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A STUDY OF UNITED
STATES AIR FORCE MEDICAL
CENTRAL PROCESSING AND
DISTRIBUTION SYSTEMS

A Problem Solving Project
Submitted to the Faculty of
Baylor University

In Partial Fulfillment of the
Requirements for the Degree
of

Master of Hospital Administration

by

Captain Scott H. Garner, USAF, MSC



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CHAPTER I
INTRODUCTION

Central Processing and Distribution

During the last seven years, the United States Air Force has been evaluating and implementing Central Processing and Distribution (CPD) systems in Air Force medical facilities. The largest of these systems has been included in the major construction program at Wilford Hall USAF Medical Center. This system will provide comprehensive materials handling support to the medical facility. Areas to receive support include:

1. Food service
2. Linen
3. Processed supplies
4. Empty cart returns and soiled returns
5. Bulk supplies
6. Medical equipment
7. Pharmacy
8. Sterile supplies and surgery
9. User areas¹

Implementation of this system began in 1980. Although technical problems with the rail delivery component of the system have not been completely solved, the system is now operational. The first year of operation of this system and evaluations of other Air Force CPD systems have disclosed valuable information about the benefits and costs of implementing CPD systems in

Air Force medical facilities.

Purpose of Research

The primary purpose of this research was to determine if CPD systems are effective methods of providing material handling support to Air Force medical facilities.

Limitations

On 6 April 1976 the Major Air Commands were directed to implement CPD systems in medical facilities under their control.² This research effort was originally directed toward investigating these existing CPD systems to see if they provided an effective material support system. Initial research findings, however, revealed that only a small number of Air Force medical facilities had implemented or had plans to implement small CPD systems which included cart exchange systems. Data available on existing Air Force CPD systems, therefore, was very limited. Due to this limitation, the research effort had to be broadened to not only include investigation of existing Air Force CPD systems but also include a study of the evolution of the Air Force concept and problems with its implementation. This additional research supplemented the study on existing systems to help determine the effectiveness of CPD in Air Force medical facilities.

Wilford Hall USAF Medical Center has the largest Air Force CPD system. The system includes the only Air Force overhead rail delivery system. Since technical problems with this rail system have not been completely solved, an extensive evaluation of the total CPD concept within a 1,000 bed medical facility was not feasible. The other major components of the Wilford Hall CPT system were operating and used for comparative studies between the former

non-CPD system and the new CPD system.³

Literature Review

Materials management is one of the most important areas of concern for hospital administration. It is an area in which management has an opportunity to directly influence both the operation costs and quality of patient care of a medical facility. Although there is much literature concerning material handling systems, the Air Force CPD concept is a relatively new one which was still under development as late as 1975. The literature search included finding sources which led to the development of the Air Force CPD concept and documentation on successful CPD systems within the civilian community.

A comparison between the CPD system designed for the Air Force and financially successful civilian CPD systems disclosed important differences which indicate why the Air Force application of the CPD concept has not been as effective as originally anticipated and has met a great deal of resistance in many medical facilities.

The successful CPD systems identified in the literature search which were used to compare to the Air Force concept were:

1) Emanuel Hospital - This 550 bed hospital in Portland, Oregon implemented what they believe is a cost-effective, zero-inventory CPD system in 1974.⁴

2) El Camino Hospital - This hospital in Mountain View, California is a 464 bed, short-term community hospital who in 1978 implemented a CPD system consisting primarily of a cart exchange system.⁵

3) Veterans Administration Hospital, Atlanta, Georgia - A 572 bed general medical and surgical hospital which was the 1966 pilot station charged with exploring and developing the Friesen CPD material support system for the Veterans Administration system.⁶

Emanuel Hospital and El Camino Hospital were chosen for comparative purposes because they both are medium size hospitals having documented, successful CPD systems using manual cart delivery systems similar to the Air Force. Additionally, there was cost effectiveness data available on both of these systems. The Veterans Administration CPD system was reviewed because it was one of the primary models used in the development of the Air Force concept. Descriptions of these systems as well as a theoretical description of the Air Force CPD concept are provided in Chapter 2.

Research Methodology

Four stages were used to complete this research project. The first stage was a complete literature review. This review concentrated on finding and describing successful civilian CPD systems and describing the Air Force CPD concept. Portions of this review were used in the second stage to establish analysis criteria. The third stage consisted of an analysis of current CPD systems. Analysis techniques included:

- 1) A comparative analysis between successful CPD systems and the Air Force system.
- 2) Statistical analysis of data collected in surveys and personal interviews of personnel involved with the development, implementation, and maintenance of Air Force CPD systems.

3) Statistical analysis of data available in historical documents.

The final stage of the research was an evaluation of the potential of CPD for Air Force medical facilities, based on the analysis criteria.

Analysis Criteria

Information gathered in the literary review led to the development of the following two research objectives.

1. Can CPD be successfully implemented in Air Force medical facilities?
2. Does CPD provide valuable benefits to the Air Force?

In order to determine if these research objectives are achieved the following criteria were developed.

1. Does the Air Force CPD system cost more for manpower, equipment, or facility modification than the current non-CPD system?
2. Has the Air Force CPD system achieved the benefits it was projected to achieve when it was initiated? (Projected benefits are listed in Chapter 2).

FOOTNOTES

¹AMSCO Systems Company, Automated Materiel Processing and Distribution System for Wilford Hall USAF Medical Center (Oklahoma City, Oklahoma: Benham Blair & Affiliates, Inc., 1975), p. 3.

²Garth B. Dettinger, Brig Gen, USAF, MC, Director of Medical Plans and Resources, Office of the Surgeon General, letter titled "Central Processing and Distribution (CPD)", April 6, 1976.

³Harvy Sietsema, Jr., Captain, USAF, MSC, Operations Officer, Central Processing and Distribution, Wilford Hall USAF Medical Center, Lackland AFB, Texas. Interview, May 1981.

⁴Lawrence R. York, Vice President of General Services, Emanuel Hospital, Portland, Oregon, Doing More With Less Through Life-Cycle Materials Management, study published by Herman Miller, Health/Science Division, January, 1977.

⁵Bruce L. Tilley, Senior Management Engineer, El Camino Hospital, Mountain View, California, Study Results Favor Exchange Cart Supply System, Unpublished study, May, 1980.

⁶John G. Hood, Hospital Director, Veterans Administration Hospital, Atlanta, Georgia, Supply Processing and Distribution, Unpublished Operation Manual, November, 1968.

CHAPTER II

DISCUSSION

The Implementation of Central Processing and Distribution

In the early 1970s, the Directorate of Health Care Support of the Office of the Surgeon General noted several new problems facing medical materiel managers. These problems included:

1. Increasing amount of material being processed due to:
 - More tests
 - Increased technology
 - Increased outpatient and emergency cases
2. Increasing personal costs due to:
 - Increasing training and supervision costs
 - Increasing employee absenteeism, food, smoking and rest breaks, and vacations
3. The larger the hospital, the more decentralized the supply system becomes and the more people are needed.
4. The aseptic techniques of today's modern hospital require modern processing methods and equipment.⁷

In response to these problems, the Directorate began to seek a supply system which would provide solutions.

In early 1974, the Chief of the Materiel and Services Division noted that within civilian hospitals a need existed to decrease initial hospital construction costs to decrease manpower requirements, to decrease overall

operating costs, and to insure optimum patient care. The solution in many of these hospitals was the implementation of a Central Processing and Distribution (CPD) system which brought the total management of materiel into one functional area under the direction of a materiel manager.⁸ The following section describes three of these systems.

Central Processing and Distribution In Non-Air Force Medical Facilities

Overview

There is a large variation of procedures in non-Air Force CPD systems. The following three systems are each different but have common characteristics such as a single materiel manager and cart exchange systems. The descriptions of these systems are designed to provide data for comparison to the Air Force CPD concept. No effort is made to describe the activities which occur in the CPD system. The discussion of the Air Force system provides a more detailed description of these activities.

El Camino Hospital

El Camino Hospital in the South Bay Area of San Francisco is a 464 bed, short term community hospital. Approximately 400 physicians and 1,050 full-time employees staff the hospital.⁹ Prior to the implementation of an exchange cart system, supplies were handled in the following manner:

- 1) Floor nurses filled out requisitions for supplies and equipment
- 2) Store room or central service personnel picked up the requisitions
- 3) Orders filled
- 4) Materials delivered to nursing units
- 5) Materials stored in large wall cabinets.

6) A dumbwaiter was used for all clean, reprocessed items, solutions, and emergency items.¹⁰

The CPD system instituted at El Camino consists primarily of a cart exchange system. One materials manager coordinates the activities of Nursing Service, the store room, and central service. The purchasing department routinely orders supplies which are delivered within 24 hours. Three exchange carts are maintained on each 34 bed ward while three identical carts are being replenished in the store room. Carts are exchanged daily.

The senior management engineer of El Camino Hospital, Mr Bruce L. Tilley, conducted a study of the new CPD system which looked at costs, labor, and employee acceptance. Cost and labor results of this study are shown in Appendix C. Results are summarized as:¹¹

- 1) There is a net decrease in ward stock of 37%
- 2) Nursing personnel like the new CPD supply system better than the old system.
- 3) There is an annual store room labor cost of 8.6 hours per-bed.
- 4) There is an annual central service labor savings of 7.8 hours per-bed.
- 5) There is an annual Nursing Service labor savings of 9.6 hours per-bed.
- 6) The net annual labor savings at the time this study was made was \$211.82 per-bed.
- 7) Uncharged supply use is reduced by between 8% and 33%.
- 8) The pay back for implementing the new CPD system is slightly more than 8 months.

The cost study did not include the cost of a new cart wash since it was already being purchased for surgery. The study also noted a large labor saving for Central Service personnel. This savings occurred because there was a dual supply delivery system in use. The implementation of the cart exchange system eliminated the use of one of these systems - the dumbwaiter.

Emanuel Hospital

The CPD system implemented in October, 1974 at Emanuel Hospital was motivated by a desire to reduce the total life-cycle cost of supplies traditionally used at nursing stations for direct patient care. The following problems were identified as major costs associated with materials handling:¹²

- 1) Large inventories in Central Service, Central Stores, and nursing stations tie up too many funds.
- 2) A significant storage cost is associated with carrying an inventory of medical supplies.
- 3) An unknown amount of shrinkage exists.
- 4) Obsolescence is on going with the constant introduction of new products.
- 5) Many patient-chargeable items are unaccounted for.
- 6) Materials handling personnel are required in Central Supply and Central Stores to receive requests and make deliveries of excessive quantities of goods and to respond to unscheduled requests for products.

The CPD system introduced to reduce these costs included a 24 hour cart exchange system and one central manager. When a nurse needs patient supplies, she takes the items from the cart and, if chargeable, makes a notation in a

patient charge book attached to the cart. When carts are returned to Central Supply for replenishment the patient charge forms are sent to the accounting office, where charges are posted to the patient's account. Non chargeable items are charged to the budget of the appropriate nursing unit.¹³

Only 10 percent of the supplies used in this CPD system are maintained in stock. The prime vendor delivers from his inventory, 365 days per year, the supplies needed to replenish those used in the previous 24 hours. The hospital is billed once a month for the supplies acutally used.¹⁴

Benefits gained from this system are shown in detail in Appendix D. They are summarized as:

- 1) A one-time inventory reduction of \$199,179.
- 2) An on-going carrying reduction of 30 percent of inventory eliminated.
- 3) A labor savings of 4.5 man years for the hospital.
- 4) Increased revenues with reduction of lost charges.
- 5) A reduction in paper work.

The study conducted by Mr York concentrated on the benefits achieved when the CPD system was implemented. There was very little cost information such as cart costs included in the study. Despite this, the inventory reduction is very dramatic.

Atlanta, Georgia Veterans Administration Hospital (VA)

The VA CPD system is much more extensive than the systems in Emanuel and El Camino hospitals. With the exception of linen processing and the size of bulk storage, the VA CPD system contains all the activities of the Air Force

CPD system as described in Figure 1. This system supports the entire hospital including outpatient clinics.¹⁵

The CPD system in the Atlanta VA hospital has the following major characteristics.¹⁶

1) The entire system including ordering, materiel storage, breakdown, decontamination, sterilization, and delivery are under the control of one central manager.

2) There is a responsive purchasing department which is able to obtain routine supplies on a daily basis. Individual supply requests are obtained within 30 days.¹⁷

3) There is a minimum of bulk storage - most supplies are broken into units of issue immediately upon delivery and placed on mobile shelving.

4) The hospital in Atlanta was designed to accommodate the CPD concept - particular attention was placed on reducing horizontal movement of supplies from the breakdown area to the point of need.

5) The cart exchange element is in operation 24 hours, 7 days per week.

A Theoretical Description of the Air Force CPD System

Overview

The CPD is the operational entity which links the activities of materials handling and provides efficient movement of the materials in the medical facility system. It provides:

1. Requirements determination
2. Procurement
3. Inventory management
4. Receiving
5. Processing
6. Assembling
7. Storing
8. Distribution
9. Interface with Air Force logistics and financial systems - of all material within the medical facility and its supported satellites.¹⁸

By the end of 1974, the Air Force concept of CPD was developed and Hill, Pease, and Luke AFBs were chosen to establish CPD prototypes. On 6 April 1976, the concept was initiated Air Force wide.¹⁹ The following description was adapted from Program Action Directive 1-75:²⁰ It does not attempt to detail all the functions which occur in the CPD system but does serve as a description of the flow of activities which can occur in a CPD system. Not all Air Force hospitals having CPD systems have all of the elements described. Various limitations of size, building configuration, and manpower availability have caused modifications to the CPD system described. Figure 1 provides a flow chart of the activities described in the following sections.

CPD

The theory of CPD states that the efficient operation of the logistics function within the medical facility is based on the standardization and centralization of the elements of processing, storage, and distribution. The processing element includes such functions as laundry (linen supply), equipment wash, and assembly/sterilization. The current organizational alignment fragments this

element between materiel services and the central supply service, each under separate management. CPD identifies the processing and sterilization function as integral to the supply system and provides central management for total coordination with other CPD elements.

Under CPD, the storage element is expanded to include a subelement, "processed stores". Processed stores provides central storage for all materiel in a ready-to-use form and includes both new and recycled materials in sterile and non-sterile form. It is from this area that the materiel is distributed to the user via a distribution system. Materials enter processed stores from either the bulk stores or from any of the processing functions. To insure the availability of materiel from processed stores to the user, the materiel manager must control and coordinate both the bulk stores and the processing functions.

Distribution in the CPD concept is an automatic resupply system. A cart exchange system was chosen as the most adaptable for Air Force needs. In the cart exchange system, materiel personnel deliver carts which have been stocked to pre-determined levels with routinely used items (linens, sterile and non-sterile supplies) to the using activity. The carts are stored on the unit and exchanged as frequently as required with a freshly stocked cart (usually every 24 hours).²¹

Exchange Cart System (ECS)

The ECS is based on two mobile supply carts assigned to each using activity. One supply cart is in service in the using activity while the other cart is being replenished in the materiel area. Carts are exchanged daily. All recurring demand items and certain as-required items are kept on

the carts. Using activities are required to specifically order only items not stocked on the carts. Carts are stocked, processed, delivered, and picked up by materiel personnel. Ideally, the need for storage cabinets in using activities is eliminated except for drug storage.

An area for replenishing and staging the exchange carts is designated which is continuously located to the existing loose issue warehouse. A separate "break down" storage area conveniently located to the staging area is established for medical supplies which are normally stocked on the carts in less than unit of issue quantities. Unit of issue packs are issued from the Medical Dental Stock Fund (MDSF) to the "break down" storage area as required to meet the demands of the exchange carts. "As required" items not normally stocked are delivered with the cart if sufficient space is available. A central processing dispatch office controls the stocking and dispatch of carts as well as provides a single point of contact for emergency orders of supplies.

Normally, two identical carts are maintained for each using activity. One cart is always located in the using activity while the other is being replenished. Replenished carts are dispatched to the using activities in late afternoon of each workday. Used carts are brought to the staging area on the return trip. This insures, initially, full carts during the time that the cart resupply function is closed. Cart processing begins in the supply staging area. Immediately prior to transfer to the using activity, the cart is resupplied with sterile packs and small items of checkout equipment which can be transported on the cart. After restocking, the carts are transported to the using activities and exchanged. Used carts are returned to the staging area for reprocessing. Orders for check out equipment and sterile packs not

routinely stocked on the cart are attached to the used exchange cart or telephone ordered to a designated control point. Replenishment of these carts is normally accomplished during the morning of the following day in preparation for afternoon delivery.

Linen Exchange

Linen supply conducts a linen exchange cart service which is limited to inpatient activities. This system has three linen carts for each participating activity. These carts are used for the following functions:

1. Clean linen cart
2. Dirty linen cart
3. Cart in reprocessing

Normal flow within the system starts with a full clean linen cart departing from linen supply and arriving at the clean utility room in the using activity. All clean carts are covered with a disposable plastic cover enroute to the using activities. The old clean linen cart is removed from the clean utility room. Any remaining clean linen is transferred to the new cart. The full dirty linen cart is then removed from the soiled utility room and replaced by the empty (old) clean linen cart after the shelves have been readjusted to the dirty linen cart configuration. The disposable cover is removed from the clean linen cart and placed on the full dirty linen cart for the return trip to linen supply. Disposable covers are not reused after completion of this cycle. The full dirty linen cart then returns to the dirty linen holding area for off loading. After off loading, each linen cart is processed through the sterile supply cart wash before re-entry into the exchange cycle. Linen exchange cart quantities are furnished as a result of previously determined levels or are the result of daily telephone orders from participating activities.²²

(See Figure 2.)

Sterile Processing

Orders for sterile packs and check out equipment are normally received as a result of the cart exchange process in the late afternoon and from telephone orders received during the day. Orders are processed and prepared for stockage on the exchange carts by noon the following day. Urgently required items which cannot await the next scheduled cart exchange are individually hand carried to the requesting activity or made available to a representative of the applicable using activity.

Receipt for check out equipment is prepared and provided to the exchange cart transporter. The exchange cart transporter obtains the proper signature in the using activity and returns the receipt to the supervisor of sterile supply.²³

FLOW OF MATERIEL

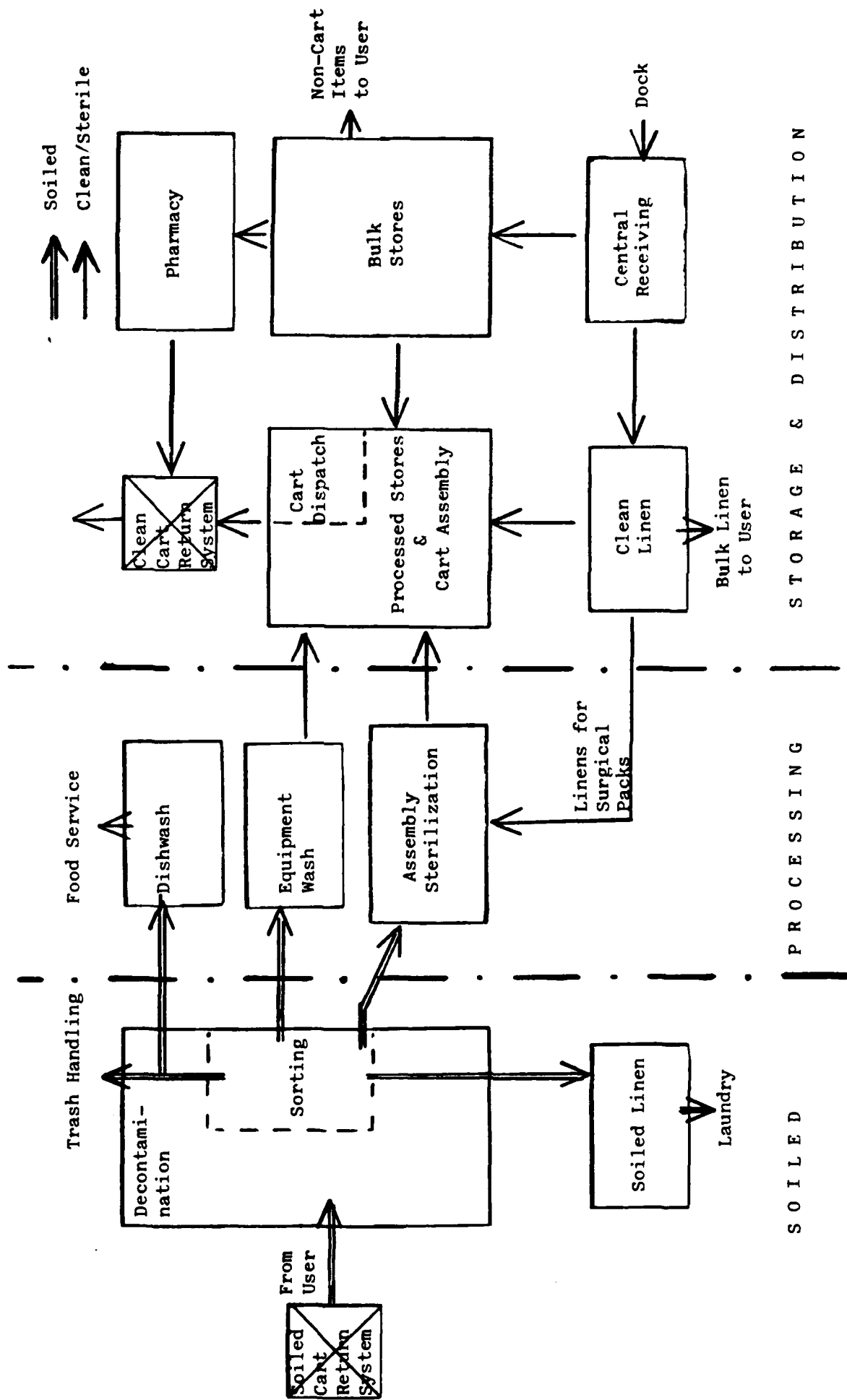


Figure 1 - Adapted from CPD Concept Letter 13

FLOW OF LINEN CART SYSTEM

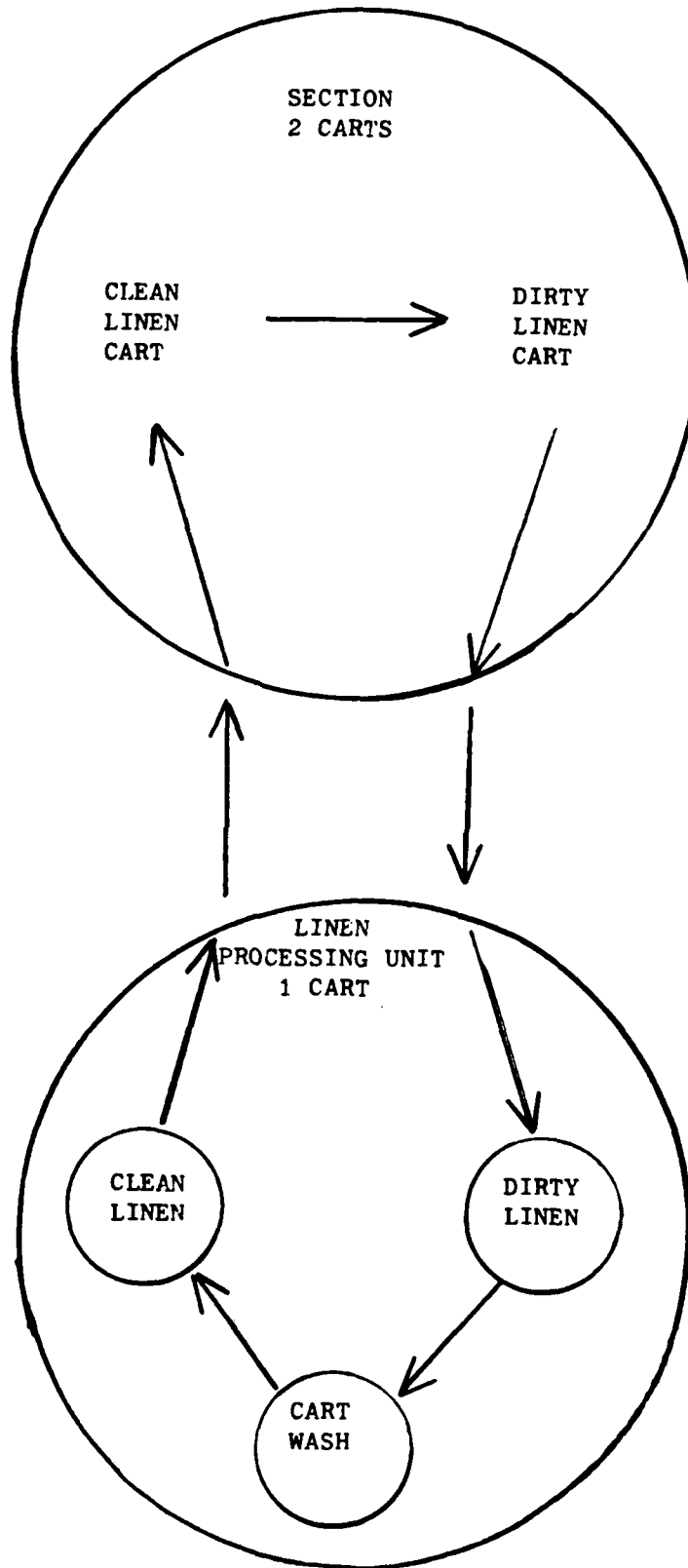


Figure 2

Projected Benefits

The theoretical Air Force CPD system as described was envisioned to provide the following benefits:

1. Personnel intensively trained in specific patient-oriented health care tasks are released from routine supply-related duties.
2. Supply responsiveness is improved.
3. Investment in using activity supply inventories is reduced.
4. Intermediate inventory holding points are eliminated.
5. Eliminates the requirement for storage cabinets in the using activities, except for controlled item storage, e.g., drugs, needles, and syringes.
6. Eliminates time wasted in searching storage cabinets for supplies.
7. Provides better control and supervision of the processing and re-supply functions and personnel.
8. Provides more expertise in the processing of supplies and in the re-supply functions.
9. Provides for automatic routine supply of sterile/nonsterile medical material.
10. Provides an orderly self-contained locker of supplies adapted for ease of usage.
11. Provides for closer scrutinizing of dated items.
12. Provides for breaking of units of issue into practical quantities.
13. Reduces manpower requirements.
14. Stockpiling is eliminated.²⁵

Projected Costs

Manpower

Manpower requirements for CPD systems were projected in the 31 October 1975 Program Action Directive which implemented the CPD concept throughout

the Air Force. This directive noted the need for a revision to existing manpower authorizations and specific skills. The overall demand on total hospital personnel resources, however, would not be altered.²⁶

Equipment

The projected equipment necessary to support CPD system requirements is:

1. Exchange carts - Two supply carts per participating using activity; two or three linen carts per activity as required.
2. Static storage for processed stores - Open wire mobile shelving with lockable casters.
3. Cart wash - Not necessarily essential but should be programmed in the appropriate equipment category where facility design will permit installation and workload justifies its use.²⁷

The actual cost per medical facility for acquiring this equipment varies greatly depending upon the size of the facility and the types of carts chose. Air Force total cart costs alone were projected to be \$1.7 million for 69 inpatient care facilities.²⁸

Facility Modifications

Initial projections about facility modification requirements were very unclear. The 31 October 1975 Program Action Directive encouraged the early implementation of CPD at facilities requiring little modification. It also directed that facility modification projects exceeding \$10,000 be submitted through the command civil engineers to the Materiel and Services Division, HQ USAF/SGHF, for an administrative and functional review.²⁹

Efficient Utilization of the

Exchange Cart Concept³⁰

<u>Bed Size Groupings</u>	<u>Eligible Inpatient Facilities</u>	<u>Projected CPD Facilities</u>	<u>Ave Cart Cost Per Bed</u>
10	14	6 (60)	\$926
11-25	24	24 (485)	837
26-35	16	13 (415)	611
36-55	4	4 (190)	383
56-100	18	13 (970)	353
101-200	4	4 (550)	398
201-360	8	5 (1215)	283

() Indicates number of beds in group.

Figure 3

Net Maximum Authorization

Increase for CPD³¹

<u>Bed Size</u>	<u>Projected Total Manning</u>	<u>Current Standard</u>	<u>Net Increase</u>
10	15	1	14
11-25	40	15	25
26-35	48	32	16
36-55	12	8	4
56-100	78	44	34
101-200	25	13	12
201-360	73	41	32

Net projected increases for CPD is 137 authorizations serving 89 bases.
This is a maximum projection.

Figure 4

Implementation Program

Locations

Initially, 90 Air Force medical facilities were considered for CPD implementation.³² This figure was reduced by the Major Air Commands to 69 after review of the criteria in the Program Action Directive.³³ An extensive 1980 survey (see Appendix A) conducted by the Air Force Materiel and Services Division found that only 21 Air Force medical facilities had taken action to implement CPD systems.

Major Implementation Issues

The Program Action Directive directed that each major command develop CPD implementation programs for their medical facilities.³⁴ As these programs were developed and CPD systems initiated, the following important issues emerged:

1. CPD is not suitable and cost effective at all medical facilities. Facilities of 25 beds or less, and facilities in which extensive plant modification is required to accommodate the CPD concept, are not candidates for economical CPD conversion.³⁵ A study of the command implementation programs (see figure 3) indicated that the cost of implementing CPD was inversely related to bed size. Extensive plant modifications were also found to be a limiting factor. A limit of \$500 per authorized bed was established as a criteria for plant modifications up to a 150 bed facility. Hospitals larger than 150 beds were limited to \$75,000 of CPD plant modifications.³⁶
2. Sterile processing should not be organizationally realigned under Medical Materiel. Program Action Directive 1-75 required that the central

sterile supply function under CPD be manned by a mixture of materiel personnel and civilians and be under the control of the single materiel manager.³⁷ This concept was based on civilian and veteran administration experience that CPD efficiency was improved when the CPD system was under the control of one central manager.³⁸ This problem emerged when materiel personnel began to be asked to perform the specialized central sterile tasks of pack assembly, sterilization, and instrument identification. The nursing service felt strongly that their technicians should not remain in central sterile supply after initiation of a CPD system and that the nursing staff should not be supervised by Medical Service Corps officers. The materiel supervisors felt that the materiel career field was already extremely complex and that inclusion of the specialized central sterile tasks would adversely affect materiel personnel career progressions. There was also a general consensus that complete civilianization of these positions would be detrimental to Air Force interests.³⁹ As a result of this conflict, the Air Force CPD concept was modified so that Sterile Processing and Medical Materiel retain their individuality and separate organizational structures.⁴⁰

3. Additional manpower is required to facilitate the cart exchange system and the management of processed stores. Although manpower increases relative to CPD implementation have not been confirmed by a medical manpower evaluation team, the experience at the two test bases indicated that an increase of manpower is required. Based on this experience and a 1977 evaluation of the command implementation plans, a study was conducted to project how much additional manpower would be needed to implement CPD Air Force wide (see Figure 4). This study concluded that a net maximum authorization increase

for CPD would be 137 serving 89 bases.⁴¹ Research findings presented later in this chapter indicate that this 1977 manpower projection underestimated the new requirements.

Actual Personnel Costs

Overview

As noted earlier the Air Force projected that CPD would not alter the overall demand on total hospital personnel resources. The two groups on which Air Force CPD systems have the greatest impact are supply personnel and nursing personnel. Each of these groups must be carefully evaluated to understand the total effect the CPD system has on manpower requirements.

Nursing Personnel

Wilford Hall Medical Center is the only medical facility which has recently converted to a CPD system. It is, therefore, the only current location that the effects of introduction of CPD can be measured on individual nursing units. Although Wilford Hall is the largest Air Force medical facility the individual wards and unit manning levels are similar to other Air Force hospitals. Sample data is, therefore, assumed to be applicable to other Air Force hospitals.

The sample data in figure 5 was collected by interviewing ward personnel who are in charge of their units' supplies and who have prior knowledge of the supply system prior to CPD. Only wards which are normally found in other Air Force hospitals were surveyed. The population data is assumed to be normally distributed. The sample size of 12 was acceptable since the twelve wards accounted for 496 beds out of 1,000. High and low data points

were discarded since they were extreme values and:

-The neurosurgical ward is not commonly found in smaller Air Force medical facilities

-The surgical ward was not using the same CPD procedures as the other wards.

MANPOWER SAVINGS ON WARDS
 SAMPLE DATA FROM WILFORD HALL MEDICAL CENTER
 JULY 1981

Type Ward	Number of Beds	Composit Hourly Wage Rate ⁴²	Prior CPC Weekly Hours Material Support	CPD Weekly Hours Material Support	Net Annual Gain/(Loss) Hours	Annual Per Bed Gain/Loss Hours	X	X ²
Neuro Surg	35	TSGt/\$8.26	10.5	3	390	11.143		discarded data
Surgical	48	MSgt/\$9.53	6	10	(208)	(4.333)		discarded data
Medical	48	Sgt/\$6.12	7.5	6	78	1.625		2.641
Medical	35	TSGt/\$8.27	7.5	3	234	6.686		44.703
Medical	35	MSgt/\$9.53	8	5	156	4.457		19.865
ENT/Opth	36	MSgt/\$9.53	10	5	260	7.222		52.157
Medical	40	SSgt/\$7.02	9	4	260	6.500		42.250
Medical	35	SSgt/\$7.02	8	5	156	4.457		19.865
Mental Health Alcohol	43	Sgt/\$6.12	4	1.5	130	3.023		9.139
Pediatric	70	SSgt/\$7.02	14	5	468	6.686		44.703
Med/Surg	35	SSgt/\$7.02	8.5	5	182	5.200		27.040
Surgical	36	SSgt/\$7.02	7.5	9	(78)	(2.167)		4.696

n=10 412 beds \$7.70 hourly wage 100.5 hours before 61.5 hours after x=43.689 (x²)=267.059

FIGURE 5

MANPOWER SAVINGS ON WARDS
ANALYSIS OF FIGURE 5 SAMPLE DATA ⁴³

$$\text{Standard deviation of Sample (5)} = \sqrt{\frac{n \sum x^2 - (\sum x)^2}{n(n-1)}} = 2.9095$$

$$\text{Mean } (\bar{x}) = 4.369$$

To obtain a 95% confidence interval with:

- 2 tailed test
- 9 degrees of freedom
- t distribution

$$t = 2.262$$

$$\text{Maximum error (E)} = |t| \frac{s}{\sqrt{n}} = 2.08$$

$$\bar{x} - E < N < \bar{x} + E = 2.288 < N < 6.45$$

Annual Ward Personnel

$$\text{Cost savings per bed} = (\bar{x}) \text{ (hourly wage rate)} = \$33.64$$

According to sample data there is a 95 percent confidence that the actual annual ward personnel cost savings per bed lies between \$18 and \$50.

$$(\bar{x} \pm E) \text{ (hourly wage rate)}$$

FIGURE 6

Supply Personnel

The survey information in Appendix A provided the data necessary to evaluate the manpower requirements for supply personnel. The data obtained was for all hospitals having or able to project additional manpower requirements for CPD. The population data is assumed to be normally distributed. Projections of two of the larger hospitals were discarded since they fell well out of the data grouping and three systems were not yet in being. The standard deviation is very large for this sample. This was attributed to differences in the services being offered at the various hospitals. It is acceptable since the purpose of this cost analysis is to demonstrate whether the system saves or costs money rather than determine the amount.

MANPOWER COST IN SUPPLY
 SAMPLE DATA FROM APPENDIX A

Size Operating Bed	915X0 Personnel Required	X Personnel Required	X^2
60	2	.033	.00109
40	1	.025	.00063
50	2	.04	.0016
25	1	.04	.0016
30	1	.033	.00109
65	2	.031	.00096
50	2	.04	.0016
40	1	.025	.00063
45	1	.022	.00048
64	4	.062	.00384
20	2	.10	.01
45	2	.044	.00194
30	4	.133	.01769
25	4	.16	.0256
44	1	.023	.00053
105	2	.019	.00036
n=16	32	$\sum x = .83$	$\sum (x)^2 = .06963$
beds=739			

FIGURE 7

MANPOWER COST IN SUPPLY
ANALYSIS OF FIGURE 7 DATA⁴⁴

$$s = \sqrt{\frac{n \sum x^2 - (\sum x)^2}{n(n-1)}} = .04209 \qquad \bar{x} = .051875$$

To obtain a 95% confidence interval with:

- 2 tailed test
- 15 degrees of freedom
- t distribution

$$t = 2.131$$

$$E = |t| \frac{s}{\sqrt{n}} = \pm .02242$$

$$\bar{x} - E < \mu < \bar{x} + E = .02945 < \mu < .074298$$

Standard composit hourly wage rate (SSGT)⁴⁵ = \$7.02

Standard annual manhours per requirement⁴⁶ = 1840 hours

The annual supply personnel cost

$$\begin{aligned} \text{per bed} &= (\bar{x}) (\text{standard annual manhours per requirement}) (\text{hourly wage rate}) \\ &= \$670 \end{aligned}$$

According to sample data there is a 95% confidence that the actual average annual supply personnel cost per bed lies between \$380 and \$960. $(\bar{x} \pm E)$
(Standard annual manhours per requirement) (hourly wage rate)

FIGURE 8

Summary

The total effect on personnel costs if a CPD system is implemented is an increase in personnel costs. According to this analysis the total annual per-bed manning cost increase for implementing a CPD system will be approximately \$636 with a 95 percent confidence that in the worst case the cost will increase to \$942 and that in the best case the cost will go to \$330.

Actual Equipment Costs

As noted in figure 9, the only major CPD equipment purchased for 8 of the 12 facilities having CPD systems is supply exchange carts. These carts were, therefore, chosen as the best equipment element to study to demonstrate minimum equipment costs necessary to implement limited CPD systems. Fifty percent of facilities having exchange carts were randomly sampled. The data was drawn from a normally distributed population. The analysis shown in figures 10 and 11 indicate that the one time average per bed cart cost to implement a CPD system is \$172.

SUMMARY OF INTERVIEW FINDINGS

Facilities Surveyed	Hospitals with Extensive CPD Systems	Hospitals with Modified CPD Systems	Hospitals Planning Elimination of CPD	Hospitals Who Have Phased out CPD
21	5	7	1	2
Hospitals Who Have Cancelled Plans To Implement CPD	Hospitals Currently Planning To Implement CPD	Hospitals With Major Construction Programs CPD Design	Supply Accounts Who Favor CPD System	Nursing Staff Who Favor CPD System
3	4	4	6 of 12	10 of 12
Hospitals Using Exchange Carts Only	Hospitals with Major Construction Programs CPD Design	Hospitals With One Central Manager	CPD Systems With One Central Manager	Hospitals Who Have Performed CPD Plant Modification
8 of 12	4 under construction 1 constructed	3 of 12	3 of 12	1 for \$3,500
Hospitals Having Processing Area Within Supply Warehouse				

4

Figure 9

(see Appendix B for locations and personnel interviewed)

CPD CART COST PER BED

(ANALYSIS OF FIGURE 10 SAMPLE DATA) ⁴⁷

$$s = \sqrt{\frac{n \sum x^2 - (\sum x)^2}{n(n-1)}} = .069 \qquad \bar{x} = .3123$$

To obtain a 95% confidence interval with:

- 2 tailed test
- 5 degrees of freedom
- t distribution

$$t = 2.571$$

$$E = |t| \frac{s}{\sqrt{n}} = \pm .00724$$

$$\bar{x} - E < \mu < \bar{x} + E = .3050 < \mu < .3202$$

The standard complete GSA equipment cost per CPD cart is approximately \$550.00.⁴⁸

The average per bed CPD cart cost = (\bar{x}) (unit cart cost) = \$172

According to the sample data there is a 95 percent confidence that the actual average per bed CPD cart cost lies between \$167 and \$176. (\bar{x}) (unit cart cost)

ACTUAL FACILITY MODIFICATIONS

A survey of Air Force Medical facilities having CPD systems disclosed that only 1 facility out of 12 had made any major modifications to their facilities to accommodate CPD. (see figure 9). The survey indicates that only hospitals having a configuration compatible with the CPD cart exchange concept, implemented any form of CPD. There are four exceptions noted in figure 9 of facilities operating a cart exchange system without separate processing or breakdown areas. None of these facilities have any current plans to modify their facilities to create processing areas outside the medical materiel warehouse. The survey also disclosed that 5 major construction programs include plans to configure the hospital for CPD systems. (see Appendix B).

ACTUAL BENEFITS

The following benefits were reported, during the interviews outlined in Appendix B, by facilities who have had an adequate implementation of the CPD concept. They were Fairchild AFB, Luke AFB, Hill AFB and Wilford Hall Medical Center. Three of these facilities include a central sterile CPD system. Some of the benefits were achieved at F.E. Warren AFB, Mt Home AFB, Elmendorf AFB, Dover AFB, Barksdale AFB, Dyess AFB, and Vandenburg AFB. Personnel at Griffiss AFB, Pease AFB, and Whiteman AFB indicated dissatisfaction with CPD. With the exception of Barksdale AFB, the 4 hospitals reporting the benefits are the most extensive CPD systems offering many more services than the other hospitals.

Barksdale's system was very extensive until 1 June when the outpatient support was reduced. In addition, Barksdale does not have a processing area separate from the medical supply warehouse.

1. Intensively trained patient care personnel have been released from routine supply-related activities. This benefit has been gained primarily on inpatient wards through the cart exchange system. (See figure 6)

2. Using activity supply inventories have been reduced. This benefit, however, is minimal since supply levels are duplicated on exchange carts. Breakdown area stock levels have increased and some stockpiling still occurs. There is, however, an overall reduction in supply inventories.⁴⁹

3. Intermediate inventory holding points have been reduced.

4. There has been a reduction in the number of static storage cabinets in using activities.

5. Wasted time has been reduced in looking for routinely stocked items.

6. There is better control, supervision, and expertise of the processing and resupply function within the Medical Center for routine, non-sterile medical materials.

7. There is an orderly, self-contained storage system for high use items.

8. Dated items processed on exchange cart systems are highly visible and receive a close scrutiny.

9. Units of issue are broken down into usable quantities. This reduces waste and loss due to expiration of dated items.

Even in medical facilities where extensive CPD systems were successfully implemented, not all of the projected benefits were achieved. The most important of these were:

1. Improved supply responsiveness and the elimination of stockpiling - these goals were not achieved due to the internal nature of the Air Force CPD system. Medical Materiel has always had some problems with stock-outs of routine items despite its batch process computer system. These stock-outs are a key reason for sections stockpiling supplies. The Air Force CPD concept did not address this external materiel problem. Stock-outs still occur even on exchange carts, thus reducing supply responsiveness and encouraging unit stockpiling.⁵⁰

2. Reduced manpower requirements - the earlier analysis conducted on CPD manning requirements for nursing and supply personnel concludes that there is a net increase in manpower requirements.

THE AIR FORCE VS. NON-AIR FORCE CPD

It is clear that the Air Force has run into several major problems in trying to implement CPD. Several important benefits, including manpower savings and supply responsiveness were not achieved. Only a few Air Force facilities attempted to implement comprehensive CPD programs. In order to try and identify causes of some of these problems the following comparison is made between the Air Force CPD concept as it has developed and the non-Air Force systems described early in this chapter.

One of the most important elements of the original Air Force CPD concept was that the entire system be under the control of one manager. Due to the conflict, noted earlier, between nursing and medical materiel personnel the concept has been modified so that the management function is split between

nursing and materiel personnel. Only the three Air Force hospitals at Luke AFB, Hill AFB, and Lackland AFB have maintained the one manager concept. All of the non-Air Force CPD systems have one central manager. Mr Lawrence R. York of Emanuel Hospital noted that the degree of success of CPD is directly proportionant to the degree of teamwork and communication within the system.⁵¹ One manager facilitates this cooperation.

As demonstrated, the Air Force has a net labor cost with CPD while El Camino and Emanuel Hospitals report net gains. There was only one major difference which could be observed in comparing the systems. Nurses in both of the civilian hospitals were the key ward personnel responsible for ordering and maintaining supplies, however, the Air Force used a less expensive labor resourcecorpsman. Additionally, they did not have to be concerned with charging individual patients for supplies used. Although there were labor savings on the wards they were not as dramatic as the civilian experience.

An important reason for the financial success of these non-Air Force CPD systems is the inclusion of purchasing in the CPD concept. Each of these hospitals is able to dramatically reduce on-hand inventories and thus reduce the costs incurred in maintaining them. The two civilian hospitals have purchasing systems which enable them to order and obtain most supplies within a 24 hour period. The V.A. purchasing agents are located within the hospital and are also able to provide responsive support. The Air Force CPD concept, however, is viewed as an internal system.⁵² The batch process order system continues to function as it did prior to CPD. The lead time for receiving supplies through the depot system or base purchasing agents remains the same.

Large inventories of supplies must, therefore, continue to be maintained in the supply warehouse.

FOOTNOTES

7. AMSCO Systems Company, p. 2.
8. Walter P. McHugh, Colonel, USAF, MSC, Chief Materiel and Services Division, Brooks AFB, Texas, letter titled: "Central Processing and Distribution System (CPD), February 19, 1974.
9. Tilly, p.1.
10. Ibid., p.1.
11. Ibid., p.3.
12. York, p.6
13. Ibid., p. 8.
14. Ibid., p. 9.
15. Hood, p. 1.
16. Ibid., p. 3.
17. C.M. Kjellberg, Contracting Specialist, Audie Murphy Memorial Hospital, Veterans Administration, Interview, July 10, 1981
18. McHugh, CPD letter, February, 1974
19. Garth B. Dettinger, Brig Gen, USAF, MC, Director of Medical Plans and Resources, Office of the Surgeon General, Program Action Directive 1-75, October 31, 1975.
20. Dettinger, Program Action Directive 1-75.
21. Ibid., p. 7.
22. Ibid., p. 8.
23. Ibid., p. 9.
24. McHugh.

25. Compiled from various sources including:
Daniel J. Dryan, "Supply - Processing - Distribution", Hospital Management 110 (November, 1970), p. 53.
Charles E. Housley, "Hospital Supplies a la Cart", Dimensions in Health Service 53 (February, 1976), p. 27.
Dettinger, Program Action Directive 1-75, p. 1.
Management Evaluation Team, Air Force Logistics Command, Management Engineering Advisory Study on Central Sterile Services, March 19, 1975 p. 2.
26. Dettinger, Program Action Directive 1-75, p. 4.
27. Ibid, p. 4.
28. CPD Concept Paper, p. 2.
29. Dettinger, Program Action Directive 1-75, p. 5.
30. Ibid., p. 4.
31. Ibid., p. 7.
32. Dettinger, Program Action Directive 1-75, p. 1.
33. Materiel and Services Division, Brooks AFB, Texas, Review of MAJCOM CPD Implementation Programs, titled: "CPD Concept Paper", January, 1977, p.1.
34. Dettinger, Program Action Directive 1-75, p. 1.
35. Kenneth W. Peters, Col, USAF, MSC, Director, Health Care Support Office, Office of the Surgeon General, Brooks AFB, Texas, letter titled: "Central Processing and Distribution Implementation Guidance, March 29, 1977, p.2.
36. Ibid., p. 2.
37. Dettinger, Program Action Directive 1-75, p.3.
38. Peters, p. 2.
29. CPD Concept Paper, p. 2.
40. Peters, p. 2.
41. CPD Concpet Paper, p. 7.

42. Tracy Welch, Lieutenant, USAF, Manning Evaluation Team, Detachment 26, OLAA, Systems Command. Interview, July 8, 1981.
43. Donald R. Byrkit, Elements of Statistics, 2nd Ed. (New York New York: D. Van Nostrand Co., 1975), p. 190.
44. Ibid. p. 190.
45. Welch, July 8, 1981.
46. Ibid.
47. Byrkit, p. 190.
48. Metropolitan Wire Coporation, Authorized Federal Supply Schedule, GSA Contract No. GS-005-81642 (GSA Federal Supply Schedule, August 31, 1980), p. 14.
49. Sietsema, May, 1981.
50. Joe M. Kana, Major, USAF, MSC, Base Medical Supply Officer, Wilford Hall Medical Center, Lackland AFB, Texas, Interview, July 6, 1981.
51. York, p. 11.
52. George D. Smith, Lt Col, USAF, MSC, Chief, Materiel Management and Procedures Section, Brooks AFB, Texas, Interview, May 6, 1981.

CHAPTER III

CONCLUSIONS

Comprehensive CPD systems have been successfully implemented under the one central manager concept at several Air Force medical facilities including Hill AFB, Luke AFB, and Lackland AFB. Despite this most Air Force medical facilities have either not implemented CPD or have implemented very limited systems, usually a cart exchange system. The hospitals at Griffiss AFB and Pease AFB actually eliminated existing CPD systems due to space and manning problems. (see Appendix B) Despite the large number of hospitals which have not achieved effective CPD systems, the successful ones have demonstrated that given the right hospital configuration, equipment, manning, and expertise CPD can be effectively implemented in Air Force medical facilities. Appendix F provides recommendations on how CPD systems can be designed and implemented in Air Force medical facilities.

When CPD is effectively implemented, there are many benefits achieved including:

- release of intensively trained patient care personnel from routine supply-related activities
- reduction of using activity supply inventories
- fewer inventory holding points
- efficient storage system for high use items
- better control of dated items
- supplies broken down into usable quantities

Despite the achievement of these benefits, this study indicated that not all projected benefits have been achieved. Two of the most important are:

- Overall reduction in facility manpower costs related to supply activities
- Increased supply responsiveness including a reduction in stock-outs

Continued development of CPD, however, may provide additional benefits.

Appendix E outlines potential future applications of the CPD concept.

This study indicates that implementation of a CPD system has both initial costs in equipment and possible plant modifications and ongoing manpower costs. The study did not detail the exact costs for implementing CPD systems. These costs will have a great variation depending upon the individual characteristics of each hospital and the type of CPD system being implemented. The study did show that the costs exist and indicated cost averages for the cart exchange component.

Central Processing and Distribution is a viable alternative to current Air Force medical supply systems. It can be implemented and achieve many important benefits. The system, however, will cost more than the current supply system. Each Air Force medical facility must weigh the potential benefits which can be achieved given the current slow procurement system against the increased costs.

FOOTNOTES

53. CPD Concept Paper, p. 2.

APPENDIX A

MEMO FOR LT COL SMITH
COL WILLIAMS

SUBJECT: Update on Status of the Central Processing and Distribution
System (CP&D)

HQ SAC/SGHLL:

<u>Location</u>	<u>Size Operating Beds</u>	<u>915X0 Personnel Required</u>	<u>Systems Utilized</u>
Barksdale AFB	60	2	CP&D & PAR
Dyess AFB	40	1	CP&D & PAR
Fairchild AFB	50	11/2	CP&D & PAR
F E Warren AFB	25	1	CP&D
Grand Forks AFB	30	1	PAR
Griffiss AFB	15	1	CP&D
*Offutt AFB	65	2	CP&D
Pease AFB	50	2	CP&D
Vandenberg AFB	40	1	CP&D
*Whiteman AFB	15	1	CP&D

*Bases initiating the CP&D system.

HQ PACAF/SGAMM:

Yokota AFB	45	1	CP&D 2 Wards only
Clark AFB	176	Linen exchange only	

HQ TAC/SGAM:

Luke AFB	65	2-915X0 2-902X0	CP&D
Mt Home AFB	20	2-902X0	CP&D
*George AFB	45	2	CP&D

*Implementation upon completion of MCP

HQ AFLC/SGAM:

<u>Location</u>	<u>Size Operating Beds</u>	<u>915X0 Personnel Required</u>	<u>Systems Utilized</u>
Hill AFB	30	4	CP&D
*Tinker AFB	25	4	CP&D
*Wright-Patterson AFB	320	4	CP&D
*Implementation upon completion of MCP			

HQ ATC/SGHL:

*Keesler AFB	335	7	CP&D
*Implementation upon completion of MCP			

HQ MAC/SGAML:

*Altus AFB	44	1	CP&D
*Implementation is scheduled for June-July 1980			

HQ USAFE/SGHL:

No CP&D and no plans to implement any primarily due to the physical constraints of each facility.

HQ AFSC/SGHR:

Lackland AFB	1000	18	CP&D/PAR
		29	Central sterile supply
		23	Material

HQ USAFA/SGL:

Have a plan for implementation but no funds

HQ AAC/SGL:

Elmendorf AFB	105	2	CP&D
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APPENDIX B

SUMMARY OF INTERVIEW FINDINGS
FOR CONTINENTAL U. S. MEDICAL FACILITIES
IDENTIFIED IN APPENDIX A

<u>Location/Interview</u>	<u>System/Comments</u>	<u>Central Sterile CPD?</u>
Barksdale AFB 1Lt George Walker, BMSO 13 May 1981	CPD & PAR Total inpatient with some outpatient support - Outpatient CPD to be eliminated 1 June 1981, space problems, breakdown area in warehouse	No
Dyess AFB TSgt David T. Avers 18 May 1981	Inpatient CPD Space OK, manning problem	No
Fairchild AFB MSGT Rockne D. Anderson 14 May 1981	Inpatient CPD, Outpatient PAR Adequate space, excellent layout, like system	No
F. E. Warren AFB TSgt William French 13 May 1981	Inpatient CPD Split control - Nursing and supply, 2 wards on system	CS CPD Under Nursing
Grand Forks AFB Lt Jeffrey Kresner, BMSO 14 May 1981	Decision made not to implement CPD due to space and manning, supply physically removed from hospital	
Griffiss AFB Lt Richard E. Jones, BMSO 14 May 1981	CPD system eliminated Fall 1980, small operation	

<u>Location/Interview</u>	<u>System/Comments</u>	<u>Central Sterile CPD?</u>
Offutt AFB Captain Rainer Kopp, BMSO 14 May 1981	Decision made not to implement CPD system due to space and expense	
Pease AFB Captain Toney Gelish, BMSO 14 May 1981	CPD system phased out in July 1980 due to space and manning problems, linen still on CPD	
Vandenburg AFB Captain Robert E. Clover, BMSO 13 May 1981	Inpatient CPD	No
Whiteman AFB Lt John Wells, BMSO Captain Robert Marousky, OIC Operat- ing Room 14 May 1981	Very modified CPD - cart delivery system used without breakdown area	No
Luke AFB Captain David A. Bloomer, BMSO 23 March 1981	Inpatient CPD, Outpatient CPD Civilian nurse runs entire CPD system including CS, works for Chief Nurse	Yes
Mt Home AFB TSgt David Moore 13 May 1981	CPD on 2 wards, small system controlled by nursing service	Yes
George AFB SSgt Donald Fink 14 May 1981	CPD implementation pending major construction project, long lead time	

<u>Location/Interview</u>	<u>System/Comments</u>	<u>Central Sterile CPD?</u>
Hill AFB CMSgt Robert K. Farrell 14 May 1981	Inpatient CPD Limited outpatient CPD, civilian nurse controls system; works for Chief of Medical Materiel	Yes
Tinker AFB Capt Ronald Johnson, BMSO 18 May 1981	CPD system implementation pending completion of major construction program	
Wright-Patterson AFB Maj William L. Ramsey, BMSO 14 May 1981	CPD implementation pending completion of major construction project	
Keesler AFB Maj Jeffrey Dunkle 18 May 1981	CPD planned for implementa- tion as soon as manpower assigned, manning levels verified by MET	
Altus AFB Lt George Sherman, BMSO 18 May 1981	IG visit in October 1980 recommended that CPD not be implemented due to facility layout Sent 16 carts to Dover AFB	
Lackland AFB 1Lt Harvey Sietsema, CPD Operations Officer 11 May 1981	Inpatient CPD, use overhead rail system	Yes
Elmendorf AFB Maj Ross Smith, BMSO 14 May 1981	Inpatient CPD, manpower problems	No

Location/Interview

System/Comments

Central Sterile CPD?

Dover AFB
Capt David Aycoth,
BMSO
18 May 1981












Partial CPD inpatient
system, Dover AFB required
Altus AFB CPD carts and
established cart exchange
system controlled and
run by nursing service

Yes

APPENDIX C

Table 1

Operations Flow 2-West Exchange Cart Cycle

Activity	Description	Observed Times (Minutes)		
		1/22	1/23	1/27
	Get carts and transport to 2-West	2	2	3
	Exchange carts	4	5	6
	Inventory bulk supplies and gather central service reprocessible supplies	2	3	2
	Return to Stores via Central Service, and station carts	6	9	5
	Pull 2-West bulk supplies	2	2	2
	Transport 2-West bulk	2	3	3
	Stock 2-West Bulk Storage	3	2	3
	Return to Stores	2	2	2
	Inventory carts	21	16	17
	Pull 2-West supplies and stock carts	18	16	19
	Observed unavoidable delay	4		
	<i>Subtotal:</i>	66	60	62

- Average time/cycle = 62.7 min/cycle $\bar{t} = 3.1$
- Per week @ 7 trips/week = 7.35 hrs/week






Legend	
	Operation
	Delay
	Inspection
	Storage
	Transportation

Table 2

**2-West Exchange Cart Prototype
Summary of Identified Changes in Labor**

Changes in Labor	Estimates of Changes		
	Optimistic Hours/Week	Average (Observed)	Pessimistic Hours/Week
Store Room			
Order Taking	6.7	7.4	8.2
Picking and Filling Delivery			
Less Prior System	(1.9)	(2.1)	(2.3)
Added Information Processing	.30	.33	.36
Subtotal	5.10	5.63	6.26
Central Services			
Dumbwaiter Service	(5.7)	(4.7)	(3.8)
Floor Stock Service	(0.5)	(0.4)	(0.3)
Subtotal	(6.2)	(5.1)	(4.1)
Nursing			
Unit Secretary	(7.5)	(6.3)	(5.0)
Staff Nurse	—	—	—
Subtotal	(7.5)	(6.3)	(5.0)
Total Change Hours/Week	(8.6)	(5.77)	(2.84)
Hours/Period	(34.4)	(23.08)	(11.36)
\$/Period	(206.4)	(138.50)	(68.16)

Table 3

**2-West Exchange Cart Prototype
Summary of Identified Changes in Cost**

Area of Change	Estimates of Cost Changes		
	Optimistic (\$/Acctg. Pd.)	Average (Observed)	Pessimistic (\$ Acctg. Pd.)
Labor	(206)	(139)	(68)
Supply Usage	(576)	(476)	(376)
Total*	(782)	(615)	(444)
Annual Cost	(10,166)	(7,995)	(5,772)

Summary of Identified Changes in Investment

Equipment Purchase	4,600	6,380	8,160
Inventory Reduction	(855)	(950)	(1,045)
Net Investment	3,745	5,430	7,115
Pay Back	.4 years 4.4 months	.68 years 8.2 months	1.2 years 14.8 months

* Based on constant dollars

APPENDIX D

Conclusion

We find that our original objectives can be measured and that our cost reductions are substantial.

1. Inventory Reduction: (a one-time cash flow improvement)

storeroom inventory - 12/31/74 . . .	\$220,128
storeroom inventory - 12/31/76 . . .	<u>58,349</u>
	\$161,779

Plus:

reduction in Central Supply Inventory	\$ 11,900
reduction at nursing stations	<u>25,500</u>
total inventory reduction	<u>\$199,179</u>

2. Nursing Time Saved: nurses no longer have to

- inventory,
- order,
- receive,
- put away, or
- run for.

Yet, nursing controls the quality and quantity of everything in the system. No changes are made without nursing approval. Daily checks with Nursing Service establish levels for each item in each locker to insure that:

- adequate levels are maintained,
- items with no activity over a reasonable period are removed,
- expiration dates on sterile items are adhered to,
- necessary changes in levels are made promptly,

Authorized Distributor Association

- new products are introduced on a timely basis,
- recalls can be removed within 24 hours, and
- all lockers, drawers, and contents are kept in a clean and sanitary condition at all times.

3. Increased Revenue:

The daily reconciliation of patient charges has recovered, to date, \$80,263 in revenue.

If this \$80,263 in revenue had not been recovered from otherwise lost patient charges, it probably would have required a larger across-the-board increase in room charges.

4. Ongoing Cost Reductions:

carrying cost - 30% x \$199,179	\$ 59,754
4.5 F.T.E.'s eliminated	<u>54,000</u>
annual savings	\$113,754

Summary

Inventory Reduction	\$199,179
Annual Savings	\$113,754
Increased Revenue	\$ 80,263

Our system continues to earn a return on investment. We have recovered our cost of implementing the system. Our comptroller is happy. Members of the nursing staff, an important part of the process, are no longer inventory clerks - actually another cost savings in the use of their time. Purchasing is a problem-solving department. And our Central Service team has become an extension of our Accounting Department.

Come visit us at Emanuel and see our system in action!

APPENDIX E

POTENTIAL CPD APPLICATIONS

One problem identified earlier was stock-outs of routine supplies. Although CPD did not solve this problem, it has the potential of decreasing the severity of the problem. The Air Force is continuing efforts to obtain a real time computer system to replace the current batch process system. When this is achieved, CPD will provide an excellent mechanism for reporting supply requirements and quickly getting routine or non-routine issues which were not in-stock to the appropriate using activity. Under the current batch process system, a week can pass from the time an item is received until the time it is disclosed on computer records for issue. The on-line system will record an issue of the item immediately. This still does not provide a method of getting an item to the user. CPD provides an effective system of getting even non-critical items to using activities within short periods.

Another emerging problem area is the allocation of costs for the Uniform Chart of Accounts. CPD with computer support will offer a viable means of allocating materiel costs to using activities.

APPENDIX F

Recommendations

Central Processing and Distribution is a highly responsive supply system which has many benefits for patient care. It should not, however, be implemented at all Air Force hospitals without considering the needs and situation of each. Implementation of CPD at a hospital which has not been designed for it can be expensive and possibly inferior to the system already in use. The following recommendations were designed to assist in the development of the best possible Air Force materiel system while meeting previously established criteria:

1. Adapt an Air Force-wide policy which assumes the attitude that there is no one best internal materiel system. Each facility should develop the best internal system which meets its local demands and configuration requirements. These internal systems should still be required to be compatible with standard Air Force systems and requirements. This policy is necessary since the materiel system demands of a 200-bed medical facility differ greatly from the demands of a 35-bed facility. It also allows the development of a range of CPD activities.

2. Centralize the planning and decision functions for CPD to the Air Force Materiel and Services Division at Brooks AFB. Recent experience has demonstrated that few medical facilities have the expertise to develop and implement effective CPD systems. The efforts of this centralized function should be directed toward:

- The elimination of current inefficient systems.
- Pooling expensive specialized CPD equipment and sending it to new CPD operations.

- Evaluating and choosing potential CPD system locations.
- Serving as a central contact point for manning evaluation team studies on CPD manning requirements.
- Coordinating nursing participation in CPD.
- Supporting CPD equipment and plant modification requirements.
- Coordinating and developing computer applications for CPD.

3. Establish an experienced CPD implementation team. This team, acting under the direction of the Materiel and Services Division, would be physical link between medical facilities and the central coordinating activity. It would provide the functions of:

- Visiting medical facilities to make final evaluations of facility eligibility for CPD.
- Designing individual facility CPD systems.
- Coordinating local nursing and central sterile personnel participation in CPD.
- Establishing final CPD manning, equipment, and plant modification requirements.
- Acting as good will ambassadors, generating local support and involvement in CPD projects.
- Periodically returning to medical facilities to supervise implementation programs and teach localized CPD concepts.
- Acting as CPD consultants.

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