by the physician such as giving by mouth a drug ordered intramuscularly.

There are a number of reasons contributing to the cause of errors involving medications. The physician is the one best suited to observe and detect untoward reactions resulting from medication errors. Since this is impossible, the responsibility is delegated to the nurse and her subordinates. The nurse, as the doctor, is also limited by time and therefore the duty is unofficially passed to an individual who does not have the qualifications to determine untoward reactions (8).

The human element also plays an important role in medication error situations, since it is up to the discretion of the individual to report a particular reaction. Hence, an observation reported by an aide that is of any consequence is passed to the nurse who then decides its significance prior to notifying the physician. It is quite obvious that individuals with lesser training and experience are unknowingly capable of overlooking an observation that might have important bearing on the patient's condition. The use of the medicine card is another item responsible for medication errors. The majority of hospitals employ clerks who are responsible for the transcription of medications

from the physician's drug order. Hospital pharmacists will testify to the difficulty of reading and identifying dosage forms prescribed. Utilizing a ward clerk, with no medical background, and who is not familiar with trade or generic nomenclature, is an unsound practice.

The incorrect preparation of a medication card can lead to a chain of events that can compound the original error. It is common practice in hospitals that once the medication card is prepared, no further reference is made to the original order. Medication cards in error could result in a repetitious error until discovered (8). The significance of medication errors is magnified when the physician is misled by erroneously charted information stemming from medication errors. Further complications arise with the physicians' increasing armamentarium, which enhances the possibility of more untoward reactions occurring, with the detection of reactions from medication errors diminishing in proportion (8).

Medication error studies have made an important contribution in establishing an awareness that errors do occur. It should be emphasized, however, that statistics produced by such studies are not conclusive and should not be implicitly regarded as infallible, as non-professionals associated with the health team have sometimes assumed. These studies have served their purpose by alerting the profession to the fact that errors exist. There is a discrepancy in a study of this nature which is strictly oriented toward the nursing

profession. Little consideration is given to the hospital pharmacy and the possibility of errors originating from this source. The approach to the problem is apparent. In an attempt to solve it, the concept of the traditional drug distribution system must be declared obsolete and the development and implementation of modern systems is considered imperative to ensure patient safety.

Seven years have elapsed since the publication of the first medication error report and its recommendations for drug distribution reforms. Opportunity to evaluate a unit dose drug distribution system regarding medication errors was reported in a recent publication (1). Results of this study considered many variables and depended upon specific criteria to evaluate errors. The significance of this report is based on the conclusion that unit dose drug distribution systems markedly lower the error rate involved with drug preparation and administration (1).

#### Unit Dose Packaging

The modernization of hospital drug distribution systems is revolving around the concept of unit dose medications which has been given much attention since the introduction of solid, oral drugs in strip packages. Considering the available forms of drugs, the concept can be defined as:

A system whereby medications which are ordered packaged, handled, administered, and charged in

multiples of single dose units containing a predetermined amount of drug or supply sufficient for one regular dose application or use (42).

The variety of unit dose medications has markedly increased and the current trend indicates its continuation. Observers have predicted that within the next five years, the physician will prescribe many common drugs in a single dose--single pack (38).

Prior to instituting the unit dose concept, the hospital pharmacist must consider prepackaging of drugs and how this is to be accomplished. Although pharmaceutical manufacturers are progressing in their endeavors, the availability of the 500 most commonly prescribed drugs is limited to 20%. Oral solids require hospital pharmacists to resort to strip-packaging either by investing in a stripping machine or by jobbing-out the packaging to a local packaging company. The current trend reflects the investment in stripping machines. Presently, purchase of such machines represents a stopgap until the manufacturer can supply all the hospital's unit dose medication demands.

The purchase of a stripping machine is a costly and questionable investment. Solutions to this problem are debatable, but tend to lean toward positive acceptance if certain conditions are carefully evaluated, such as cost, scheduled use, and adaptability to other hospital requirements. If a stripping machine is to be purchased, the full utilization of the device is essential to offset the high cost.

Another solution is using the equipment of a hospital that has

previously implemented a unit dose drug distribution system. This would afford strip-packaging potential without costly expenditures. Technical and legal ramifications must be considered in such an approach. The hospital with the capability must be willing to assume this responsibility and ensure the availability of necessary personnel and equipment. A remunerate system must be established that takes into account costs involved with the machine's operation. Also, attention must be given to the source of drugs and the type of quality control to be used. Finally, legal implications must be researched and pertinent questions concerning requirements of a manufacturer's license, packaging errors, and possible liabilities must be resolved. When these problems can be qualified, this approach to unit dose packaging could show worthwhile promise.

The most practical solution involves the employment of a reputable, local packaging company. Such companies are difficult to locate and those that are available probably cannot meet desired requirements. When considering a local company, quality control procedures as well as legal requirements of packaging and labeling must be met. If a hospital is fortunate enough to find a local company that meets all requirements and the cost for services is not prohibitive, difficulties involved in implementing a unit dose system will be greatly reduced.

Commercial prepackaging of liquid unit doses has made slow

progress compared to oral solids. With the exception of one manufacturer, who offers a line of 40 generic liquid unit dose items, little has been accomplished. This forces hospital pharmacists to purchase bottling equipment ranging from completely mechanized machinery to devices that assist with the manual filling and capping of each dose. A variety of containers are being employed to bottle liquid doses. These include unit dose bottles and caps, glass prescription vials, and assorted polyethylene cups with lids. Filling devices vary from automatic dual pipettors to hand-operated syringes. Considerable assistance is needed within this area and the pharmacist must look to the manufacturer or the local company if the purchase of expensive equipment is to be avoided. Parenteral preparations create few problems due to the availability of single dose vials, ampuls and the wide assortment of injections in prefilled disposable syringes. In addition, the availability of empty injectable cartridges makes breech-filling unit dose syringes from multi-dose vials relatively simple. The prepackaging of ophthalmic unit doses by the hospital pharmacist is not readily feasible and breaking down topical preparations becomes costly. Manufacturers have explored this particular area and are supplying unit dose medications to some degree. Therefore, topical and ophthalmic medications should be procured and dispensed in the smallest commercial package.

The difficulties of implementing a unit dose distribution system

sometimes seem overwhelming. However, considering existing problems and comparing them with the advantages offered, the conclusion to overcome these initial difficulties is justifiable. There are a number of advantages offered by unit dose medications (42):

1. Positive identification of medications up to administration.
2. Positive strength identification.
3. Prevention of medication contamination.
4. Reduction of medication tampering and pilferage.
5. Protection against product degradation.
6. Identification of expiration date of each dose where applicable.
7. Reduction of preparation and dispensing time.

The disadvantages include:

1. Nursing service personnel must adjust to a new system.
2. Lack of uniform size packages.
3. Difficulty in opening smaller packages.
4. Difficulty in reading small print on packages.

Contention relating to excessive cost of unit dose medication has been raised by opponents. Claims of excessive cost in maintaining such a program are unfounded. Recent publications have given the results of cost and comparison studies indicating that unit dose packages in dispensing, distribution, and administration in a hospital do not increase medication cost (12, 30). Evidence further indicates that unit of use drugs achieve a savings when the costs of vials, labels,

medication cups and labor are included (12, 30).

### Drug Distribution Systems

When an affirmative decision regarding unit dose distribution has been made, consideration must be given the concept to be followed.

The specific course of action that is pursued by the hospital pharmacist must ensure that the selected system satisfies the requirements of a good distribution system. A good distribution system provides the physician with assurance that the patient receives the drug he prescribes, that it contains labeled potency, administered in the proper strength, is not contaminated, and is given on time. The nurse requires the medications be available without any difficulty, that they are properly labeled, and easy to administer. The last and most important member of this chain is the patient who expects his medications on time, handled in a professional manner with minimum discomfort upon administration and that charges be made in an equitable manner (25).

In view of the nationwide shortage of competent hospital pharmacists, and the cost of employing additional pharmacists for utilization in the decentralized unit dose concept, it is felt that the centralized unit dose dispensing approach is best suited for the majority of hospitals (21). A basic understanding of conventional drug systems and associated problems is essential to the pharmacist

pondering unit dose.

Traditional drug distribution systems are classified into two categories and possible combinations, namely, the complete floor stock system and the individual patient prescription system (20).

Despite the merits of these systems, there are two important problems. These are medication errors and improper utilization of pharmacy and nursing time. Medication errors have been apparent to professional personnel for a long time. Pharmacists and nurses have long complained that a large percentage of their time is being wasted by routine non-professional tasks. Hence, it becomes apparent why drug distribution systems must be updated if they are to remain in step with increasing workloads, the introduction of new drugs and the futuristic approach to hospital care. A new system must offer more advantages and fewer disadvantages than the present system. Centralized unit dose distribution does possess these prerequisites and is the least difficult of the two unit dose concepts to implement. Unit dose distribution has proven to be feasible, economical and acceptable by a number of hospitals (1, 3, 9, 30, 32, 34).

#### Centralized Drug Distribution

A description of the procedures involved from the time the physician writes a drug order until administration of the drug will assist in providing a logical order of execution (Appendix C).

Numerous advantages of the centralized unit dose concept have been demonstrated (6, 7, 16):

1. Significant saving of nursing time.
2. Reduction in the number of medication errors.
3. Reduction of floor stock losses resulting in large monetary savings.
4. Patient charges are made on a dose administered basis.
5. Returned drugs for credit are completely eliminated.
6. Pharmacist gets a complete picture of the patient's medications by maintaining the medication record.

From a legal standpoint, unit dose distribution provides an added benefit for the physician. He is afforded more protection by virtue of the pharmacist assuming a greater load of legal responsibility (1).

New hospital drug distribution systems will probably revolve around the unit dose concept with the use of pharmacy technicians (29). This development will serve to liberate the pharmacist from the performance of time-consuming routine functions and will open the door for new roles. These roles will involve the control of drug distribution and drug use, drug consultation and extemporaneous compounding. The actual distribution of drugs will be accomplished by technicians under the supervision of the pharmacist (2, 32). Perhaps one of the most detailed and comprehensive statements concerning the future role of the hospital pharmacist was made by Ray Brown at the 25th anniversary meeting of the American Society of

### Hospital Pharmacists:

The hospital pharmacist will become increasingly viewed more as a professional and less as an entrepreneur. Both he and others will see his professional role as paramount...

The doctor will recognize the unique expertise that the hospital pharmacist possesses and will turn increasingly to him for advice and counsel. This will necessarily occur as drugs become more single-purpose, more potent and more expensive. For the same reasons, the hospital pharmacist will become more involved with the nurse and the nursing service. The increasing complexities of drug therapy will require that his professional knowledge be utilized at the point of administration of the drug (14, p. 186-187).

## II. THE UNIT DOSE PROJECT

### Development of the Problem

Good Samaritan Hospital in Corvallis, Oregon, was utilized to conduct the unit dose pilot study and is typical of many hospitals in a moderate sized city. The hospital consists of 185 beds and is staffed by 65 physicians. The pharmacy is operated by a chief pharmacist, a part-time registered pharmacist, two pharmacy interns, and an administrative assistant. Drug distribution is accomplished by the individual prescription method with a reasonable amount of floor stock available to cover routine and emergency orders. Narcotics are available at each nursing station and are accounted for by conventional methods. Carbon copies of the physicians' handwritten orders are transmitted directly to the pharmacy. Charges are computed by pharmacy personnel, utilizing a carbon copy of the nurses' medication notes which are forwarded to the business office upon patient discharge.

As with many smaller hospitals, the need to develop a drug distribution system that could provide increased efficiency and patient safety became apparent at Good Samaritan Hospital. Future plans for the hospital take into consideration expansion to 400 beds, which brought to mind the pharmacy's capability to provide service for a facility of this size. In light of possible future expansion and the antiquated drug system in use, the chief pharmacist was amenable to the introduction

of a unit dose pilot study. The program in essence was conceived to serve a twofold function; namely, to provide a research laboratory necessary to gain experience and to provide pertinent data in developing guidelines required to implement such a program, and secondly, to enable the chief pharmacist to determine the feasibility of such a program and how it would be accepted by members of the hospital staff. With an awareness of individual objectives and how they would serve to benefit patient care, the initial steps were taken leading to the accomplishment of the project. Preliminary, informal discussions were conducted to establish ground rules and to determine capabilities and limitations in attaining predetermined goals.

Of great significance was the limited budget which dictated that the program be carried out without the aid of any sophisticated mechanized equipment.

#### Orientation Phase

The next step in the plan called for a detailed orientation in order to obtain approval from the hospital administrator. During this period the chief pharmacist thoroughly briefed the administrator, pointing out the need for a new drug distribution system, present problems of the traditional system, the plight of nursing personnel concerning procuring, preparation, administration, and clerical responsibilities involving medications. He stressed the fact that the pharmacy service

would remain within limitations of its budget, and that the opportunity would be available to develop and test a system that would be suitable to the expansion program.

A meeting was scheduled that included the nursing service director and the in-service training director with the intention of informing them of the proposed implementation of the centralized unit dose distribution system, of soliciting their assistance in selecting a suitable nursing station, and of obtaining any help they could provide to accomplish the task. To avoid any misconception, it should be pointed out that initial discussions with nursing service were held and therefore the concept was not unveiled without prior preparation. These discussions were essential since they provided the basis for determining how such a project would be accepted. Well aware of the problems confronting the nursing service and the changing trends in drug distribution, nursing service co-operated to the fullest extent and permitted nursing supervisors to participate in a panel discussion with pharmacists and hospital pharmacy graduate students at Oregon State University School of Pharmacy. During the discussion, the Director of Pharmacy, Sacred Heart Hospital in Eugene, Oregon, showed slides of a centralized unit dose system in operation within his hospital and with the assistance of a nurse involved on a unit dose nursing station, described the procedures from the physician's original order to the administration of the prescribed medication.

The presence of the nurse, with unit dose experience, was later to be considered quite important, since many questions were directed to her in relation to nursing problems and how the unit dose distribution system had helped to alleviate them. The open discussion offered many interesting points such as problems to overcome when first implementing the system, advantages and disadvantages of the system, how it might lighten the nurses' work load, the nurse's loss of her traditional responsibility of pouring medications, the problem of medications prepared by others being administered by the nurse, and numerous other questions relevant to the situation.

Given time to analyze proceedings of the panel discussion and an opportunity to study various references made available, the director of nursing consented to the commencement of a unit dose program on a thirty-bed medical-surgical floor. To provide further enlightenment for key nursing personnel who would be involved in the program, a field trip was made to Sacred Heart Hospital to give personnel a view of a centralized unit dose distribution system in operation.

Prior to beginning the program, a standard operating procedure was written for nursing service with the specific purpose of establishing a format for their common understanding and the feasibility of a unit dose distribution system. Once approved, it was disseminated to key personnel as a reference document.

### Selection of Research Site

A number of vital factors were carefully evaluated prior to selecting a nursing station for the demonstration site. The unit picked was a thirty-bed medical-surgical ward and is considered the busiest in the hospital. It was the opinion of the pharmacy staff that the selected station would be the most difficult location and that if it was successful on this unit, little difficulty would be encountered implementing the program on other wards. The direct approach was taken rather than starting on a unit that would offer a lesser challenge and then extending unit dose services to a much more difficult station. Some of the factors considered were as follows (17, 32):

1. Attitude of head nurse
2. High average patient census
3. Relatively short patient stay
4. Large variety and amounts of medications used
5. Location in relation to pharmacy
6. Activity of other health team members in relation to nursing functions.

### Designing Forms

As with any hospital procedure that is to be modified, the development of new forms becomes an essential element. In doing so, careful consideration was given to the specific objectives in mind and

how the development of new forms or the use of current forms would assist in achieving these objectives.

The physician's order form becomes the most vital document to devise when implementing a unit dose system. Therefore, its design and practicality are important because it will have to be accepted by the physician and must be easy to manipulate to ensure nurses' acceptance. Fortunately, the hospital had switched to a new form with a non carbon reproduction copy before this time. Along with the above innovation, the nurses' medication record had been revised to make accommodations for the pharmacy's charging procedure. The medication nurse continued to chart in the usual manner on the new form and the copy was forwarded to the pharmacy to record charges for the business office.

The development of the pharmacy medication dispensing record is of considerable significance, since it places before the hospital pharmacist a totally new form that is essential for the operation of a unit dose system. The design of the drug medication dispensing record at Good Samaritan Hospital was a conglomerate of numerous variations used by other hospitals. Basically the medication records or the profile sheets, as they are referred to at times, are quite similar. They usually contain the following:

1. Patient identification
2. Medication column

3. Strength column
4. Route column
5. Signa or dose column
6. Cycle column or hours of day

Additions and deletions have been made by hospitals that have adapted them for their specific needs to include:

1. Shaded columns to indicate dose delivered and dose administered.
2. Multi-carbon copies to facilitate charging on a daily or weekly basis.
3. Indication of laboratory test to preclude false values when contraindicated by certain drugs.
4. Code columns to facilitate computation of charges by computers.

It is apparent that this type of form can be suited to any type of unit dose system contemplated, and therefore requires considerable thought in designing if it is to fit particular requirements. It is essential that flexibility be built into a form development program. Good Samaritan Hospital changed its form three times during the first three weeks of the program.

Since the pharmacy was not at this time dependent on the medication records to record charges due to the previously mentioned format, little consideration was given to a charge column. However, future plans call for multi-copy profile sheets that will enable charges to be recorded and compiled on a daily basis.

### Uniform Drug Schedule

The importance of a uniform drug schedule cannot be over emphasized. The current practice of varied interpretations of a set of directions is widespread among nursing personnel. The decision was made to utilize two medication cycles for drug distributing, making it imperative that a uniform dosage schedule be devised and strictly followed. The medication cart for the first cycle was delivered prior to 10:00 a. m. , containing medications for the period covering 10:00 a. m. to 7:00 p. m. The second cycle cart was delivered prior to 7:00 p. m. , containing medications for the 7:00 p. m. to 9:00 a. m. period.

Specific time designations were standardized such as B. I. D. , T. I. D. , Q. I. D. , etc. , to establish a uniform dispensing time within each cycle. Nursing personnel were instructed to gradually adjust administration of doses for patients admitted during irregular medication periods to conform with the uniform schedules.

The foregoing procedure ensures that the patient is on a schedule enabling the pharmacy to supply sufficient quantities to cover requirements of each cycle.

### Cabinets, Carts and Labels

When considering the type of cabinets to order, numerous factors were taken into account. Aware of the austere financial situation, the purchase of elaborate cabinet-cart combinations was not considered.

Hence, efforts were concentrated on selecting a set of cabinets that were reasonable priced, available from a local source, adequate in size, durable, and compact for ease in transporting.

Akro-Mill cabinets fulfilled the requirements and prompted placement of an order for cabinets with the following specifications:

1. Sixteen cabinet drawers
2. 4" x 11" x 2 1/8"
3. Gray non-transparent

As an alternative, cabinets with the following specifications were found to be acceptable:

1. Fifteen drawers each
2. 3" x 8" x 3 1/32"
3. Gray non-transparent

Since the pilot study was conducted on a thirty-bed unit, two cabinets were needed for each cycle. Hence, the purchase of four cabinets was necessary for each nursing station. While one set was on the nursing unit, the second set was being serviced in the pharmacy for the next cycle. Compactness of the cabinets proved extremely valuable when stacking them one above the other or placing them back to back. Arrangements of the two units were left up to the individual nurse, but the preference seemed to be back to back since this provided a large working area for writing and dispensing.

Each patient's drawer was identified with a self-adhering label

that contained the patient's name, room number, hospital number, and physician's name. Due to the constant turnover of patients, it was important that a self-adhering but easily removable label be used. The two extra cabinet drawers available were used to carry special supplies required to administer medications.

A compact, lightweight metal cart was first employed to transport the cabinets. The lower shelf was arranged to carry any extras deemed necessary such as alcohol sponges, syringes, needles, bulk medications, etc. Upon recommendations from nursing personnel, and to conform with future plans of the pharmacy, a custom-made cart is being designed. Its basic design stresses compactness, mobility, security, built-in light source for evening rounds, and cost.

### Unit Dose Packaging

Strict observance of the restrictions imposed by a limited budget necessitated that a comprehensive search be made to uncover the most economical and feasible methods of packaging unit dose medications. Monetary restrictions excluded any thought of purchasing a strip-packaging machine or any form of bottling equipment for liquid dose preparation. The initial approach to a partial solution was to purchase all available items that were packaged by pharmaceutical manufacturers in unit dose. During the early planning stages, every possible source of literature was examined for the availability of unit dose items. Two

articles published in the American Journal of Hospital Pharmacy rendered the most assistance (27, 28). With this information and the help of current catalogs, orders were placed to purchase all items that were in current demand and available.

The second approach was to explore the possibility of utilizing the capabilities of Salem Memorial Hospital, Salem, Oregon. This hospital is in the process of converting completely to unit dose and possesses all equipment necessary for the project. In an attempt to achieve full utilization of equipment and personnel, thought was given to prepackaging for facilities contemplating unit dose who could not afford the equipment.

Prior to pursuing this course of action, a number of legal ramifications had to be explored and clarified to avoid future entanglements. The matter was presented to the Oregon State Board of Pharmacy with the hope of obtaining a satisfactory decision. Prepackaging for other hospitals would require strict adherence to Federal Drug Administration regulations pertaining to labeling and control procedures. However, of major consequence is the liability factor and the assessment of responsibilities concerning the packaging source and the distributing source.

With the possibility of establishing a state or national precedent, the matter, at this particular time, is in the hands of the Oregon State Attorney General for detailed study, research and evaluation prior to

the State Board rendering a decision.

The third approach offered a great deal of promise, but it did not provide any assistance to help launch the current unit dose project. A local pharmaceutical manufacturer was contacted. He showed considerable interest and agreed to discuss the situation at length. During the course of the conference, explicit requirements of such a service were presented to the representative to include cost, package size, labeling, quality control, and many other pertinent features. Reassurance was provided that if the company undertook such a project, all federal and local regulations pertaining to repackaging would be followed. Motivation on the manufacturer's part stemmed from the possession of strip-packaging machinery that was being utilized to package over-the-counter preparations on contract from another manufacturer. Apparently, as expressed by the representative, the down time (not utilized) of this machine was greater than its usage. Therefore, any possibility of increasing its use to help offset original cost and operating expenses was worth considering. The possibility of a new market for repackaged unit dose medications was also indicated to the representative, since a few of the local hospitals were on partial unit dose systems and others were asking for assistance of this type. The manufacturer, at the present time, is conducting a feasibility and cost study of preparing unit dose medication for hospitals and indicated that a decision would be forthcoming.

### Current Procedures

In spite of the difficulties encountered in securing unit dose packaging assistance, it was decided to continue with the project and become operational as originally scheduled. This decision left only one alternative: hand packing all unit dose medications not available from the manufacturer until a reasonable solution could be reached.

Empty unit dose packets were supplied by Salem Memorial Hospital to assist with the packaging of solid oral medication. These packets were fabricated by a Mercury Stripping Machine and were produced as single units, 1 1/2" x 1 1/2" in size, and heat sealed on three ends. Addressograph equipment was used to label each packet by cutting master plates that indicated nomenclature, strength, control numbers, and expiration dates when required. Each packet was stamped and made ready for use. Building up an initial supply of unit dose drugs by this method was a tedious process and therefore no more than 200 units of any item were prepacked at one given time. Once established, little difficulty was encountered, since packaging of new items or replenishing supplies seldom required that more than five items had to be packaged during any given day.

Close scrutinization and tabulations, involving prescribed medication for patients on the demonstration site, were carried out over a period of three months. These data provided an experience factor that assisted with the determination of which drugs should be prepacked

or purchased in unit of use packages. Secondly, it provided a broad picture relating to the prescribing of various dosage forms and indicated that approximately 85-90% of all medications were administered in the solid oral forms. The remaining 10-15% were unevenly divided between parenterals and liquid dosage forms.

Liquid preparations not available in unit dose were put up in half-ounce polyethylene cups and sealed with polyethylene caps. Liquids used in large volumes were prepared with the aid of a Cornwall Syringe that automatically measured and delivered a predetermined volume with speed and accuracy. Seldom-prescribed liquids or viscous liquids were prepared by utilizing disposable syringes. Pressure-sensitive labels with necessary information were affixed to each lid. Liquid antacids were not purchased in unit dose containers or broken down to unit dose by the pharmacy because of the excessive cost it would impart to the patient. Original bottles of these antacids were dispensed to the patient, remained on the drug cart, and were poured by the nurse during her medication rounds.

All parenterals that were available in unit dose form were utilized to the maximum extent possible. Some multiple dose vials and ampuls, at times, were used due to non-availability of unit of use items and the non-existent capability of the pharmacy at the time to prepare unit dose injectables. In this situation, the multi-dose container remained on the cart with a supply of syringes and needles

available to the nurse for speedy preparation and administration during medication rounds.

Ophthalmic medications and other similar preparations that could not be broken down to unit dose measures were dispensed in the original package and charged to the patient. As with the previously mentioned bulk items, transfer of the item was achieved from cart to cart with each cycle switch.

Narcotics were dispensed from floor stock supplies during early stages of the pilot program. Efforts to radically change this procedure for incorporation into the unit dose system and to couple record maintenance with available data processing equipment are presently under extensive investigation.

### Personnel Training

Training the administrative assistant relating to the general operation of the centralized unit dose distribution system was essential, since she was delegated the responsibility of maintaining the pharmacy medication dispensing records. This function was achieved with relative ease because of the clerk's capabilities and knowledge of drug nomenclature and strengths obtained from billing procedures. The only difficult area to overcome was the inability to read medication orders and comprehend the interpretation of directions. This was accomplished by the daily practice of transcribing physicians' orders

onto the medication records. During these daily sessions, the chief pharmacist carefully supervised the clerk and provided instructions, evaluated her work, and made corrections. This method of instruction enabled the assistant to assume the responsibilities of her job regarding unit dose with little difficulty during the change-over phase. Her responsibilities involved maintenance of profile sheets to reflect admissions, discharges, bed and room changes, discontinued drugs, new drugs, and other related details. Transcribed orders were inserted into the medication record folder and checked by the pharmacist when preparing medication carts for delivery.

Other than the administrative assistant, all other personnel, including the part-time pharmacist and interns, required no special orientation pertinent to procedures. This was attributed to the involvement of all professional personnel in every feature of the program from initial planning to present operations. Soliciting assistance from the professional compliment reaped large dividends that helped overcome many obstacles.

#### Pharmacy Facilities

Pharmacy facilities remained intact, with no physical alteration attempted. Rearrangement of shelving was necessary to accommodate all unit dose items in one central location. Storage accessibility and space requirements were of prime concern when selecting this working

area. Shelving was arranged to allow storage of unit dose packages that were available from the manufacturer along with items prepacked in the pharmacy. Prepacked items were stored in plastic trays, and together with commercial packages, provided a neat and orderly appearance.

### Practical Orientation

Although an initial orientation program was arranged for nursing personnel, a similar but more practical program was placed into being one week prior to starting the program. Head nurses were thoroughly briefed concerning procedures and what would be expected of them under the new system. Practice runs were instituted using the medication records of currently hospitalized patients. This imparted a realistic approach when the medication cart loaded with these drugs was delivered. With the pharmacist reading from the nurse's kardex file and the nurse checking for the prescribed medication, the actual procedure was completely simulated. Instructions were given concerning the proper techniques of opening unit dose packets, along with an indoctrination to other unit dose items that would be new to the medication nurse.

### III. RESULTS AND DISCUSSION

#### General Observations

A 30-day trial period of the new drug distribution system proved to be successful and was instrumental in achieving the proclaimed advantages ascribed to unit dose drug distribution systems. The feasibility of the new procedure was clearly evident to the chief pharmacist by the relative ease of its incorporation and acceptance. Moreover, immediate plans were made for the conversion of another thirty bed station to unit dose distribution.

Reduction of medication errors was evident to pharmacy and nursing personnel by simple routine checking procedures carried out upon delivery of the medication cart. Events during the trial period verified an early assumption that if any amount of difficulty was encountered, its originating source would be the human nature element of participating individuals. Initial concern was first observed, stemming from older individuals, who were set in their ways and could not or would not adapt to the new concept. The approach to this problem was to proceed with caution and provide additional guidance, instruction, and reassurance to overcome their resistance. This particular approach yielded excellent results and together with solicited suggestions proved extremely valuable. Younger personnel found little or no difficulty in becoming acclimated to the new form of drug

distribution. With recently graduated nurses, a basic understanding of the theory was present and they were most helpful and eager to participate.

Initial reaction by most nursing personnel was difficult to evaluate and created the impression that they were passive. Continued observation soon removed this assumption, due to familiarity with the system. The nurses noticed a gain of valuable time, permitting them to accomplish other tasks.

The problem of seasonal turnover among nursing personnel was not included in the original planning phase due to sheer omission. The resultant effect served to create a small amount of confusion, since the permanent evening medication nurse terminated employment prior to implementation of the system. A permanent replacement was not available and this required the rotation of nurses normally employed on other units. An immediate difficulty encountered was total unfamiliarity with the concept, thus requiring almost daily orientation for the evening medication nurse. Annoying little problems of minor significance constantly arose, such as not complying with prescribed dosage schedules leading to a shortage of medications for a future medication period, not informing the pharmacy of discontinued medications, new orders, and room changes. However, once each nurse survived her initial exposure and all individuals had the chance to rotate through the demonstration site, these problems were largely

eliminated. The temporary evening medication nurse, having been previously exposed to the system, could now administer drugs within a relatively short period of time as opposed to the time-consuming process of acquainting herself with patient medications, their preparation and administration.

Adjustments concerning minor deficiencies were made immediately. Indicative of this type of problem was the transfer of multi-dose containers from each cart when switched for an ensuing cycle. This was remedied by affixing self-adhering red indicators to patient medication drawers in order to provide a reminder that medications required transfer. Simple innovations such as partially ripping the medication card for a discontinued medication and placing it in the patient's drawer served as a helpful reminder to the pharmacist.

A disconcerting sight to observe during the first few days of the pilot study program was nursing personnel setting up medications by tearing open unit dose packets and placing them in medication cups prior to administration. Since this practice defeated the purpose of the system, immediate corrections were made.

As the initial trial period came to a close, the overall impression one obtained for the complete operation was a flawless, smoothly operating procedure. Contrasted to the beginning of the trial period, the final results of the pilot study were highly encouraging. They demonstrated a completely functional system in operation that opened

the door for continued expansion of the unit dose concept. Suggestions from nursing personnel were considered quite essential since they provided a basis to evaluate current procedures and also assisted in the planning of future innovations. The majority of nurses made comments relating to the unit dose packets, their size, difficulty in opening, what standard size they would like, and arrangement of subdivisions in the patient medication drawers. Labeling of patient medication drawers with large, bold print, to give quick identification of the patient's room, was suggested by nurses and proved to be helpful.

#### IV. GUIDELINE PROCEDURES

##### Introduction

Development of the ensuing unit dose guideline procedures stems from the planning and implementation of a centralized unit dose distribution system within a 185 bed private hospital. The objective of the guideline is to provide a comprehensive set of directions along with pertinent information needed to implement suggested concepts. Avoidance of a minutely detailed presentation is emphasized, based on the supposition that every hospital operation in itself is unique. Hence, a procedure that proves successful in one hospital might meet with failure in another, due to infinite variables.

The text of the guideline presents a number of concepts and methods of application. Although many principles are mentioned, all were not included within the research project. However, they were investigated for validity and feasibility. When using this guideline to implement a unit dose drug distribution system, one should keep in mind that it is not all-inclusive. Its design allows for flexibility and leaves an option for selecting the avenue of approach best suited for a given hospital situation.

The format of the guideline has been arranged to instill a quick grasp of concepts, originating with the basic hypothesis and the steps to its implementation and evaluation. The pharmacist referring to this

guide should carefully review each procedure and proceed in a step-wise fashion. In doing so, he should use the principles provided to the greatest extent possible and when they do not apply, he should disregard them completely. Ingenuity and improvisation are essential qualities necessary for successful installation of a unit dose drug distribution system. These qualities, applied to the following guidelines, should minimize the complexities of the undertaking.

## Guideline Procedures

### I. Review of Current System

A. Review current drug distribution and identify weak points with added impetus relating to disclosure of dangerous characteristics.

1. Categorize the current drug distribution system:
  - a. Complete floor stock system.
  - b. Individual prescription system.
  - c. Combination of both systems.
2. Determine the advantages and disadvantages of the current distribution method which are distinctive to the hospital's mode of operation and appraise two major problems inherent within the system, namely:
  - a. Occurrence of medication errors.
  - b. Improper utilization of pharmacy and nursing time.

The following queries, although not all-inclusive, will readily assist the hospital pharmacist in making a meaningful estimate of the situation:

3. Medication errors
  - a. How are the physician's orders for medications relayed to the pharmacist?
  - b. Are ward clerks and nurses transcribing medication orders onto medication cards, Kardex files and pharmacy requisitions?
  - c. Are nursing personnel keeping abreast with current trends, e. g., the ever increasing number of new drugs and their special characteristics?
  - d. Is the current system capable of providing the control

required to insure the maximum in patient safety and well-being?

#### 4. Efficient time utilization

- a. Is the pharmacist utilizing most of his time to provide professional services?
- b. Can the pharmacist's unique knowledge of medications and their characteristics be better employed to assist the physician and nurse in the ultimate goal of providing superior patient care?
- c. Does the nursing service complain about the great deal of time spent away from the bedside in regard to the performance of menial tasks?
- d. Has the increased requirement of record maintenance pertaining to medications contributed to this problem?
- e. Is the nurse utilizing her training to the utmost in providing total patient care?

A careful evaluation of the answers to questions like these should be sufficient to demonstrate to the pharmacist who is contemplating modernization of a drug distribution system that reforms are drastically needed and a course of action to pursue them should be given immediate priority.

## II. Selection of Unit Dose Concept

Having made the decision to modernize existing drug distribution procedures, consider a method of approach and the specific unit dose drug distribution to select and implement. Unit dose distribution systems are classified into two categories:

### A. Centralized Unit Dose Distribution

## B. Decentralized Unit Dose Distribution

Since decentralized unit dose distribution was deemed unfeasible for the present project, emphasis has been placed on centralized unit dose distribution. However, the principles presented can readily be applied to decentralized systems.

The selection of the centralized unit dose distribution method takes into consideration many features and the confirming decision should be based on the following criteria:

- A. Cost of employing additional pharmacists.
- B. Shortage of competent hospital pharmacists.
- C. Future objectives of the Pharmacy Service.
- D. Budget limitations.

## III. Comparative Study of Distribution Systems

The comparative study is considered essential since it will point out the deficiencies of the traditional drug distribution system and indicate how implementation of centralized unit dose distribution can achieve and provide added advantages. Meticulous preparation and thorough acquaintance with the subject matter will render valuable assistance when presenting the proposal to administration and nursing for approval.

The comparative study can be tailored to a specific situation but the general approach should include:

- A. Detailed step-by-step procedures of the traditional and unit dose

systems. Include all functions of pharmacy and nursing personnel, starting with the physician's order and on through to medication administration and subsequent administrative requirements.

- B. Analysis of detailed comparison to pinpoint advantages and disadvantages of both systems.
- C. Establishment of the premise that unit dose distribution, even with its intricacies, can prove to be relatively safer, more efficient, and more economical than conventional distribution systems.
- D. Preparation of a preliminary outline as to the particular approach, and decisions that must be made for the adaptation of the unit dose concept.

#### IV. Theory Advancement Principles

The next phase in establishing a unit dose distribution system depends on the hospital pharmacist's management and idea-selling capabilities. This aspect offers a challenge and confronts the pharmacist with a few serious questions concerning drug distribution changes. Where to begin? How to sell the concept to administration and nursing? Solving these problems and being able to convince other department heads requires a well planned and detailed approach that must include flexibility. To render assistance in this area, the outline below provides essential points that can be applied to any situation and tailored to specific demands that may be imposed (35).

- A. Ideas should be presented in a manner where there is likelihood of acceptance, starting with suggestions on which there is a chance of common agreement.
- B. Avoid overwhelming cooperating departments by presenting too much to them at one time. Approach the problem with

piecemeal presentation of ideas.

- C. A proposed timetable is essential for either immediate or future implementation and alternate time proposals should be available in the event other hospital projects take precedence.
- D. Initial presentation of the theory might present a complex picture to unfamiliar participants. Therefore, demonstration aides such as pilot models showing changes, and comparative flow charts outlining present and proposed drug distribution systems will help clarify proposals.
- E. Thoroughly research all published information on unit dose drug distribution systems.
- F. Compromise may be essential since every point of the proposal may not be accepted, and the pharmacist should be capable of determining which compromise will be acceptable to the overall program.
- G. Give credit for assistance to others for their contributed time and talents in assembling the proposals.
- H. Demands for immediate acceptance of controversial points should be avoided and held for a more opportune moment.
- I. Avoid the overwhelming approach that causes over-selling the program--concentrate on major observable advantages and hold back doubtful advantages.
- J. Immediate acceptance of the original plan may not be forthcoming and a temporary retreat may be required. An altered approach at another time would be the next best alternative for this situation.

#### V. Advancement of Theory

- A. Armed with the availability of all significant data, a meeting with hospital administration and the director of nursing is the next step. During this meeting, the chief pharmacist must be well prepared to discuss the following:
  - 1. All methods of drug distribution.
  - 2. Comparative studies and results relating to advantages and

disadvantages of the various systems.

3. Why a new drug distribution system is necessary.
  4. The importance of patient safety, as well as economical feasibility.
  5. The nurses' requirements for additional time that will enable them to provide better bedside care.
  6. Benefits patients will derive from a unit dose distribution system.
- B. Having sold the concept to the hospital administrator, a meeting of the nursing service director, in-service training director and key nursing service personnel should be considered to further advance the theory and formulate concrete plans. In doing so, the subsequent items are worthy of consideration:
1. Establishment of a good line of communications.
  2. Ensuring that nursing personnel are given the opportunity to become familiar with unit dose concepts by the provision of selected preliminary literature.
  3. Arrangements for the presence of guest speakers with working experience involving unit dose (pharmacy and nursing representatives).
  4. Audio visual aides such as slides and tapes or a film covering unit dose concepts.
  5. Discussions as to how the new system will be advantageous to nursing service and how it will be adapted to the needs of the hospital.
  6. Avoidance of delving into the shortcomings of drug distribution and medication errors involving nursing service personnel. Nurses are aware of these problems and continued emphasis might create the formation of obstacles leading to diminished cooperation and communication.
  7. Provision of an opportunity for nursing personnel to become involved in a panel discussion, thus allowing them the chance to ask questions and make any contributions that will clarify issues or enlighten other participants.

8. Provisions for pharmacy and nursing service personnel to visit other hospitals that have converted to centralized unit dose distribution.

## VI. Establishment of Committees

Assurance of intra and inter departmental cooperation can be acquired by the establishment of the committee principle. The committee method will serve to consolidate the potential of a department or various departments and channel it into a direction that will yield the best possible results. When planning to organize committees consideration should be given to the formation of groups as described below:

### A. Pharmacy Planning Committee

Members: Chief Pharmacist  
Selected staff pharmacists

Purpose: To research, evaluate, and implement all professional, technical, and mechanical aspects requisite to ensure smooth and economical transition to unit dose distribution.

### B. Hospital Drug Distribution Committee

Members: Administrator's Representative  
Director of Pharmacy Service  
Director of Nursing Service  
Director of In-Service Nurses Training

Purpose: To evaluate, recommend, revise, or delete any facet of the proposed plan to ensure total congruity. Also, each member responsible for a professional complement will assume direct supervisory charge of subordinates to assure complete cooperation, application, and initiative necessary for rapid professional discharge of delegated functions.

Although the physician will not be directly associated with drug distribution implementation, courtesy dictates that he be informed of the changing concepts. This can be accomplished in a number of ways:

- A. Representation as a member of the Drug Distribution Committee.
- B. Detailed presentation of the complete proposal to the Pharmacy and Therapeutics Committee for evaluation and recommendation.
- C. Individual orientation depending on the degree of inquisitiveness demonstrated.

#### VII. Administrative Procedure

- A. Once the theory of unit dose has been advanced and accepted, the next step is the writing of standard operating procedures for nursing and pharmacy. Written procedures should be thoroughly reviewed by the established committees and revisions made prior to approval (Appendix A and B).
- B. A chronological description of unit dose execution should be written (Appendix C).
- C. Further clarification of the unit dose distribution system should be made by the availability of a simple flow chart (Appendix D).

#### VIII. Pharmacy Aspects

- A. Pharmacy Renovation. Serious deliberation involving any major pharmacy renovation should be thoroughly investigated and drawing a conclusion should be based on the following:
  - 1. Can existing facilities handle the proposed workload, equipment, and personnel?
  - 2. Does the pharmacy provide sufficient floor space in square feet to accommodate all personnel comfortably?
  - 3. Will partitions or walls hinder the flow pattern of unit dose distribution procedures?
  - 4. Will the installation of contemplated unit dose equipment, if any, require additional construction or floor space?

5. Are current shelving and storage capabilities sufficient to handle unit dose packages, and are they adequate to permit accessibility and efficiency?
6. Will expansion or renovation of existing premises be negated by future hospital expansion plans?
7. Are budgeting appropriations commensurate with asserted improvements that are desired?
8. Are adequate communication means available such as a pneumatic tube system or an efficient messenger service?
9. Are realistic plans being formulated for future construction that will provide flexibility in relation to augmentation of current pharmacy services?
10. Has every effort been made to avoid high expenditures and thought given to utilization of existing facilities where possible?

B. Degree of Involvement. Because of the uniqueness of a given hospital's operation and its varied capabilities, the hospital pharmacist planning to incorporate centralized unit dose distribution will be faced with decisions embodying a number of problems:

1. The complete or partial approach
  - a. Complete conversion of all medication distribution systems to unit dose dispensing to include assuming responsibilities for intravenous additive mixture programs.
  - b. Proceed in a step-wise fashion thus ensuring that all responsibilities accepted can be managed with an excessive degree of proficiency.
2. Electronic data processing has exerted its influence upon execution of hospital administrative functions. This modern procedure has been applied to an array of pharmacy and nursing administrative procedures yielding excellent results. Medication cards can be eliminated, automatic daily printouts of the patient's medication record can be achieved, and narcotic and restricted drugs can be inventoried and accounted for with little effort. Application

of this equipment seems to be unlimited and deserves careful thought.

3. Pharmacy coverage creates a dilemma. The amount of pharmacy coverage required for a pharmacy to successfully operate a unit dose distribution system is unpredictable and hinges on the particular hospital. The ideal answer to this question would be the provision of 24-hour, seven days a week service. In reality, a proposal of this nature appears impossible for the majority of hospitals. Hence, careful consideration of this situation is required.
4. The frequency of routine medication delivery requires some thought since this involves a decision based on a number of suppositions. Continuous pharmacy coverage reduces the degree of difficulty encountered and provides continuity throughout nursing shifts. Ideally, two cycles would be adequate and practical to maintain up to date patient information, whereby changes could be incorporated or deleted as required for the second cycle. However, if this is not feasible due to limited pharmacy coverage, a single daily cycle will serve the purpose. When deciding on more than one cycle, consider distribution of doses and their frequency on the demonstration site. Ensure that the distribution load is equally divided, allowing the heavier medication periods and the part of the day generating the majority of order changes to be included in a cycle that can be serviced during routine working hours. Arrangements must be made in a single cycle operation to assure a method of screening orders for pertinent data to guarantee compliance with the latest order. Essentially, the selection of cycles or frequency of cycles will vary with the hospital. When making the decision, consider the nurse and her needs, especially peak work periods, pharmacy coverage and providing all medications without creating hardships.
5. One of the objectives of unit dose distribution is to minimize floor stock on the nursing unit. This should be accomplished as soon as possible but is to be attempted with caution. The degree of involvement regarding unit dose concepts alludes to how much and what stock is to be removed. Cooperation from key nursing personnel is needed to help determine what medications should remain. Also, policies directing the use of floor stock should be established and enforced to prevent indiscriminate use for routine situations.

Since the majority of narcotics are administered on a stat or as needed basis, their incorporation into unit dose dispensing should not create undue concern initially. However, if adequate security measures and computerized accounting procedures are available, it definitely would warrant complete transition to the unit dose concept.

Certain bulk items will always be required as floor stock, but if constant surveillance is maintained and rigid justification required, floor stock can be maintained at a minimum.

The preceding points further serve to illustrate the multitude of complications with which the hospital pharmacist will be confronted when seeking a course of action to implement unit dose distribution and what degree of involvement must be undertaken to guarantee a successful transition of systems.

There are many points that must be examined and a guideline in this particular area is of little value. The degree of involvement will depend on the initiative and motivation of the pharmacist, availability of funds, equipment, qualified personnel and the support and cooperation of administration and nursing. Alternatives have been mentioned and the ultimate avenue of approach and degree of involvement remain at the discretion of the hospital pharmacist.

#### IX. Selection of Demonstration Site

There are two approaches to this requirement:

- A. Selection of a nursing station that will offer the least resistance to change.
- B. Selection of a nursing station that will offer the greatest resistance and provide a vast degree of hardships.

The direct approach is considered to be the most conclusive means of attaining true results, since all possible challenges are offered as opposed to the station that could provide a false assurance of success. By taking the direct approach in the selection of the demonstration site, some factors to consider are:

- A. High average patient census.
- B. Attitudes of nursing personnel.
- C. Relatively short patient stay.
- D. Large variety and amounts of medications used.
- E. Location in relation to pharmacy and communication capabilities.
- F. Activity of other health team members in relation to nursing functions.
- G. Opinion of key personnel as to the feasibility of the selected site.

#### X. Designing Forms

The successful transition from traditional distribution systems to centralized unit dose distribution will be enhanced by the design of forms and records that will assure acceptance and ease of use by all involved. Prior to the actual designing of any form, careful evaluation of current operational forms and records should be accomplished. Adaptability of current forms and records to the application of the new distribution system may serve to keep expenditures down and eliminate confusion arising from the changeover. The actual design of forms and records will vary depending on the hospital. Invariably, hospitals

with computer potential will require fewer forms as opposed to hospitals with partial computer capabilities.

Basically, the transition to unit dose drug distribution will require the development of the following forms and records:

- A. Physician's Medication Order Form capable of providing a duplicate copy (Appendix E, Figures 1, 2).
- B. Pharmacy Medication Dispensing Record suitably designed to facilitate charging procedures that are automatically or manually computed (Appendix E, Figures 3, 4).
- C. Pharmacy Notification Form specifically designed to enable nursing personnel to inform pharmacy of current drug changes and related information (Appendix E, Figure 5).

#### XI. Drug Administration Schedule

The non-conformity of medication order interpretations necessitates the contrivance of a uniform drug administration schedule. Key nursing personnel should be called upon to qualify administration instructions and also to exert the authority for strict compliance once adopted for use (Appendix F).

#### XII. Availability of Unit Dose Drugs

Preparation necessary for the implementation of centralized unit dose distribution depends on the availability of unit dose medications. Pharmaceutical manufacturers are currently supplying some of these items. However, not all of the pharmaceutical houses have made similar commitments and those who have are still demanding justification for further expansion. Until the majority of items are available in

unit dose form, hospital pharmacists will have to improvise in order to circumvent this deficiency. Therefore, preliminary steps must be taken that will furnish the information necessary to establish an experience factor relating to drugs used and their frequency. Once this factor is determined, the purchase of all needed and obtainable unit dose drugs should be undertaken.

An alphabetical listing of oral, solid, liquid and injectable products in unit of use form will serve as a handy reference when ordering (Appendix G). Due to continuing availability of newly packaged unit dose drugs, items not listed should be checked against the latest catalogs available. A two to three week order and shipping time must be considered, since the majority of unit dose drugs will be ordered directly from the manufacturer.

### XIII. Unit Dose Packaging

Pending greater assistance from the manufacturers relative to the availability of unit dose drugs, the interim period decrees that hospitals utilizing unit dose distribution continue to supplement the manufacturers' capability. These procedures can be engineered by using varied methods. When considering the method of approach to unit dose packaging, the hospital pharmacist is confronted with unique problems. Therefore, the following outline will envelop an array of ideas that could be adapted to the many diversified situations.

Oral Solids

- A. Purchase manufacturers' strip-packaged items whenever possible.
- B. Purchase a strip-packaging machine.
- C. Utilize facilities of a hospital with strip-packaging equipment.
- D. Job out strip-packaging to a local company.
- E. Semi-manual and manual packaging.
  - 1. coin envelopes
  - 2. polyethylene bags
  - 3. plastic vials

Oral Liquids

- A. Purchase manufacturers' preparations
- B. Purchase automatic bottling equipment.
- C. Purchase semi-automatic equipment.
- D. Purchase manual equipment.
- E. Utilize facilities of a hospital possessing required equipment.
- F. Job out unit dose preparations to a local company.
- G. Manually prepare unit doses by use of inexpensive equipment.

Injectables

- A. Purchase manufacturers' prefilled preparations.
- B. Prefill disposable syringes using varied equipment and supplies.
- C. Continue with traditional methods necessary to supplement commercially unavailable unit dose injectables.

### Miscellaneous Preparations

Miscellaneous preparations that are not suited for unit dose packaging due to economic feasibility or problems related to stability or sterility should be dispensed and charged as a complete unit and transferred with each medication cart changeover.

### XIV. Equipment and Materials

The approach to the selection of equipment and materials emerges as one of the most vital factors necessary for the establishment of unit dose distribution. Since so many variables must be considered when making a decision of this nature, the only assistance that can be offered is a listing of devices and items that can be adapted to the three basic dosage forms. The hospital pharmacist contemplating unit dose must carefully review requirements, selecting equipment and materials that will accomplish the job within the hospital's financial limitations.

#### A. Packaging equipment and materials.

1. Oral solids (Appendix H-I)
  - a. Mechanical strip-packaging machines
  - b. Manual procedures
    - 1a. coin envelopes
    - 2a. polyethylene bags
    - 3a. small prescription vials
    - 4a. manufactured blister packets
2. Oral liquids (Appendix H-II)
  - a. Mechanical

- 1a. automatic pipetting machines
- 2a. mechanical capping devices
- b. Manual
  - 1a. Cornwall syringe
  - 2a. 5 and 10 cc disposable syringes
  - 3a. time-measured volume delivery
  - 4a. manual capping machines
3. Injectables (Appendix H-III)
  - a. laminar flow hoods
  - b. disposable syringes
  - c. rubber tip seals
  - d. syringe filling stand
  - e. spin weld machine
4. Accessories (Appendix H-IV)
  - a. marking or labeling devices
  - b. packaging aides
  - c. counting devices
  - d. shelving
  - e. dispensing carts
  - f. medication cabinets
  - g. medication record holders
  - h. glassware and caps

#### XV. Orientation and Training Phase

Once the preliminary complexities are solved, an elaborate, well-coordinated training phase should be inaugurated. This training

orientation phase is primarily intended for pharmacy and nursing service personnel who will be immediately involved with the centralized unit dose distribution system. Noteworthy subjects to dwell upon during such presentations are:

A. Nursing

1. Thorough orientation to unit dose concepts and procedures.
2. Familiarization with unit dose preparations (use of unit dose drugs within traditional system).
3. Practice sessions to bring all aspects into focus (approximately one week prior to actual implementation, utilizing orders for currently hospitalized patients).

B. Pharmacy Assistants

1. Understanding of complete concept.
2. Maintenance of unit dose records.
3. Reading and interpretation of physicians' orders.
4. Knowledge of unit dose medications (strength, size, availability).
5. Packaging of unit-of-use drugs.

XVI. Implementation

Upon institution of the new distribution system, the appearance of various problems should be anticipated. Usually the first few weeks under the new system will be the most trying, and the difficulties that arise cannot be pinpointed or attributed to one specific source. Discouragement in such a situation will be prevalent, but should not interfere with the positive approach necessary to overcome initial

problems. The ability to "trouble shoot" situations as described will render indispensable assistance, vital to the efficient operation of the new distribution system. All possible difficulties that might be encountered cannot be predetermined but a listing of the following would be typical:

- A. Lack of communications.
- B. Inadequate education and orientation related to objectives and goals.
- C. Negative acceptance by nursing personnel due to misunderstanding of the concept, presenting a job security problem.
- D. Misconception of increased cost.
- E. Rotation of personnel insufficiently briefed on new procedures.
- F. Unfamiliarity with new procedures on the part of all involved.
- G. Difficulty of personnel accepting any change.
- H. Latent or open animosities among participating personnel.
- I. Ambiguous procedures, methods, or standing operating procedures.
- J. Indifference on the part of personnel.

The difficulties mentioned are not all-inclusive, but do serve as starting points to recognize problems and their sources. Consequently, owing to the uniqueness of each hospital, no definite model can be used to illustrate specific problems, thus placing the burden on the skills and abilities of the hospital pharmacist. Attempts to solve these problems should be based on logic and the objective to keep in mind is the provision of efficient, safe, and economical hospitalization for

the patient.

## XVII. Evaluation

A reasonable trial period should be allowed that will permit personnel the opportunity to become thoroughly familiarized and proficient in all aspects of the new system. Thirty to 90 days, depending on circumstances, is ample in most cases to work out major difficulties and firmly establish a well-coordinated operation. Once this phase is reached, evaluation of the entire concept should be pursued. Evaluation of the system can be approached from different viewpoints, but basically should disclose the following:

- A. Quality of patient care.
- B. Reduction of medication errors.
- C. Increased efficiency of system.
- D. Reduction of job difficulties.
- E. Popularity and desirability of system.
- F. Continuation and expansion of the system.
- G. Advantages as opposed to disadvantages.

Among the most efficient means to obtain reliable evaluations are questionnaires, observations, and administrative surveillance of records.

Data resulting from the various methods used to make evaluations should be well documented and presented at a meeting of the Drug Distribution Committee. The primary purpose is to give a

comprehensive report concerning all aspects of the experiment and to plan a course of action for total conversion to unit dose distribution.

## V. SUMMARY AND CONCLUSION

The objectives of this study were to design, implement, and evaluate a unit dose drug distribution system and to use the experience in developing guidelines for others to use. The system was installed on a 30 bed unit in Good Samaritan Hospital, Corvallis, Oregon.

Evaluation of the system leads to the conclusion that it is practical and efficient, and that it provides the advantages to both hospital and patients that have been claimed for such systems by other hospital pharmacists.

The guidelines prepared from this study as well as many other published studies should prove helpful to other hospital pharmacists contemplating unit dose drug distribution.

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## APPENDICES

## APPENDIX A

## UNIT DOSE PROCEDURES

Good Samaritan Hospital  
Ward - 2/East

Purpose: Establishment of tentative operating procedures to determine the feasibility of implementing a unit dose drug distribution system on floor 2/East.

To: Nursing Service Personnel

Procedures: Admission of New Patients

Newly admitted patients will have in addition to current admission forms, a medication profile with two pre-lettered self-adhering labels. Profile sheets will contain the patient's name, hospital number, and bed number. The Admission Office will be responsible to insure that profile sheets and labels are addressographed with required patient information.

Profile Sheets

Will serve as pharmacy medication dispensing records for every patient.

Profile sheets are designed to:

1. maintain a record of all medications ordered by physician
2. maintain a record of route of administration
3. maintain a record of dose
4. maintain a record of quantity delivered to ward
5. maintain a record of quantity administered to the patient

This record is maintained for a seven day period.

Ordering From Pharmacy

Ordering procedures required of the unit dose system will not vary to any large extent as compared to current established procedures. The first medication order for a new admission will involve the established procedure of:

1. removing the duplicate copy of the physician's order
2. forward to the pharmacy:

- a. the duplicate copy of doctor's orders
  - b. profile sheet
  - c. self-adhering labels
3. Pharmacy personnel -- will assume the responsibility for transcribing physician's orders to the profile sheet and maintaining the status of patient charges. To avoid unnecessary confusion and most important to insure that ordered medications are available to the nurse when needed, the below terms will be defined and utilized.

Stat Orders. Request for medications needed for immediate dispensing. Stat Orders will be filled immediately with provision made to provide rapid delivery to the floor.

Priority Orders. Medication orders that will be required prior to delivery of medication cart. As with stat orders, arrangement will be made to ensure delivery of drug to the floor.

Routine New Orders. New Orders received prior to release of medication cart and required for routine administration during normal cycle, will automatically be filled and made available in cabinet drawers.

To ensure efficient and accurate utilization of this drug distribution system, it will be imperative that the following changes be reported to the pharmacy immediately regarding patient status:

- a. order changes
- b. discontinued orders
- c. new orders
- d. dose changes
- e. patient transfers
- f. discharges
- g. any other possible change that will affect patient status

This information will be of vital importance when preparing medication cabinets for the forthcoming dispensing cycle.

Change in status information will preclude unsupplied new orders, medications for transferred or discharged patients, erroneous medication for new admissions and insufficient or excess quantities.

As indicated by the above enumerated possibilities, it is apparent that information of this nature must be immediately made available to pharmacy personnel in order to provide accurate professional care of the highest caliber.

#### Medication Delivery

During the pilot study the medication cabinet will be delivered twice daily at 9:30 a. m. and 6:30 p. m. Medication drawers will contain all required medications for the period between 10:00 a. m. - 6:00 p. m. and 7:00 p. m. - 9:00 a. m. the following morning.

Medications such as ointments and ophthalmic preparations will be transferred during cabinet exchange.

#### Floor Stock

Limited amounts of floor stock will be available. Determination of items to be stocked should be considered and any suggestions should be directed to the pharmacy. Used floor stock is to be ordered as soon as possible in the usual manner in order to facilitate charges.

#### Narcotics and Hypnotics

Sedative and hypnotic medications will be supplied as routine medications. All narcotics will be dispensed from floor stock supplies and current accounting procedures will remain in effect.

## APPENDIX B

## UNIT DOSE PROCEDURES

Good Samaritan Hospital  
Pharmacy Service

Purpose: Establishment of Operating Procedures for the Implementation of a Centralized Unit Dose Distribution System.

To: Pharmacy Service Personnel

Procedures: Medication Order Receipt

The duplicate copy of the physician's medication order will be received by the pharmacy. Upon receipt, all orders will be screened for "stat" and "priority" orders. Initial orders will be accompanied by a completed Pharmacy Medication Dispensing Record and placed in the profile kardex in proper room number sequence. Two self-adhering labels will be prepared for each medication drawer and contain patient identification information. Subsequent orders, discontinued medications and other related data will be correctly recorded and a copy of the order inserted within the kardex to allow checking.

Transcription of Orders

Transcription of orders will be accomplished by the entry of medication nomenclature, strength, route and frequency of administration. The frequency and number of doses to be dispensed within each cycle will be directed by the uniform drug administration schedule.

Preparation and Delivery

Medication carts will be prepared and completed to allow delivery to the nursing station at least one-half hour before the first scheduled dose. Medication cabinets will be delivered twice daily, at 9:30 a. m. and 6:30 p. m. Bulk preparations will be transferred during cabinet exchange and will be indicated by a red indicator on the patient's drawer.

Dispensing

1. The pharmacist will read from the Pharmacy Medication record and select appropriate medications and

- sufficient quantities, to ensure absolute conformity with the physician's order and the dosage schedule for each cycle.
2. The number of doses supplied will be indicated in the specified column.
  3. PRN medications will be supplied in adequate quantities taking into consideration the maximum allowable dosage that might occur during the cycle.
  4. Returned medication will be recycled until discontinued orders are received or when other specific instructions are provided.
  5. Partially used quantities will be replenished until further order changes are indicated.
  6. Stat and priority requests will be recorded in the normal manner and necessary measures taken to assure prompt preparation and dispatch.
  7. Discontinued medications will be removed from drawers and a red line drawn through the nomenclature entry on the Pharmacy Medication Dispensing Record.
  8. Upon discharge, the patient's medication drawer will be stripped of identification label, drugs removed and Pharmacy Medication Dispensing Record filed.

#### Narcotics and Other Restricted Medications

Sedatives, hypnotics and other non-narcotic restricted medications will be supplied as routine medications. All narcotic preparations will be dispensed only as floor stock items.

## APPENDIX C

## OUTLINED UNIT DOSE PROCEDURES (33)

1. Physician initiates the procedure by writing the patient's drug order which is simultaneously reproduced in carbon or by non-carbon reproduction.
2. Nurse removes the duplicate copy of the order containing proper identification and forwards it directly to the pharmacy.
3. Pharmacy clerk will screen the order for prescriptions and transcribe each medication, order change, discontinued medication or other pertinent information on the Pharmacy Medication Record. The order then will be attached to the Pharmacy Medication Record and verified by the pharmacist who conjointly checks for therapeutic incompatibilities, drug allergies, etc.
4. Stat and emergency orders required prior to a cabinet delivery and orders requiring compounding are given immediate attention and are handled independently. Completed orders of this nature are dispatched directly to the requestor.
5. Routine orders filled by technicians and interns under the supervision of a pharmacist are automatically checked prior to delivery to the nursing station.
6. Approximately 30 minutes preceding commencement of a designated cycle, completed medication cart is delivered to the nursing station.
7. Medication nurse and pharmacy representative conduct a second check by comparing available medications with kardex requirements.
8. At prescribed intervals, medication nurse will then administer ordered doses as dictated by the kardex file or medication cards.
9. Charting is accomplished from the kardex or medication cards which are then set up to administer subsequent doses if required.
10. Non-routine orders are handled in the following manner:
  - a. PRN - Sufficient quantities to cover all possibilities within each cycle.
  - b. Routine and emergency night orders:
    1. Obtained from limited or emergency floor stock supplies.
    2. On call personnel summoned to handle such a request.
    3. Night supervisor with access to pharmacy dispenses sufficient quantities.

APPENDIX D

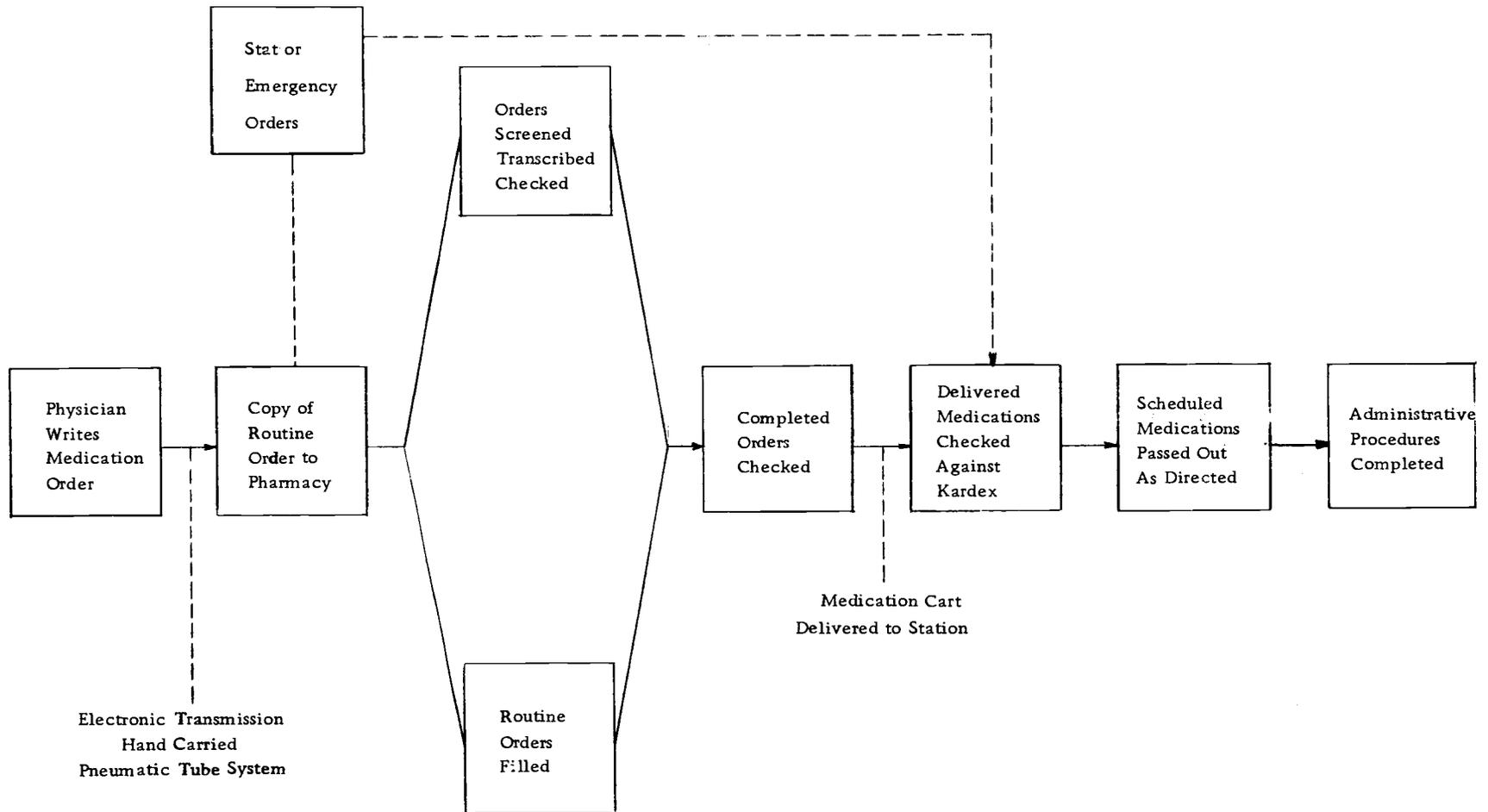


Figure 1. Unit Dose Medication Cycle (40)

PROVIDENCE HOSPITAL			FORM #218	
PATIENT	DATE & HOUR	PHYSICIAN'S ORDERS	NOTED BY	
			NURSE	HOUR
		ANOTHER BRAND OF DRUG IDENTICAL IN FORM AND CONTENT MAY BE DISPENSED UNLESS CHECKED <input type="checkbox"/>		
		ANOTHER BRAND OF DRUG IDENTICAL IN FORM AND CONTENT MAY BE DISPENSED UNLESS CHECKED <input type="checkbox"/>		
		ANOTHER BRAND OF DRUG IDENTICAL IN FORM AND CONTENT MAY BE DISPENSED UNLESS CHECKED <input type="checkbox"/>		
		ANOTHER BRAND OF DRUG IDENTICAL IN FORM AND CONTENT MAY BE DISPENSED UNLESS CHECKED <input type="checkbox"/>		

PROVIDENCE HOSPITAL—PHYSICIAN'S ORDERS FORM 218

PAPER PATENTED BY THE HUB COMPANY

PRINTED BY THE STANDARD REGISTER COMPANY, U.S.A. ZIPSET®

Figure 2. Physician's Medication Order Form

DATE & HOUR	PHYSICIAN'S ORDERS	

PATIENT INFORMATION

ANOTHER BRAND OF DRUG IDENTICAL IN FORM AND CONTENT MAY BE DISPENSED UNLESS CHECKED

PATIENT INFORMATION

ANOTHER BRAND OF DRUG IDENTICAL IN FORM AND CONTENT MAY BE DISPENSED UNLESS CHECKED

PATIENT INFORMATION

ANOTHER BRAND OF DRUG IDENTICAL IN FORM AND CONTENT MAY BE DISPENSED UNLESS CHECKED

SACRED HEART GENERAL HOSPITAL

PHYSICIAN'S ORDERS

Figure 3. Physician's Medication Order Form

PLEASE PRESS FIRMLY

DOSE	MEDICATION & STRENGTH	ROUTE	DOSAGE	CYCLE	1	2	3	4	5	6	7
50-	1			1							
				2							
50-	2			1							
				2							
50-	3			1							
				2							
50-	4			1							
				2							
50-	5			1							
				2							
50-	6			1							
				2							
50-	7			1							
				2							
50-	8			1							
				2							
50-	9			1							
				2							
50-	10			1							
				2							
50-	11			1							
				2							
50-	12			1							
				2							

SACRED HEART GENERAL HOSPITAL - PHARMACY MEDICATION DISPENSING RECORD

DIAGNOSIS \_\_\_\_\_ ALLERGIES \_\_\_\_\_

Figure 4. Pharmacy Medication Dispensing Record



PATIENT _____
DATE _____ TIME _____
DRUG(S) _____
_____
_____
REASONS
<input type="checkbox"/> NPO
<input type="checkbox"/> Refused
<input type="checkbox"/> Not on unit
<input type="checkbox"/> Expired
<input type="checkbox"/> Discontinued
<input type="checkbox"/> Not ordered
<input type="checkbox"/> Wrong dosage
<input type="checkbox"/> Discharged
<input type="checkbox"/> Recycle for delayed administration
<input type="checkbox"/> Will resume medications at _____
<input type="checkbox"/> Patient transferred to _____
<input type="checkbox"/> Not available
<input type="checkbox"/> Patient's condition did not warrant administration of _____
<input type="checkbox"/> Other (specify) _____
COMMENTS _____
_____
_____
_____

Figure 6. Pharmacy notification form.



## APPENDIX G

AVAILABLE ORAL SOLID MEDICATIONS IN  
SINGLE UNIT PACKAGES (27, 28)

Achromycin Capsules	250 mg
Amytal Capsules	200 mg
APC Tablets	
APC with Codeine	15 mg, 30 mg
APC with Meperidine	30 mg
Apresoline Tablets	25 mg
Ascorbic Acid Tablets	250 mg
Ascriptin Tablets	
Aspirin Tablets	300 mg
Aventyl Capsules	10 mg, 25 mg
Benadryl Capsules	50 mg
Camoquin Tablets	200 mg
Carbrital Kapseals	
Carbrital Kapseals Half Strength	
Chloromycetin Kapseals	250 mg
Colace Capsules	50 mg, 100 mg
Coumadin Tablets	2 mg, 2.5 mg, 5 mg, 7.5 mg, 10 mg, 25 mg
Cyclamycin Capsules	250 mg
Crystodigin Tablets	0.1 mg, 0.2 mg
Cytoxan Tablets	50 mg
Darvon Capsules	32 mg, 65 mg
Darvon Compound	32 mg, 65 mg
Darvon with ASA	
Deltasone Tablets	5 mg
Declomycin Tablets	150 mg, 300 mg
Declostatin Capsules	
Diethylstilbestrol Tablets	5 mg
Dialose Capsules	
Dialose Plus	
Dilantin Capsules	100 mg
Diuril Tablets	250 mg, 500 mg
Donnatal Tablets	
Doriden Tablets	500 mg
Dulcolax Tablets	5 mg
Emprin Compound with Codeine	Nos. 2, 3, 4
Equagesic Tablets	
Equanil Tablets	200 mg, 400 mg
Erythrocin Tablets	250 mg

Esidrex Tablets	50 mg
Gantrisin Tablets	500 mg
Hydrodiuril Tablets	25 mg, 50 mg
Ilosone Capsules	250 mg
Lanoxin Tablets	0.25 mg
Librium Capsules	5 mg, 10 mg, 25 mg
Lincocin Capsules	500 mg
Macrochantin Capsules	50 mg, 100 mg
Maolate Tablets	400 mg
Meperidine HCL	50 mg
Mysoline Tablets	250 mg
Mysteclin F Capsules	250/50 mg
Nembutal Capsules	100 mg
Niacin Tablets	50 mg
Nitro-B-D Tablets	
Noctec Capsules	500 mg
Omnipen Capsules	250 mg, 500 mg
Orinase Tablets	500 mg
Pavabid Capsules	150 mg
Penbritin Capsules	250 mg, 500 mg
Penicillin G Tablets	100,000 u, 200,000 u, 250,000 u, 400,000 u
Pentids Tablets	125 mg, 250 mg
Pentobarb Sodium	100 mg
Pen Vee K Tablets	125 mg, 250 mg
Peri Colace Capsules	
Phenergan Tablets	12.5 mg
Phenobarbital Tablets	12 mg, 30 mg, 60 mg, 100 mg
Placidyl Capsules	500 mg
Polycillin Capsules	250 mg, 500 mg
Polymagma Tablets	
Premarin Tablets	1.25 mg
Principen Capsules	250 mg, 500 mg
Purodigin Tablets	0.1 mg, 0.2 mg
Pyribenzamine Tablets	50 mg
Quibron Capsules	
Raudixin Tablets	100 mg
Reserpine Tablets	0.25 mg, 1 mg
Ritalin Tablets	10 mg
Seconal Capsules	50 mg, 100 mg
Serpasil Tablets	0.25 mg
Serpasil-Esidrex Tablets	25 mg, 50 mg
Serax Capsules	10 mg, 15 mg, 30 mg
Soma Compound	
Sparine Tablets	100 mg
Sumycin Capsules	250 mg

Surbex T Tablets	
Tetrachel Tablets	250 mg
Theragran Tablets	
Theragran M Tablets	
Thiamine HCL Tablets	100 mg
Thiosulfil Forte Tablets	500 mg
Thyroid Tablets	15 mg, 30 mg
Tofranil Tablets	25 mg, 50 mg
Tolinase Tablets	250 mg
Tuinal Capsules	100 mg, 200 mg
Unipen Capsules	250 mg
Vasodilan Tablets	10 mg
V-Cillin K Tablets	500 mg
Quinidine Sulfate Tablets	200 mg
Zactirin Tablets	
Zactirin Compound Tablets	

## Appendix G. (Continued)

AVAILABLE ORAL LIQUID MEDICATIONS IN  
SINGLE UNIT PACKAGES (27, 28)

Acetaminophen Elixir	120 mg/5 ml
Aludrox Suspension	10 ml
Aluminum Hydroxide Gel	30 ml
Amphogel Suspension	10 ml
Aromatic Cascara Sagrada Fluid Extract	5 ml
Belladonna Phenobarbital Elixir	5 ml
Buffered Phosphate Solution	30 ml
Castor Oil	30 ml, 60 ml
Castor Oil Flavored	30 ml, 60 ml
Chloral Hydrate	500 mg/5 ml
Declomycin Syrup	75 mg/5 ml
Diphenhydramine HCL Elixir	10 ml
Ferrous Gluconate Syrup	300 mg/5 ml
Glyceryl Guaiacolate Elixir	100 mg/10 ml
Ipecac Syrup	15 ml, 30 ml
Kaolin and Pectin Suspension	30 ml
Maalox Suspension	15 ml
Magnesium-Aluminum Hydroxide Gel	30 ml
Milk of Magnesia	15 ml, 30 ml
Milk of Magnesia with Cascara	30 ml
Milk of Magnesia-Mineral Oil Emulsion	30 ml
Mineral Oil	30 ml
Mineral Oil Light	15 ml, 30 ml
Oxaine M Suspension	5 ml
Paregoric	5 ml
Penbritin Suspension	125 mg, 250 mg
Pen Vee Suspension	180 mg/5 ml
Phenergan Expectorant	5 ml
Phenergan with Codeine	5 ml
Phenergan VC Expectorant	5 ml
Phenergan VC with Codeine	5 ml
Phenergan with Dextromethor- phan	5 ml
Phenobarbital Elixir	20 mg/5 ml, 15 mg/10 ml, 100 mg/5 ml
Potassium Chloride Liquid	20 meq/30 ml, 40 meq/30 ml

Potassium Iodide Liquid	500 mg/30 ml
Terpin Hydrate and Codeine Elixir	5 ml

## Appendix G. (Continued)

PARENTERAL PREPARATIONS AVAILABLE IN  
UNIT OF USE FORM (27, 28)

Abbocillin 800 M	800,000 u	
Abbocillin D-C	600,000 u	
Atarax	50 mg	1 ml, 2 ml
Bicillin LA	1,200,000 u, 2,400,000 u	2 ml, 4 ml
Bicillin C-R	1,200,000 u	
Bicillin P-A-B	2,400,000 u	4 ml
Codeine Phosphate	30 mg, 60 mg	1 ml
Crystifor	400,000 u	
Crysticillin	300,000 u, 600,000 u	
Cyanocobalamin	100 mcg, 1000 mcg	1 ml
Decadron	4 mg	1 ml
Deladumone		1 ml
Deladumone OB		2 ml
Delalutin	250 mg	1 ml
Delatestryl	200 mg	1 ml
Delestrogen	20 mg	1 ml
Deluteval 2X	250 mg	1 ml
Dilaudid	2 mg	2 ml
Diphtheria and Tetanus Toxoids Pertussis Vaccine		
Diphtheria and Tetanus Toxoids		
Diurnal-Penicillin	300,000, 500,000 u, 1,000,000 u	
Duracillin F. A.	1,000,000 u	
Duracillin A. S.	300,000 u, 1,200,000 u, 600,000 u	2 ml, 1 ml
Epinephrine	1:1000	1 ml
Ergotrate	0.2 mg	1 ml
Erythrocin	100 mg	2 ml
Heparin Sodium	1,000 u, 5,000 u, 10,000 u, 15,000 u, 20,000 u	
Hydromorphone	2 mg, 4 mg	1 ml
Hydroxocobalamin	100 mcg, 1000 mcg	1 ml
Ilopan	250 mg, 500 mg	2 ml
Influenza Virus Vaccine, Polyvalent		
Largon	20 mg, 40 mg	1 ml, 2 ml
Lentopen	400,000 u	1 ml

Lentopen All Purpose	400,000 u	1 ml
Lidocaine	1%, 2%	2 ml
Lincocin	600 mg/ml	2 ml
Measles Virus Vaccine		
Mepergan	50 mg	2 ml
Meperdine	50 mg, 75 mg, 100 mg	1 ml
	25 mg, 50 mg, 75 mg,	
	100 mg	1 ml/2 ml
Morphine Sulfate	8 mg, 10 mg, 15 mg	1 ml
	8 mg, 10 mg, 15 mg	1 ml/2 ml
Penicillin Benzathine G	600,000 u, 1,200,000 u,	
	2,400,000 u	
Penicillin Procaine	300,000 u, 600,000 u,	
	1,200,000 u, 2,400,000 u	
Penicillin Procaine G with Streptomycin Sulfate	400,000 u-50 mg,	
	600,000 u-50 mg	
Pentobarbital Sodium	50 mg, 100 mg	1 ml, 2 ml
Phenergan	25 mg, 50 mg	1 ml
Phenobarbital Sodium	50 mg	1 ml
Pressonex	10 mg	1 ml
Pyribenzamine	25 mg	1 ml
Rubramin PC	100 mcg, 1000 mcg	1 ml
Seconal	50 mg, 100 mg	2 ml, 1 ml
Sodium Chloride	0.9%	2 ml
Sparine	25 mg, 50 mg	1 ml
	50 mg, 100 mg	2 ml
S-R Penicillin	400,000 u	
Streptomycin	500 mg, 1 gm	1 ml, 2 ml
Strep-Combiotic		2 ml
Terramycin	100 mg, 250 mg	2 ml
Tetanus Antitoxin	1500 u, 3000 u, 5000 u	
Tetanus Toxoid	0.5 ml	
Tetanus Toxoid Fluid		
Purified	0.5 ml	
Thiamine HCL	100 mg	2 ml
Thiomerin	125 mg, 250 mg	1 ml, 2 ml
Visteral	25 mg, 50 mg	1 ml
Vitamin A	50,000 u	1 ml
Water for Injection		1 ml, 2 ml
Wyamine	30 mg, 60 mg	1 ml, 2 ml
Wycillin Suspension	300,000 u, 600,000 u,	
	1,200,000 u, 2,400,000 u	
		1 ml, 2 ml
Wycillin SM	400,000 u, 600,000 u	2 ml

## APPENDIX H

## EQUIPMENT AND MATERIALS (10)

## I

Oral SolidsStrip Packaging MachinesStrip-O-Matic

Mercury Heat Sealing Equipment Company  
2601 N. Howard Street  
Philadelphia, Pennsylvania

Una-Strip Packer

Ivers-Lee Company  
215 Central Avenue  
Newark 3, New Jersey

Little Packager

Bartelt Engineering Company Inc.  
1900 Harrison Avenue  
Rockford, Illinois

Wrap Aide

Wrap Aide Machine Company Inc.  
189 Sargeant Avenue  
Clifton, New Jersey

Uhlman Universal Packing Machine

Chemical and Pharmaceutical Industry Company Inc.  
99 West Broadway  
New York 7, New York

Una-Strip Packer

Becton-Dickinson Company  
Rutherford, New Jersey 07070

Packaging AidsCounting DevicesVi-Count

Lakso Company Inc.  
Fitchburg, Massachusetts

Mini-Counter, Rotax, Versacount

Production Equipment Inc.  
17 Locust Place  
Rochelle Park, New Jersey

Triumph

Modular Packaging Systems Inc.  
3 Grant Meadow Lane  
Hanover, New Jersey

Medicounter

Marick Corporation  
501 S. Arroyo Parkway  
Pasadena, California

Medication Packaging MaterialsPolyethylene Bags

Errick International Corp.  
721 Broadway  
New York, New York 10013

Bemis Company Inc.  
800 North Star Center  
Box 33  
Minneapolis, Minnesota 55402

Coin Envelopes

Viking Stationers Inc.  
131st at Spring  
Los Angeles, Calif.

Klip Stationers  
P. O. Box 3082  
Portland, Oregon 97208

Manufactured Blister Packets

Russo Corporation  
Rio Rancho Industrial Park  
P. O. Box 848  
Albuquerque, New Mexico 87103

Small Prescription Vials

Owens-Illinois  
Toledo, Ohio

Brockway Glass Company Inc.  
Brockway, Pennsylvania

## Appendix H. (Continued)

## II

Oral LiquidsAutomatic Pipetting Machine

Becton-Dickinson  
Rutherford, New Jersey 07070

Capping Devices

Becton-Dickinson  
Philips Roxane Labs Inc.  
Columbus, Ohio 43216  
The West Company Inc.  
Phoenixville, Pennsylvania 19460

Manual Filling DevicesCornwall Syringe

Becton-Dickinson

Disposable Syringes

Becton-Dickinson  
Intra Products  
Dayton, Ohio 45414  
Jelco Laboratories  
Raritan, New Jersey

Unit Dose Bottles

T. C. Weaton Company  
Millville, New Jersey 08332  
The West Company  
Owens-Illinois Company  
Aluminum Company of America  
Pittsburgh, Pennsylvania  
Philips Roxane Labs Inc.

Polyethylene Cups and Caps

American Can Company  
New York, New York

Scott Paper Company  
Eugene, Oregon

Thunderbird Container Corp.  
El Paso, Texas

Premium Plastics Inc.  
Chicago, Illinois

American Hospital Supply  
14848 N. E. 36th  
Bellevue, Washington 98004

## Appendix H. (Continued)

## III

InjectablesLaminar Flow Hoods

Abbott Laboratories  
North Chicago, Illinois 60064

Becton-Dickinson

Disposable Syringes, Needles and Accessories

Becton-Dickinson Company

Jelco Laboratories Inc.

Spin Weld Machine

Intra Products Inc.

Syringe Filling Stand

Becton-Dickinson

## IV

Accessory Equipment and MaterialsMedication Cabinets and Carts

Akro-Mills Inc.  
1293 S. Main Street  
Akron, Ohio 44309

Brewer Pharmacal Engineering Corp.  
9138 Westchester Pike  
Upper Darby, Pennsylvania

The Macbick Company  
Wilmington, Massachusetts

Market Forge Company  
Everett, Massachusetts

American Iatro-Dynamics Corp.  
Inglewood, California

Lakeside Manufacturing Inc.  
1977 S. Allis Street  
Milwaukee, Wisconsin

Storage Devices

Market Forge Company  
Remington Rand Office Systems  
2601 Wilshire Boulevard  
Los Angeles, California  
Lundia Swain and Myers Inc.  
P. O. Box 309  
Decatur, Illinois  
Jackson Compactus  
3477 Union Pacific Avenue  
Los Angeles, California

Marking and Labeling Devices

Monarch Marking Systems Company  
Dayton, Ohio  
Professional Tape Company Inc.  
384 East Burlington Road  
Riverside, Illinois  
Markem Machine Company  
Keene, New Hampshire  
Soabar Company  
7722 Dugan Road  
Philadelphia, Pennsylvania  
Popper and Sons Inc.  
New York, New York  
Dennison Manufacturing Company  
300 Howard Street  
Framingham, Massachusetts  
Dymo Products Company  
6701 Bay Street  
Emeryville, California 94608  
Weber Marking Systems Inc.  
711 West Algonquin Road  
Arlington Heights, Illinois 67005

Medication Record Holders

Acme Visible Files  
Crozet, Virginia

Printed Forms

National Cash Register Company

Main and K Streets  
Dayton, Ohio 45409

Briggs Printing  
Des Moines, Iowa

Local Printing Companies