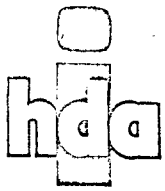


INFORMATION - CONTROL

STUDY PROPOSAL

# 352 - 67

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December 14, 1966

Community Blood Bank  
of Marion County  
2128 North Meridian Street  
Indianapolis, Indiana

Attention: Mr. John R. Keilholz, Executive Director

Gentlemen:

We are pleased to propose an "Information - Control Study" for the Community Blood Bank of Marion County. This Study will integrate the long range information needs of the bank with the interim community-centered computer system being developed by IHDA. The Study objectives and areas of investigation are outlined in the following pages. The Study will be carried out by systems engineers from the Community Systems Foundation.

The Forms Revision portion of the Study should be completed by January 15, 1967 while the entire Study should be complete by March 15, 1967.

Total cost of the Study will not exceed \$6,000.00.

Respectfully submitted,

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INDIANAPOLIS HOSPITAL  
DEVELOPMENT ASSOCIATION, INC.

Accepted by

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OF MARION COUNTY

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INFORMATION - CONTROL STUDY OF THE  
COMMUNITY BLOOD BANK OF MARION COUNTY

Proposal for a Program Definition Study

I. Objectives

It is the objective of this proposal to outline an analysis program that will consider the information and control requirements of the Community Blood Bank of Marion County (CBBM). Major goals of this preliminary study effort are the following:

- (1) Identify the major information flows within the blood bank inventory and accounting structure. A general systems design for combined inventory control and accounting system would be carried out. Forms revision will be compatible with a revised chart of accounts. It is assumed that the chart of accounts revision would be carried out by CBBM accountants.
- (2) Outline the basic requirements for a data base that is compatible with the management control requirements of CBBM.
- (3) Indicate additional or modified data gathering techniques necessary to generate and maintain the data base.
- (4) Delineate those specific areas in an information and control structure where the use of electronic data processing technology will provide significant improvement in information availability for the decision function of CBBM. This particular effort will be concerned mainly with utilizing the proposed IHDA interim information system which will be based on the IBM 1440 computer. Specific areas of effort required by CBBM to participate in this interim system will be described. Procedures for integrating various parts of the CBBM information structure will be recommended. In addition, the long range implication of future large

scale hospital-medical information systems will be discussed, in terms of CBBM participation.

- (5) Develop preliminary cost figures both for an interim and future information system based in part on computer technology.

The following sections describe more specifically the areas to be studied:

## II. Inventory and Accounting Information

### A. Inventory Control

Performance of the inventory system can be measured by one or more of the following variables:

- (1) Number of units outdating
- (2) Number of cross matches per unit
- (3) Length of time unit is in cross match
- (4) Availability in the system; e.g. the probability blood is available when demanded.
- (5) Percent of units transfused out of inventory

In the present system, the major performance criteria are in the number of units outdating and percent of units transfused. The percent outdating is directly related to the percent units transfused.

The current control system is based on a scheme which displays the remaining lifetime of units of each type at various member hospitals. This information display will be considered in terms of a computer generated output in addition to the possibility of presenting other information such as central inventory status, percent of units in crossmatch, etc.

Analysis of commonality of data between accounting information and basic inventory control information will be carried out, with the objective of providing a maximum of data

commonality. Reduction to a minimum number of forms, within the information distribution requirements, will be attempted. It is expected that accounting information will be a by-product of inventory control information.

The design of forms for reporting units in cross match and units transfused will be considered in some detail. Daily cross match and transfusion forms will be designed for the interim computer applications.

It should be noted that some of the analysis described in this section may apply only to data generated at member hospitals that carry CBBM blood on consignment. It is hoped that forms can be designed that are suitable both for consignment and cash members. If not, this study will concern itself mainly with consignment hospital information handling. A typical information flow is illustrated in Figure 1.

The use of computing devices to assist management will be examined with the assumption that control strategies are generated by the management in a Bayesian approach, thus the computer will hopefully assist the manager in making a priori estimates of the blood inventory behavior through the use of increased information content.

In summary, the analysis described in this section will attempt to provide a more integrated and complete information flow to the CBBM management for inventory control.

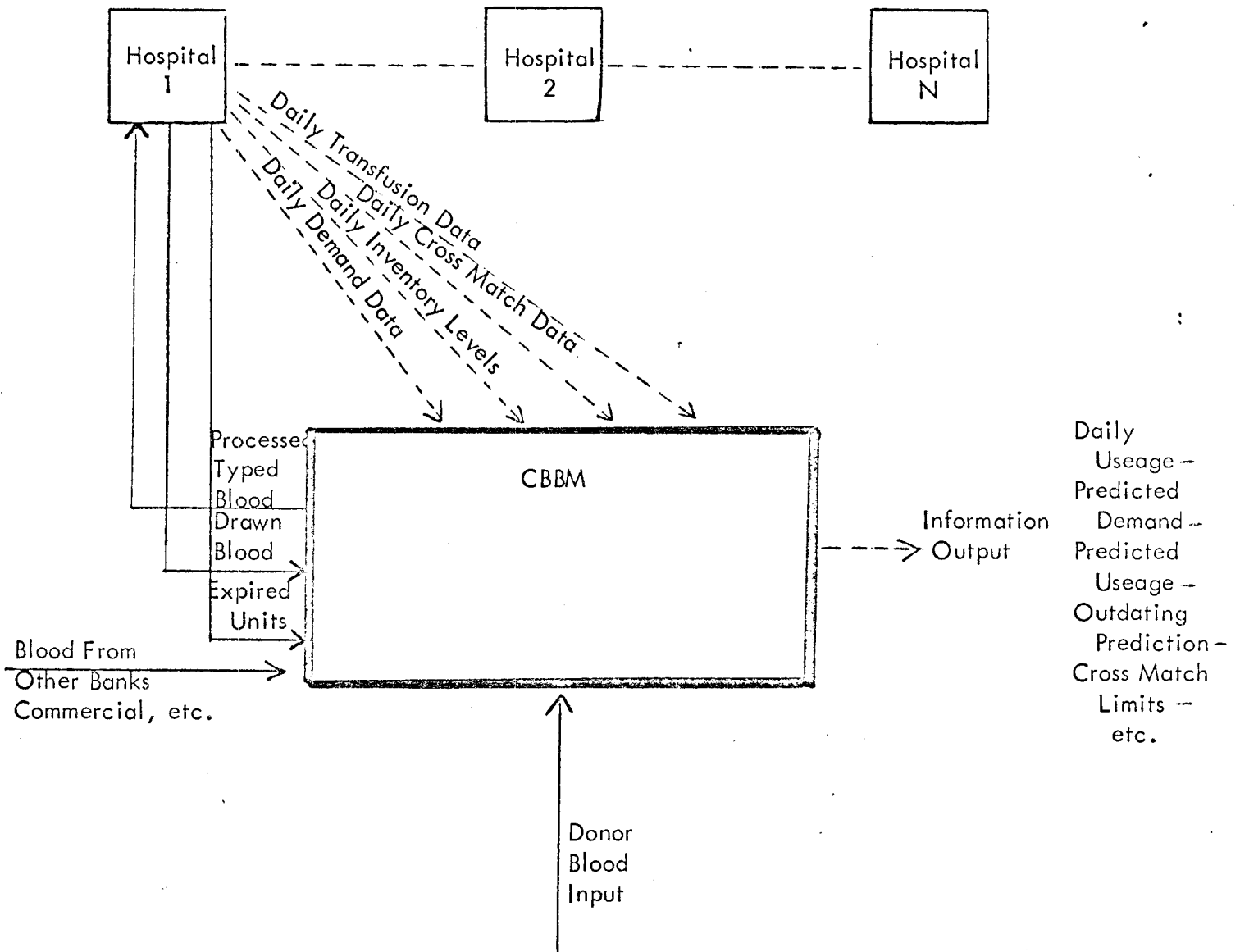
### III. General Data Base and Data Gathering for CBBM Operations

This area is obviously related closely with the function described in (II) above but includes other information requirements involved in overall operations of the blood bank; i.e., other than control of blood stocks and depletion policies. Specifically, the following areas will be considered, particularly in relation to the interim data processing system. Additionally, procedures for reporting inventory information and donor history will be

Fig. 1

TYPICAL MATERIAL & INFORMATION FLOW

IN CBBM  
(Consignment System)



studied, this would include:

1. Optimal reporting intervals for inventory data
2. Donor history file
3. Donor eligibility search
4. Rare donor listing or search

Computer search of donor histories could include flag techniques for hepatitis, ineligibility for donation, etc. History files could also be flagged for rare donor type but it may be more efficient to generate a separate file for these types.

Specific recommendations for a data base incorporating the above, and additional information, will be made in this study.

#### IV. Analysis of CBBM Participation in IHDA Interim Computer System

The availability of a commonly shared data processing system can, in many cases, result in significant increases in operating efficiencies for participating users.

Using the results of (I) and (II), the IHDA interim computer system will be examined in terms of CBBM participation. In particular, recommendation will be made in the following areas:

- (1) Specific clerical tasks that can be carried out by the 1440 system. This would include estimates of required programming necessary, key punch activity and possible output formats. Included here would be the donor file, eligibility search, rare blood types, etc.
- (2) Inventory information tasks such as transfusion data, outdating rates, cross match data, etc. Some possible format designs would also be presented.
- (3) Accounting data in terms of programming effort required (probably to be accomplished in conjunction with area (2)).
- (4) Overall cost estimate of entering the IHDA system.

V. Long Range Implication of A Blood Bank Information System

Beyond the IHDA interim computer project lies the possibility of a highly expanded, more sophisticated, United States Public Health Service supported, total hospital information system for the Indianapolis area. Implication of such a development will be discussed at least in the following areas:

(1) More complete CBBM computerized information system which would directly affect the following functions:

- a. Computer output of more extensive blood bank operation, eg: possibility of examining the "state" of the bank at frequent intervals including accumulated cross matches for each blood type, instantaneous unit costs, etc.
- b. Use of computer assisted decision making, eg: computation of management decision information and strategies, eg., critical number of cross matches, rate of change of outdating with time, optimal determination of age of shipped units as a function of individual hospital demand, minimum cost and minimum outdating inventory levels, optimal stopping rules for donor input, etc.
- c. Use of computer driven cathode ray tube displays in a time shared conversational mode where the state of the bank in (a) above and strategy generation in (b) above can be utilized in a truly real time basis.
- d. Use of on-line consoles to: elicit donor histories and input and update them directly to the central processor, integrate member hospitals inventory, and determine blood stock levels in real time.



- e. Use of simulation models to investigate changes in inventory control policies, eg: changes in shipping policies on outdating rates.
- f. Forecasting useage and demand. A factor in providing more complete inventory in both the interim and long range situation is the ability to predict demand and useage. This area would be examined in follow-up activities in light of the results of this study. The following paragraphs describe the forecasting problem.

The basic operating variables of an inventory structure are input and demand. In the case of blood inventories, a third factor, namely useage, is also present. Useage may be thought of as negative demand in any given period representing blood ordered and cross matched, not infused, and brought back into active inventory. One important and useful element of the long range information system as discussed here would be the capability to predict future demand and useage from past data.

Blood demanded is on both a scheduled and random basis, thus future demand forecasting would be based on a statistical or probabilistic methodology.

Several generally accepted forecasting techniques are available such as exponential smoothing, moving averages, average of past demand, etc. However, care must be taken in applying such techniques carte blanche to the blood inventory problem since some of the common assumptions necessary for their application may not be valid in blood demand data

history. Two of these required conditions are independence of data and stationarity in at least the sample averages. Independence itself does not present a major obstacle since dependencies in the data can usually be corrected by grouping. Non stationarity i.e., where the parameters in the probability distributions are time dependent, presents a more difficult problem with respect to forecasting.

Studies at the University of Michigan Hospital and North Carolina Hospital have shown the daily usage parameter to depend on the day of the week. It is strongly suspected that this is the case for CBBM. While a complete treatment of the forecasting problem will constitute a considerable effort, the system definition effort resultant here will consider implication of various forecasting techniques in relation to providing the blood bank management with hopefully useful decision making information.

Studies at Ohio State University have indicated that for the blood inventory situation, the classical forecasting methods such as exponential smoothing and moving averages may not be as satisfactory as the simple use of arithmetic means.

In the study proposed here, an emphasis would be placed on the data gathering requirements for generating statistical forecasts. For example: the necessary inputs and their formats from each member hospital for reporting infusion and order data.

VI. Preparation of Proposal for Systems Implementation Effort

Using the results of the above studies, a proposal outline oriented possibly toward the Public Health Service will be written. This outline will reflect various areas of work that the Public Health Service may be interested in funding in terms of blood bank operations. Emphasis might be placed on the following areas:

- (1) Regional critical donor data bank - listing donors who are ineligible due to hepatitis and other symptoms. Also listing rare type donors who are eligible.
- (2) Computer aided blood demand forecasting techniques.
- (3) Analysis of optimum blood stock depletion policies, eg: minimizing blood outdating, balancing number of cross matches versus cost of cross match using forecasted demand, etc.
- (4) Use of an on-line graphical display device for blood bank management and control.

Back up information for the proposed outline will be available for a IHDA grant to support further work at Community Blood Bank of Marion County.