A GENERAL FRAMEWORK FOR PREDICTIVE ECONOMIC EVALUATION OF COMPUTERIZED HOSPITAL INFORMATION SYSTEMS AND AN APPLICATION TO A BRITISH COLUMBIA HOSPITAL

by

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ABSTRACT

Hospital decision-makers face several uncertainties during evaluation and selection of computerized hospital information systems. Cost-benefit analysis is one method of predictive economic evaluation and is particularly important from the perspective of the hospital. Unless hospitals can economically justify such systems, it makes little sense to pursue them unless there are over-riding political or qualitative reasons.

This thesis discusses the principles of cost-benefit analysis and a general framework for such analysis from the perspective of the hospital, in order to answer the question of whether a proposed hospital information system is justifiable on cost-benefit grounds relative to the status quo method of handling information. Three dominant approaches to planning for such systems in British Columbia and Ministry of Health funding guidelines and policies are discussed in relation to the framework.

An application of the framework is made to a community general hospital in British Columbia using actual data obtained during the complete planning process for a proposed system. The analysis demonstrates that over the expected duration of the project, the sample hospital will experience net costs, as opposed to net savings for the proposed system, even if all one-time capital costs are funded by others. It is unlikely that this finding is unique to this single hospital;
thus, there are broader implications for other hospitals consider­ing such systems, especially in the face of recently published expenditure limits and priorities in British Columbia.
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"It is best to think of the cost-benefit approach as a way of organizing thought rather than as a substitute for it."

M.F. Drummond, 1980
CHAPTER I
LITERATURE REVIEW

Issues in Planning for Hospital Information Systems

There is a growing body of evidence in the current literature demonstrating the necessity of effective planning for a computerized hospital information system (HIS). Collectively, these sources underscore the importance of the HIS planning process as well as the plan produced by the process. As Austin and Greene have reported with respect to system design approaches, the 1950s saw individual departmental systems and no integration; the 1960s saw predominantly batch processing with attempts to integrate systems; and the 1970s saw shifts to on-line applications with an interest in fully integrated systems. Indeed, the 1980s are seeing development of fully integrated systems as exemplified by hundreds of installations in hospitals throughout the world. This thesis will focus on such integrated systems including such elements as defined by Austin and Greene: on-line entry, retrieval and display of information via specialized terminals; automatic message switching for communicating information throughout the hospital; facilitation of day-to-day operations; and, employment of a fully integrated design approach including common data definitions, essential data files and automatic communication of data from one functional subsystem to another as needed. The "fully integrated"
system may vary from hospital to hospital; however, full integration implies a capability of providing comprehensive and coordinated information throughout the hospital as required. This is particularly important in the hospital setting because of the highly interrelated and interdependent nature of all information required to admit, diagnose, treat, support and bill the activities related to the care, transfer and discharge of each patient. This is one reason why stand-alone, non-integrated systems have been largely destined to fail. In this era of comprehensive, hospital-wide systems, there has been an attempt to integrate the administrative activities related to provision of health care services including such things as operating and capital budgets, administrative support and reporting mechanisms. Computerized integration of such fiscal and statistical information is very important in terms of prospective reimbursements for hospitals as Diagnosis Related Groups (DRGs) or Case Mix Groups (CMGs) are becoming a fact of hospital life in the United States and Canadian settings, respectively. The need for integration of such information is extensively supported in the literature.13-20

**Soft Systems Analysis**

HIS planning and, indeed, design and implementation, is very much part of general systems theory. Even the concept of an HIS, by definition, refers to systems concepts. This is a very useful perspective from which to examine
planning since it forces the analyst to view the hospital system as a complex set of interrelationships comprised of sub-systems, the hospital itself being part of a larger system in the environment within which it functions. Systems theory as it applies to the hospital setting will not be explored here; however, interested readers are directed to texts by Austin$^{21}$ and Reisman$^{22}$ for more complete discussions. With respect to planning for such systems, it is important that the systems concept be borne in mind especially from the perspective of the hospital. As Austin notes:

Hospital functions viewed in a systems context are information-dependent. Effective information for management control purposes has several important characteristics, including relevance, timeliness, sensitivity, comprehensiveness, objectivity, action-orientation, uniformity, performance-targeting, and cost-effectiveness. Good information systems will be developed with these characteristics constantly in view of those charged with design and implementation.$^{23}$

In particular, the characteristics of cost-effectiveness of information will be the subject of this paper. This is only one characteristic of effective information in the hospital system, but for purposes of planning such systems, it is vital that this be logically addressed.

**Hospital Information Systems Planning Methodology**

As Kolenaty$^{24}$ has pointed out: "The purpose of the HIS planning activities is to outline a long-term strategy for the improvement and development of information systems
in the area of patient care, teaching, and research as well as in the administration of these areas." It follows, then, that the hospital's planning methodology and the activities that comprise such a methodology must be consistent with and further the aims of the long-term strategy. While the specific objectives of the information planning process may vary from hospital to hospital, it is generally accepted that hospitals must first identify their current information handling problems, their needs, the benefits to be achieved by a computerized information system and the solution priorities.

The literature contains several approaches to the planning, evaluation and implementation of HISs. The concept of participatory management refers to organizing the hospital's human resources to ensure needs are met and a system is selected which addresses such defined needs. Another technique called the Needs Assessment Report (NAR) reflects the needs that have been assessed by staff and management of the hospital, thus becoming the basis for specifying the system needs of the organization. This approach emphasizes the importance of the planning process as opposed to achieving documentation only. Other techniques include "bottom-up planning" emphasizing user input, but minimizing the overall systems perspective. This can be contrasted with the "top-down planning" approach which emphasizes managerial
input, presumably from a more general systems perspective while, at the same time, limiting detailed user input.\textsuperscript{29,30} Another concept is that of "outside-in" systems planning whereby outside consultants plan the system, as opposed to "inside-out" planning in which managers at all levels and parts of the organization participate in developing the overall systems plan.\textsuperscript{31} While the methodologies differ, it is the process of planning that is as important as the ultimate plan produced. Finally, there is the concept of long-range or strategic information systems planning which provides the means for ensuring that the hospital's information processing requirements of the future are met and are congruent with the hospital's philosophy and goals.\textsuperscript{32-35} A major thrust of this approach is to plan information systems in conjunction with the hospital's long-range plan, thus attempting to ensure that the hospital's needs in providing health care services can and will be met effectively and efficiently.

On a cautionary note, Davis\textsuperscript{36} warns that simply asking prospective systems users to specify their requirements will not usually suffice because of the difficulties in obtaining a correct and complete set of requirements. These difficulties include human constraints, variety and complexity of information requirements and the complex patterns of interaction among users and analysts. He suggests that:

\ldots there should not be a single approach to
requirements determination that is applied to all projects. Instead, there should be several general approaches or strategies that may be used. These strategies reflect the best approaches to use considering the alternative set of conditions that may apply.\textsuperscript{37}

Undoubtedly, further innovative planning methodologies will periodically appear in the literature; however, the principal reasons for undertaking HIS planning include: appropriately identifying current information handling problems, needs that arise as a result of these problems, benefits that should accrue by meeting these needs and the solution priorities.

\textbf{From HIS Planning to Economic Evaluation}

Moving from the planning to evaluation aspects of HIS development is a large step which requires the analyst to "... identify, measure, and compare all of the significant costs and desirable consequences of alternative means of addressing a given problem."\textsuperscript{38} Such costs and consequences are valued in monetary units, that is, dollars\textsuperscript{39,40} and CBA is the method of choice when addressing the economic feasibility of an HIS.\textsuperscript{41} This is the approach that is used throughout this thesis and the following discussion more closely defines and discusses the methodology.

\textbf{Definition and Discussion of the Methodology}

CBA is not a new theory to economics; in fact, cost-benefit theory can be traced back to welfare economics of
the 19th century with it first being made practical in the United States in the 1930s. The literature seems to indicate that CBA has been rooted in a predominantly social perspective for a myriad of applications. While early applications were concerned with society, its economy, and the welfare of such a defined society, the principles of CBA can be translated to and used in specific programs or projects with different and narrower perspectives, such as computer applications in hospitals. Of course, CBA is only one of several tools available to decision-makers. It is with this in mind that this thesis is written. As much as CBA, in the early and traditional sense, is concerned with the overall economy and society as a whole and not any smaller part of it, CBA in a hospital setting, the perspective taken in this thesis, is on a more micro level, concerned with a hospital's "society" and economy as a whole.

Traditionally, CBA attempts to describe and quantify the social advantages (benefits or negative costs) and disadvantages (costs or negative benefits) of the various policies, programs or projects in terms of common monetary units (usually dollars). This same definition can be translated directly to the hospital setting in terms of analyzing the advantages (benefits) and disadvantages (costs) of an HIS. Let us now examine the importance and advantages of this economic evaluation methodology in a predictive (as
opposed to retrospective) fashion. While there is a place for retrospective CBA, in an HIS context, decision-makers can more appropriately use CBA before and during the HIS decision-making process.

Advantages and Importance

It is generally agreed that there are several advantages to performing CBA and that it is an important tool, but there have been very few comprehensive evaluations and studies completed in Canadian hospitals. Flett notes that a 1981 survey by the Ontario Hospital Association demonstrated that only twenty-three percent of Ontario hospitals with installed systems were able to quantify savings. Again, this underscores the importance of a comprehensive CBA. While this does not necessarily guarantee realization of the projected benefits, it does offer management the ability to predict savings. A major advantage of CBA is the process of performing it. An analysis offers the analyst, in concert with all user personnel and management, an opportunity to structure what easily could become a formidable undertaking. The concept of CBA is relatively simple in that it merely weighs advantages and disadvantages of alternative ways of managing information in the hospital; translation of this concept to a practical, workable methodology to assist in decision-making and to assist decision-makers in their understanding of the solution is, however, time-consuming and
taxing even to analysts who possess a conceptual background and experience in this area.

Disadvantages and Limitations

There is more evidence of disadvantages and limitations of CBA than identification of advantages in the literature. In a more global sense, the identification and acquisition of appropriate data are commonly difficult, if not impossible. Warner and Luce note that the application of CBA to health care resource allocation is relatively new and, as a result, analyses have not taken into account concerns for practical implementation. This can easily be translated to CBA of HISs which is itself also relatively new.

While referring to the more general economic evaluation of a total medical information system in a hospital, Norwood and Gall emphasize that the major difficulty lies in quantification of benefits rather than documentation of costs. This is further complicated by the eventual need to make realizable the potential benefits; that is, the translation of potential benefits into realizable (typically labor) savings. These concerns are founded on actual experience at the El Camino Hospital project since the early 1970s.

Perhaps one of the greatest disadvantages and limitations of CBA is its proneness to misinterpretation by
the analyst and decision-makers. Results tend to be overly relied upon as if a single option or the "truth". It is not a case of merely deciding if costs are less than benefits and then going ahead with the project. On the contrary, CBA is only one of several available decision-making tools. As Roth\textsuperscript{52} emphasizes: "The choice is never all that clear." Roth\textsuperscript{53} also brings to light other limitations of the technique with respect to alternatives entertained by the CBA. An obvious limitation is the possibility of missing alternatives or, realistically, alternatives that were thought of but never given a chance to prove their practicability due to time constraints or undue complexity. With respect to valuation of costs and benefits, Roth reiterates the difficulty or impossibility of valuing immeasurables such as social integration, happiness, work satisfaction, pride and other factors which may be just as important or, in fact, more important than the dollar benefits. Thus, by reducing merely to dollars, some of the most important aspects of the HIS benefits may be missed, ignored or relegated to secondary importance. Unfortunately, some decisions are made solely on the basis of one parameter, cost. He also notes another problem with the unmeasurables; it is possible to include so many of them. Finally, Roth\textsuperscript{54} warns that "... cost-benefit analysis is not a science: It is a rational, ethical calculus."

It may be argued that this creates a case for CEA as
opposed to CBA; however, CEA should be used when the purpose is to compare only those programs that show similar objectives.\textsuperscript{55-57} If the status quo manual system is one of the alternatives, the objectives are not similar to an HIS because the latter carries a whole new level of objectives characterized by: on-line entry, retrieval and display of information via specialized terminals; automatic message switching for communicating information throughout the hospital; facilitation of day-to-day operations; and, employment of a fully integrated design approach including common data definitions, essential data files, and automatic communication of data from one functional subsystem to another as needed. This is impossible with manual methods. This thesis examines only those factors that are quantifiable; hence CBA was chosen. Interestingly, at least one source indicates that when such comparable HISs compete in this decade, the evaluation issue for hospitals will be more in terms of CEA as opposed to CBA.\textsuperscript{58} Presumably, as technology renders HISs more and more identical, evaluation will be in terms of cost-minimization analysis (CMA).\textsuperscript{59} In time, this could be the subject of further interesting research.

Drazen\textsuperscript{60} identifies two major problems with CBA as a planning tool. First, evaluation of cost impacts is a very complex process. She notes that there are no validated,
practical methodologies within the public domain which can be used as guidelines in conducting such an analysis. She notes that many of the methodologies used have subsequently been shown to be based on faulty assumptions. Second, she feels that direct cost savings, notably labor reductions, have not been a major benefit of HISs. On the other hand, increased timeliness, accuracy, completeness and accessibility of information used in patient care delivery and management of the delivery process are the major benefits. This opinion, although arguable and controversial, again underscores the fact that CBA is only one of several tools available to the decision-maker. Paradoxically, Drazen feels that, whereas the quality of care benefit is probably the most important one, it remains difficult to quantify in dollars and likely will continue to be elusive until case mix analysis becomes an acceptable measure of hospital patient care activities.

Finally, Fenna\(^{61}\) has written an interesting review of the history of evaluation which will not be reiterated here. In essence, he notes that evaluation of computer systems has been a 'poor sister', skimped of support and persistently deferred. He suggests that "lack of significant need has been one reason for the inactivity, and lack of priority has been one reason for deferment and non-completion."\(^{62}\) Finally, as Fenna\(^{63}\) reports, "little proper evaluation has thus been done, but little has been missed." Undoubtedly, this refers
to the myriad of articles purporting "proper" evaluation; however, there is little to convince the readers that one best and accurate method exists. Hopefully, this thesis will contribute to the provision of "proper" evaluation and lessen confusion in this area.

Implications and Use as a Decision-making Tool

The literature generally supports the use of CBA as a decision-making tool. King and Schrems, while focussing primarily on CBA and public organizations, not specifically hospitals, emphasize that most organizations prefer to conduct a CBA before making a major decision regarding information systems implementation. They state that, while this should guide decision-making, its use must be weighed against the difficulty in performing a CBA. A further risk lies in the use of analyses wrongly regarded as good ones. They emphasize that CBA is a planning tool only to be used in assisting decision-makers in choosing among alternatives in their attempt to allocate scarce resources among competing demands. Schauffler and Koran emphasize the importance of CBA to decision-makers in terms of accurate and timely information in the planning process.

Austin correctly places the cost analysis step within the larger methodology of development of a master plan. Emphasized again is the fact that CBA is part of the overall process of planning for information systems and is not an
end in and of itself. When decision-makers use cost (as opposed to including benefits) as the sole criterion for planning, implementing and evaluating such systems, they do so without the support of the literature of those who have actually implemented such systems and have discovered that this was only one aspect of the endeavour. Those who decided to implement in such a manner will likely pay the price of not realizing significant tangible benefits.

**Justification for Government Funding**

While not a primary rationale, CBA has a role in preparation for seeking government funding for an HIS in British Columbia. At the time of writing, *Guidelines for Computer Funding Proposals*, published December, 1984 are in effect (Appendix 1). These guidelines will be discussed in greater detail in Chapter II; however, at this juncture it should be emphasized that they are intended to assist the funding agencies in their decision to cost-share in computer acquisitions in hospitals in British Columbia; moreover, the guidelines are intended to assist hospitals in completing a CBA as part of their HIS submission.

Of greater import, however, are the computer policy guidelines recently released by the Provincial Ministry of Health (MOH) September, 1985 (Appendix 2). Again, these will be discussed in more detail in Chapter II; however,
somewhat in contradiction of the December, 1984 guidelines, these guidelines dictate the priorities that the hospital is supposed to pursue. In essence, this negates the entire planning process since the policies are clear in stating that "... the Ministry may not be in a position to provide capital funding for systems other than those of highest [the Ministry's] priority." The maximum acceptable expenditure level dictated by the policy for the community hospital environment of British Columbia is capped at 0.5% of gross annual operating income (exclusive of savings achieved through benefit realization). Thus, in addition to negating the entire planning process, the entire CBA methodology is negated by what appears to be an arbitrary capping of the expenditure level. This puts British Columbia hospitals in an interesting dilemma. On the one hand, sound rational planning based on identified needs should prevail followed by comprehensive CBA to determine economic worthiness of the proposed system. On the other hand, the MOH is clearly stating that it has already determined the systems application priorities and the maximum expenditure level. While CBA should assist the hospital in justifying proposed information systems, because of the funding mechanisms in British Columbia, the entire exercise becomes academic, at least for the purposes of obtaining funding.
The literature demonstrates that there are still several uncertainties in dealing with this tool and that it is not an exact science. A great onus is placed on the analyst's decision to include or exclude variables and what assumptions are made throughout the analysis. It is clear that CBA does have an important application in planning for HISs. While it does have several advantages there are several disadvantages and limitations to bear in mind. Used wisely, it can be an important decision-making tool for priority setting and benefit identification.

Chapter II examines three dominant streams of hospital information systems development in the British Columbia hospital environment. The British Columbia Hospitals Shared Systems Society (BCHSSS), British Columbia Health Association (BCHA) and the individual hospital perspective will be discussed. In particular, the role of the economic perspective will be examined in each of these three streams. The implications of this role in each will be discussed and analyzed.

Chapter III examines in detail the general framework for economic evaluation, focussing on the major principles of CBA. Several practical limitations of CBA are discussed and practical aspects of funding and approval from the perspective of the Provincial Ministry of Health are also addressed.

Following the discussion of principles in Chapter III,
options for a typical British Columbia community general hospital, the Chilliwack General, are described in Chapter IV. After a brief description of the hospital and the systems planning methodology used for information systems planning in this hospital, options available are detailed, including the status quo versus a proposed hospital-wide information system. The author is currently employed as the Assistant Administrator at Chilliwack General Hospital (CGH) and has been able to apply and test the principles discussed throughout this thesis.

Chapter V then applies the principles discussed in Chapter III to CGH's proposed HIS. This includes defining the question, the alternatives considered, identification, measurement, and valuation of all costs and benefits of the alternatives. Discounting of costs and benefits is performed as are sensitivity analyses.

Following this, practical guidelines are discussed for general use by other hospitals in British Columbia in Chapter VI. Specifically, a hospital systems planning methodology is discussed (the one used at CGH). A step-by-step framework is then developed taking the reader through the Request for Information (RFI) process, the Request for Proposal (RFP) process, CBA, decision-making process and selection of finalist, and seeking government approval and funding for the proposal.

Finally, Chapter VII summarizes the findings of the
thesis, referencing, in particular, the experience at CGH in an attempt to generalize the findings for use by other hospitals in British Columbia.
Footnotes


2George Kolenaty, "Hospital Information Systems Planning," in Information Systems for Patient Care, Bruce I. Blum, ed. (New York: Springer-Verlag, 1984), pp. 147-64.

3Thomas G. Roovers, "Evaluating Computer Systems -- Which Approach, the RFP, the RFI or the NAR?" Computers in Healthcare 5 (March 1984): 54.


12Ibid., p.102.

13Ibid., pp.95-112.


17. Paul Sulkers, "The Role of Senior Management," Vancouver, October 1981. (Typewritten.)


24. Kolenaty, p. 152.


26. Roovers, p. 54.


29. LaViolette, pp. 117.

30. Shaw, pp. 112-14.


Brian Shorter and Ian Ferguson, "If You Don't Know Where You're Going ... You'll Never Get There," COACH I/O (Fall 1983):27-44.


McFarlan, McKenney and Pyburn, pp. 145-56.


Ibid.


Stoddart and Drummond, p. 1431.


Ibid., pp. 8-12.


Ibid., p. 8.

Mishan, p. 11.


Warner and Luce, p. 212.

Ibid., p. 206.


53 Ibid., pp. 8-24.

54 Ibid., p. 24.


56 G.L. Stoddart and M.F. Drummond, "How to read clinical journals: VII. To understand an economic evaluation (part A)," Canadian Medical Association Journal 130 (June 1, 1984):1437.

57 Lindberg, p. 72.


59 Stoddart and Drummond, p. 1430.


62 Ibid.
Ibid.


66 Austin, p. 48.

Currently, there are three dominant groups planning HISs in British Columbia -- BCHSSS, BCHA and individual hospitals. The fact that these represent three distinct approaches is reflective of where British Columbia sits in relation to political, economic and state-of-the-art technological factors influencing development of such systems. Perhaps there should be only one correct approach; on the other hand, there is likely not one correct approach or solution since technology is itself ever-changing. Such change will lead to even further directions and choices to be influenced also by political and economic climates of the day.

In order to gain an understanding of the current climate facing hospitals planning such systems it is necessary to address, discuss and analyze these three approaches, each of which has been subject to scrutiny by various critics. This tripartite pursuit of the "right" solution is undermining rational, effective and efficient strategic planning endeavours by hospitals who faute de mieux are aligning themselves with whichever solution seems appropriate at the time. In effect, while some competition may be healthy, any overall good seems to be overwhelmed by
the costs of redundancy in and divergence of planning for such systems.

**British Columbia Hospitals Shared Systems Society**

BCHSSS was formed and legally incorporated as a Society in November, 1982 and continues to be provided with a budget by the British Columbia Ministry of Health (MOH). The original purpose of the Society was to coordinate policy, develop plans, establish priorities and aid hospitals in acquiring computer systems. By definition, the shared systems approach was the backbone of the Society's purpose; however, it was amply clear that hospitals planning for HISs were expected to mandatorily participate in shared systems development by virtue of the warning that "hospitals which choose to act without consultation or disregard of the decisions of the Society will do so with the full understanding that the capital and/or operating funds associated will not be funded by Hospital Programs in any form whatsoever."^3^  

**Role**

November, 1983 saw BCHSSS undertake a new initiative wherein the needs of intermediate and small sized hospitals in British Columbia would be addressed. This was a significant departure from the original role of this Society which, for the most part, emphasized large hospital systems. Then, in January, 1984 the Society newsletter announced that their "... priority was to design and implement systems,..."^5^
This was an interesting perspective given the initial reasons for forming the Society. By this early date, it became readily apparent that the role of the BCHSSS was changing from that of coordinating policy and developing plans and priorities for hospitals in British Columbia to designing and implementing systems. At the present time the latter seems to be the dominating focus of the Society. In essence, BCHSSS has become another, albeit MOH-backed, competitor in the B.C. HIS marketplace.

The September, 1985 newsletter formally announced BCHSSS' mission statement in reply to the often-asked question of their role:

The mission of the B.C. Hospitals Shared Systems Society encompasses two distinct but related areas:
1. Development, installation, and on-going support of quality integrated computer systems for B.C. hospitals.
2. Provision of management consulting, systems planning, and industrial engineering services, to assist hospitals in the planning, implementation, and utilization of management information systems and in the solution of management and operational problems.

It is readily apparent that BCHSSS' role is again changing to include the expansion, diversification and integration of several services. Generally, this may be a good strategy to pursue in an attempt to further penetrate and compete in the B.C. hospital marketplace. One example of market penetration is the recently announced Personnel/Time-keeping/Payroll Project which appears to be head-on com-
petition with BCHA's Hospital Personnel Management System (HPMS) and other offerings from private vendors. The system will purportedly reduce the cost per cheque very significantly. The target date for first installation is January, 1987.

Changing Plans

Systems Architecture Plan

January, 1984 saw the publication of a Systems Architecture Plan for Small Hospitals\(^8\) the objectives of which are to assist small hospitals in establishing both computerized and manual systems. The major recognized challenge was how to meet the diverse needs of smaller hospitals while keeping within their budgets. The proposed architecture consisted of networked IBM microcomputers supporting canned and custom-developed application software. Recent Society publications indicate that the Local Area Network (LAN) solution is viable; however, technical problems due to high volumes of data necessitate a re-examination of this concept.\(^9\)

Information Systems Plan

In April, 1984 BCHSSS published A Guideline for the Planning of Hospital Information Systems\(^10\) which emphasized:

The decisions made in developing the Strategic Information Systems Plan will serve as the guide to all subsequent steps in the development of information systems. It is the framework within which all information systems activity will occur.\(^11\)

In view of the recently published MOH policy guidelines which set out the Ministry's HIS solutions and
priorities, this is an interesting statement. (See Appendix 2). It would appear that earlier attempts at rational planning have now given way to a more political and non-rational orientation, at least from the perspective of the hospital.

The January, 1986 newsletter\textsuperscript{12} announced that a long-range plan was forthcoming which would include application development directions, integration, interface standards and implementation planning. This plan's relationship to the Ministry's policy guidelines will also be an interesting comparison and subject to critical examination by the hospital sector.

Economic Perspective

While BCHSSS often refers to costs and benefits of proposed HISs, a focus on the economic perspective has been conspicuous by its absence. One would expect that BCHSSS, by virtue of its implicit role as a hospital advocate for and expert on HISs, should provide strong leadership and hands-on assistance in the area of economic evaluation, especially CBA, with and for hospitals. Instead, it appears that BCHSSS is placing the onus of responsibility on the hospital. This is not incorrect; however, a large and important component of the planning exercise is predictive economic evaluation and, if ignored or relegated to secondary importance by such agencies, will likely be interpreted as such by sub-
scribing hospitals and others.

It appears that BCHSSS continues to enjoy a budget from the MOH and is content on continuing its role in the costly development and implementation of systems for British Columbia hospitals. The reasons for the MOH's continued support and pursuit of this avenue remain unclear since there are rumours that BCHSSS will be privatized within a few years. From the perspective of the hospital, what was originally called "free" software has now given way to, in some cases, costly software, costly from the perspective of the hospital and BCHSSS in terms of development. Clearly, there is duplication of effort in application software development carried out in the name of "healthy competition" in the B.C. marketplace. While further development is still occurring in the private sector, fully-integrated, hospital-wide systems are now available, installed and running well in hospitals world-wide. The efforts of BCHSSS are laudable, but how much redevelopment is really necessary? The cost of support and development must be weighed against the perceived benefits when compared to the alternative of purchasing proven systems from the private sector. Of particular note is the current trend in the hospital industry towards integrated systems. At the time of writing, BCHSSS cannot offer an integrated solution because a major component is not yet available and will not be for some time. Thus, hospitals
contemplating the BCHSSS solution are plagued by the uncertainty of eventual integration. Compared to what is available in the industry, this may be a relatively risky alternative to pursue.

British Columbia Health Association

Role

BCHA provides extensive computer services to member institutions. Currently included are such applications as Accounts Payable, General Ledger and Ancillary Reporting, Outpatients Accounts Receivable, Payroll and Personnel Reporting, Inventory Issues Analysis, Capital Inventory, Combined Hospital Reporting and Medical Abstracting. Other applications are under development.

In March, 1981 the BCHA Board authorized the development of a long-range computer plan, which was carried out by Price, Waterhouse and Associates. The long-range plan focussed on the concept BCHA termed "balanced computing" which, simply put, means balancing the computer work done within hospitals with that done on BCHA premises. In practice, this means a central IBM 4300 Series mainframe supporting remote terminals via direct communication within the shared service system. One of the keys to operationalizing the long-range plan was the advent of IBM Personal Computers and network systems. Another provision of the long-term plan was the establishment of an "Information Centre" permitting sub-
scribing hospitals to access their own data files associated with the respective applications.

Interestingly, as this was being implemented the MOH created the previously discussed BCHSSS. From the hospital perspective, this initiated what appears to be two divergent streams of planning. On the one hand there was BCHSSS in an apparent conflict of interest position, overseeing and coordinating policy and planning issues and at the same time posturing itself to be a systems developer for large hospitals, and promoting in-house, networked microcomputers for the smaller hospitals. On the other hand, BCHA was promoting shared systems or facilities management solutions using a central mainframe configuration in Vancouver with aspirations to network microcomputers and/or terminals throughout British Columbia. The latter is not strange, however, since BCHA already provides Payroll services to approximately one hundred and thirty member institutions. Nonetheless, the leap from a centralized Payroll system to hospital-wide integrated systems is a major one.

In June, 1984 BCHA\textsuperscript{14} announced availability of the IBM Patient Care System (PCS) originally developed at Duke University Medical Center in North Carolina. This particular solution permitted hospitals to automate modularly at their own speed. Further applications of the PCS have now been Canadianized and integrated with this system by BCHA. At
the time of writing, only three Lower Mainland hospitals have participated.

Of interest is the difference in philosophy in meeting the needs of hospitals. BCHSSS was and continues to be intent on being a developer of systems and their actual experience is proving this out. They either buy and substantially modify software applications or develop their own. BCHA, on the other hand, emphasizes standard software and IBM-backed support and maintenance of such software. 

A major difference is that BCHA's PCS approach facilitates development of a central patient data base on their central mainframe; in contrast, BCHSSS continues to develop stand-alone systems with a view to integrating these systems on an in-house basis. Historically, the latter has been plagued with major difficulties and, hence, there is guarded optimism in the hospital industry as to whether or not this can be effectively and efficiently accomplished, if technically feasible at all.

More important, however, are the two approaches to systems planning. Whereas BCHSSS has provided guidelines, it is left entirely to hospitals to avail themselves of and follow the guidelines. BCHA, on the other hand, offers and, for a fee, assists hospitals in systems planning using a standardized Hospital Systems Planning (HSP) methodology. The HSP methodology is based on IBM's Business Systems
Planning Methodology and has been adapted to the hospital setting by BCHA.

The two major objectives of BCHA's long-range computer plan are:

To provide and implement applications that formulate a health care data base that links patients, financial and personnel information in order to support the operational and planning requirements of health care providers in B.C.

To provide and implement applications that formulate a data base that support the operational and planning requirements of the association and related organizations.

To date, it appears that BCHA has largely met these two major objectives; however, its gaining of only three subscribers to date is, perhaps, indicative of only minimal success. This may point to uncertainty in the hospital community. The fact that the Health Labour Relations Association (HLRA) uses the data base for its forecasting model for bargaining may point to additional success.

Economic Perspective

BCHA expends significant fiscal and human resources on running its IBM 4300 Series mainframe. While it does not face the same development expenses that BCHSSS faces, it is relatively costly to run the current configuration. Lack of subscribers during the majority of 1984 placed BCHA's system in some financial jeopardy. Some criticism was also levelled at BCHA for the Payroll System surcharge which was used to develop the computer system; however, the surcharge was being
used for upgrading the system or for new applications. One of the main features of BCHA's PCS shared systems approach is the opportunity for hospitals to "quick-start", which would otherwise be a relatively costly and complicated endeavour, as will become clear through the remainder of this thesis. BCHA argues that Order Entry and Results Reporting applications in the system facilitate a reduction in length of stay and improved productivity of nursing staff through time-savings in information-handling activities such as telephone calls, transcriptions and communications at shift change. Accounting activities are also included. Reference is further made to the national Management Information Systems (MIS) Project, the chairman of which is the President of BCHA, Mr. Herman Crewson. Thus, while there is recognition of the potential for cost-savings in implementing their solution, BCHA, as does BCHSSS, relies on individual hospitals to examine the advantages and disadvantages, economic and otherwise, for themselves.

This is not surprising nor unusual, given the limited implementation experience of both these organizations to date. No doubt, once several hospitals have their respective systems in place, economic analyses will shed light on which of these different approaches and solutions is the most cost-effective from the perspective of hospitals, the MOH and the organizations.
Future Role

The future of BCHA's computer services will undoubtedly rest on its ability to gain and retain substantially more subscribers. This, in turn, is dependent on the experiences of the three recently subscribed hospitals. Interestingly, 1985 saw a flurry of activity related to merging the computer activities of BCHSSS and the Computer Services section of BCHA. Ultimately, with the assistance of a management consulting firm, this was deemed not to be feasible at this time; however, the possibility presumably still exists and may be an important future consideration for hospitals.

Of further interest is a joint venture systems development initiative between BCHA and the Alberta Hospital Association. Moreover, the role of Mr. Crewson, as Chairman of the national MIS project, will be significant in ensuring that the economic perspective is addressed more substantially than it has been. Discussions are also taking place with a view to making the Computer Services a subsidiary of BCHA similar to Purchasing and Insurance such that these fee for service activities could pay for themselves and not require support by membership dues.

BCHA is also forming a Computer Services Steering Committee which, if the Computer Services Division ultimately becomes a separate subsidiary component of BCHA, will become its Board of Management. BCHA recognizes that the Computer
Services operation is in competition with other vendors and this move obviously is an attempt to "... maintain current users of [their] systems, as well as attract new ones."22

Hospitals

General Difficulties Encountered by Hospitals in Planning for Computerized Information Systems

British Columbia hospitals, like most, face difficulties as computerized information systems are planned, developed, implemented and evaluated. Generally, this is due to the lack of a standardized and proven methodology. Austin and Greene23 report that the main reason for hospitals lagging behind their counterparts in other industries is because many hospital administrators lack the technical knowledge and skills required to understand such processes and, thus, are not involved enough in the design of information systems for their respective organizations. They state that this ultimately leads to lack of use by top management, thereby contributing to its failure. While this may be so, equally true would be the failure of some administrators to take advantage of staff and outside agencies who can offer assistance. In addition to this managerial passiveness, Austin and Greene24 also point out the importance of physician input in the system development process, something which is less than adequately tapped.

One major Canadian hospital, notably the Victoria
General Hospital (VGH) in Halifax, recently came to grips with some of its emerging problems including: unplanned systems proliferation; non-recognition of hospital goals and priorities; lack of fiscal planning focus; no logical basis for establishing systems priorities and no in-house technical group to coordinate information systems. These difficulties would appear to be fairly commonplace in most hospitals and most certainly apply to hospitals generally in British Columbia. One source places the lack of stable and long range direction for data processing squarely in the lap of hospital executives. Johnson notes that hospital executives are vital in developing the data processing strategy. Sulkers also singles out senior management by virtue of their limited understanding of the role of information systems in addressing objectives of the organization. He feels that this results in inadequate support and direction by senior management. Hammon also points to changing governmental regulations as a roadblock to achieving a cost-effective hospital information system.

Specific Difficulties Encountered in the Face of BCHSSS' and BCHA's Current Roles

Although likely not fully appreciated by either of these two organizations, BCHSSS and BCHA have inadvertently, by virtue of their conflicts in planning direction, placed British Columbia hospitals in a planning dilemma. Most
hospitals are members of BCHA and as such, owe some allegiance to their own association. As stated earlier, most hospitals participate in the Payroll system and, in fact, have been paying a systems development surcharge as part of the subscription rate. Thus, these hospitals have inadvertently supported a specific direction for computerization on a shared mainframe basis. If the majority of hospitals wanted this at once, it is unlikely that there would be the technical capability or manpower for BCHA to handle the influx of activity. On the other hand, if there are too few subscribers, BCHA would be unable to continue to support the system for any length of time. From the economic perspective, this allows hospitals to start up relatively inexpensively according to BCHA; however, this has not been validated in any actual installation. While it is true that it obviates a need for purchasing expensive on-site hardware, it is equally true that hospitals, especially if there are very few subscribers, pay a premium for use of applications software. It is also correctly argued that a major disadvantage of the system is lack of hospital control of the direction and modifications/enhancements to the system.

With respect to BCHSSS, hospitals are not necessarily members of the organization. However, BCHSSS prides itself on the fact that its Board of Directors is of and by administrators of hospitals in British Columbia and, therefore,
can formulate the policy direction of the Society. Interestingly, however, at least two of the recent directors are senior administrators of hospitals who have elected to proceed with non-BCHSSS solutions. A major difficulty with the BCHSSS solution is the fact that they have become largely developmental and cannot yet offer an integrated system. Current activities are comprised mainly of several pilot projects and integration of specific applications has not yet been completed. The BCHSSS solution also requires hospitals to purchase relatively expensive hardware with the agreement that software will be provided relatively inexpensively. Experience to date shows that this is more costly than anticipated. As stated earlier, the guidelines published by BCHSSS do not prove that there are economic benefits in implementing the systems, merely that hospitals are expected to develop their own cost-justification. Because the MOH has a vested interest in the Society, and is in effect a "silent" partner, the approval process for hospital proposals may be subject to bias depending on which solutions and priorities are identified.

In short, the economic perspective is not evident in the roles of BCHSSS nor BCHA. Neither of these organizations has made an attempt at predictive CBA of their systems, although hospitals that are attempting to purchase these systems are obligated to provide such an analysis by MOH
policy. A collaborative effort would be in order; however, no attempt has yet been made. The MOH could make a substantial contribution by providing some leadership and catalytic activity in this area by insisting that the BCHSSS and BCHA approaches are validated by comprehensive predictive and retrospective economic evaluations.

Interestingly, the MOH has recently formed a Computer Advisory Committee which has just undertaken a survey (December, 1985) to determine current expenditure trends in light of recently published Ministry guidelines (Appendix 2) regarding acceptable expenditure levels. The findings will likely cause the Ministry to review the expenditure levels since many hospitals are already spending close to or are exceeding the guidelines with only minimal computerization.

Implications of the Economic Perspective

The general lack of an economic focus in any of the current approaches and processes attests to the need for a standardized approach to undertaking predictive economic evaluation of HISs. It is mandatory that each hospital independently perform this exercise because hospital needs, solutions and priorities are unique and the process is as important as the results that it produces. Unfortunately, a standardized and reliable framework for hospitals does not yet exist. BCHA does not offer such a framework; BCHSSS suggests that one is necessary, but throws the onus on the
hospital for its undertaking; the Ministry insists on one and goes so far as to provide a very general economic evaluation framework for hospital use. It does not, however, offer any instructions as to how one should go about gaining the information. This leaves hospitals in a very difficult position. To date there has not been enough experience in British Columbia hospitals to use what other hospitals have developed. Very little has been done and what has is not generally available through the literature. Moreover, what has been done on a limited basis may not be appropriate for use by other hospitals. Finally, individuals with the necessary expertise to assist hospitals with this type of analysis are themselves as scarce as the analyses have been to date. Such a lack of methodology does not indicate its lack of importance. On the contrary, it only serves to remind us that a very necessary part of the planning process has been neglected.

Approval and Funding Processes from the Perspective of the Hospital

In December, 1984 Circular Letter #84/47 concerning Guidelines for Computer Funding Proposals by the MOH Institutional Services (Appendix 1) was published in order to assist hospitals in describing their proposed system and equipment; providing costs; identifying tangible and intangible benefits and relating their request to their information systems plan.

A long-awaited policy position of the MOH was recently published to assist hospitals in planning their computer acquisitions (Appendix 2). In essence, it outlines the
priorities the MOH will consider, maximum acceptable expenditure levels, accounting treatment, acquisition alternatives and monthly expenditure reporting. These policies are to be used in conjunction with the previously referenced Guidelines for Computer Funding Proposals. It is clear that computerization of the financial aspects of running British Columbia hospitals are of the highest priority from the perspective of the MOH. Relegated to a lesser priority are clinical areas which will enhance patient support, including such departments as Laboratory, Radiology, Pharmacy and Dietary. It is interesting to note that the Admitting/Discharge/Transfer application, which is a generally accepted area to commence systems implementation, is relegated to twelfth place in the priority list. Thus, it is difficult to comprehend how the Laboratory, Radiology, Pharmacy and other clinical applications will function in an integrated fashion (especially with respect to Order Processing) without the whereabouts of patients being known. It would seem either that a non-integrated approach is being supported, which is contrary to the direction most hospitals are taking, or the priority list has been poorly thought out.

With respect to the maximum acceptable expenditure level for computerization, the guidelines are explicit in indicating that major referral hospitals may spend a maximum of 0.75 percent of gross annual operating income. The guidelines are silent as to whether the figures are net of benefits (cost-savings) gained pursuant to implementation. Compared
to the U.S. hospital industry average of 2.0 - 3.0 percent for data processing activities\textsuperscript{31} this may very well be a gross under-estimation of actual funding requirements. No funding formula is given; however, either there isn't one and this is an arbitrary figure or there is, but with no rational basis for its employ. In any event, it does not appear to be based on the logic of hospital-wide systems.

There is obviously an attempt by the MOH to develop a sense of order and consistency in this difficult area of needs identification, priority setting for solutions and funding. Difficulties arise because the picture appears (and, in fact, is) different depending on the perspective taken and desired outcome. Nonetheless, hospitals must analyze costs and benefits for proposed HISs from their own perspective, provided cost-benefit analyses are comprehensively performed, accurately interpreted and used correctly in the decision-making process. Provided the CBA methodology is consistently applied across hospitals, the MOH could perform inter-hospital comparisons in order to determine funding priorities based on identified problems, needs, solutions and implementation priorities. Post-implementation evaluation would also be possible. Again, the immediate roadblock is the present lack of an acceptable framework for general use by hospitals.

The rationale for this thesis, then, is clear. A general and generalizable framework for predictive economic evaluation of hospital information systems, particularly in
British Columbia hospitals, seems to be missing from the repository of tools necessary to plan information systems. Thus, it is anticipated that the framework discussed in this thesis will assist hospitals in British Columbia as they embark on the planning, implementation and evaluation of their own HIS.
Footnotes

1 Province of British Columbia, Minister of Health, Institutional Services, Circular Letter No. 82/65 (December 22, 1982).


11 Ibid., p. 3.


18 Telephone Interview with P. MacAllen, British Columbia Health Association, Vancouver, B.C., 3 March 1986.


22 Ibid.


24 Ibid., p. 107.

25 Brian Shorter and Ian Ferguson, "If You Don't Know Where You're Going ... You'll Never Get There," COACH I/O 8 (Fall 1983):29.


28 Paul Sulkers, "The Role of Senior Management," Vancouver, October 1981. (Typewritten.)


CHAPTER III
A GENERAL FRAMEWORK FOR PREDICTIVE ECONOMIC EVALUATION

General Considerations and the Reasons for Selecting Cost-Benefit Analysis

There are many factors that hospital decision-makers must consider during evaluation and prior to selection of an HIS to meet its identified needs. If hospitals cannot economically justify HISs it makes little sense to pursue such systems unless there are overriding political or qualitative reasons in which case such decisions would be made through disregarding the results of the CBA if an unfavourable ratio is found. Such reasons, however, may be more important from the perspective of the hospital or the funding body. CBA is one applied method of economic evaluation, but is likely the most important one from the perspective of the hospital, particularly for decision-making during the present economic constraint period.

This thesis focuses on predictive economic evaluation using the principles of CBA. Thus, qualitative, non-monetary benefits such as staff morale, frustration level and so on will not be addressed. This is not to say that these benefits are unimportant; on the contrary, they could and should be the subject of further studies. Historically, many decisions regarding the purchase of HISs are made on the basis
of such qualitative benefits with limited or total disregard of formal cost-benefit findings. Often, however, a CBA was never even carried out.

The cost-benefit approach should be used if there is a concern for the economic viability of the proposed system. It facilitates the reduction of all quantifiable benefits to monetary units so that they can be weighed against identified costs of the system. Because the typical hospital must deal with the allocation of scarce resources amidst competing needs, economic evaluation is appropriate. The following sections describe in detail the principles, framework and process of predictive economic evaluation of proposed HISs.

The United States Office of Technology Assessment (OTA)\(^1\) advocates CBA in budget-constrained decision-making in health care. It fosters the illumination of decision-making processes and necessitates the making of explicit judgments. This forces examination of all assumptions and values placed on the decision variables. OTA describes two general findings:

... performing an analysis of costs and benefits has the potential to be very helpful to decision-makers, because the process of analysis structures the problem, allows an open consideration of all relevant effects of a decision, and forces the explicit treatment of key assumptions. The second general finding is that [CBA] exhibits too many methodological and other limitations to justify relying solely or too heavily on the results.

... Thus, [CBA] could be useful for assisting in many decisions, but is probably not appropriate as the sole or prime determinant of the decision.\(^2\)
Principles of Cost-Benefit Analysis 
Applied to Hospital Information Systems

CBA, in essence, is a logical eight-step procedure that may be used by an analyst to assist in the decision to purchase or not purchase an HIS. Several sources discuss variations of these principles; however, there is general agreement. The eight general principles are:

1. Defining the question
2. Delineation of objectives and identification and selection of alternatives
3. Enumeration of relevant costs and benefits
4. Measurement of costs and benefits in appropriate units
5. Valuation of costs and benefits in monetary units
6. Discounting of costs and benefits to their present value
7. Performing of sensitivity analyses to reduce uncertainties
8. Interpretation and presentation of findings

Each of these principles will now be discussed in detail.

Defining the Question

Clear delineation of the question is perhaps the most thought-provoking and important part of the analysis. This may take the form of attempting to solve a problem associated with information handling within a hospital and may simply reduce to the question — Will an HIS with a clearly identified set of characteristics and capabilities (as defined in Chapter I) designed to computerize/integrate the status quo methods of processing information be a cost-beneficial
solution relative to the status quo? The question must be posed in answerable form\textsuperscript{9}; it must be clear and explicit\textsuperscript{10} and the perspective of the analyst\textsuperscript{11} must also be stated.

Delineation of Objectives and Identification and Selection of Alternatives

Generally, the objectives of information systems are to expedite hospital care in order to improve the health status of the patients it houses. Information processing effectiveness, but not necessarily efficiency, is accomplished through a fully integrated system and this is generally supported in the literature. This distinction is important because as Stoddart and Drummond\textsuperscript{12} note, there is no point in merely bringing about the efficient provision of ineffective services.

The alternatives may simply be a computerized HIS and the status quo, the latter typically being a manual system. Where it may be useful to entertain other alternatives, for the most part, a clear delineation of the manual versus computerized system usually suffices. If a partially integrated HIS is being proposed, further alternatives (as dictated by the extent of integration) should be examined.

Enumeration of Relevant Costs and Benefits

At first glance, this process appears relatively straightforward; however, the identification of all relevant costs and benefits can prove to be quite onerous. The more comprehensive the analyst has been in detailing the alterna-
tives in the previous steps, the easier is enumeration.

Costs

Breaking down the total costs into a typology meaningful to the analyst is the first task. For example, it could be by one-time system costs (hardware, software, licenses and communications); conversion costs; on-going maintenance (software and hardware); and, costs of future modifications after initial implementation. These costs should be categorized into capital and operating costs, a commonly used demarcation in the hospital environment. As much as possible, the analyst must identify all relevant costs; however, this is largely predicated on the analyst's ability to conceptualize the purchase, implementation and on-going maintenance of the HIS.

Other costs may include research and development and the opportunity costs of space used, for example, in a mainframe solution. The degree of applicability of these latter costs must be clearly expressed by the analyst who must decide whether or not to include them. For example, research and development costs would be applicable if the hospital intends to purchase and further develop a system which presently meets only a portion of its present or anticipated needs. This is commonplace even in the Canadian environment. Obviously, this significantly impacts on-going operating costs, especially through the use of human resources. If physical space is required (as in the case of a mainframe
solution), this would involve space already used for, or potentially useable by, some other activity. This aspect is frequently overlooked in analyses. If the additional costs are marginal the analyst must make explicit the decision to include or exclude them.

Generally, costs can be categorized into tangible or intangible. Intangible costs may be unmeasured or, perhaps, are unmeasurable, according to Anderson and Settle who suggest asking the question: "Does it appear likely in any particular instance that the values affected by the intangible effects could have been large enough, if they had in fact been quantified, to have substantially altered the findings of the benefit-cost study?" They also note that intangible effects may, under certain circumstances, be relatively unimportant to the CBA. Minimally, the analyst must at least identify such intangibles.

The analyst should not be overly concerned with absolute costs and benefits but, rather, with the differences in costs and benefits between the status quo and the proposed system. This is particularly true in the enumeration of benefits since there may be little point in delineating all the elements of the status quo. It is necessary, however, to enumerate the differences in benefits accruing to the hospital upon introduction of the HIS. Thus, the general approach is to compare incremental costs (relative to the status quo), with incremental benefits.
While it is tidier to think of costs in terms of the entire HIS, reality often means incremental implementation of staged modules. This being the case, incremental (or marginal) costs may also need to be considered relative to the incremental benefits of each module. The marginal costs (and consequent benefits) of incrementally adding application modules, both hardware and software, may be as important as the total costs (or benefits) of the entire HIS. The implementation sequencing impacts on such incremental costs. Some applications have more tangible benefits than others; however, technical fit and implementation sequencing of the modules sometimes preclude gaining the high-yield benefits first. While the concept of incremental costs and benefits is important, boundaries must be placed on the system's ultimate configuration instead of attempting cost-benefit cases for each module of an incrementally developed HIS. If this is not done, the latter's implementation sequencing may be less than optimal because it is often difficult to achieve net-benefit (as opposed to net cost) cases for individual modules.

A typology of tangible and intangible costs is given in Figure 1. These costs have been categorized from the perspective of the hospital and are intended only as a guide for determining relevant cost elements. This should prove to be a useful framework for assisting analysts in the identification of similar costs in the typical British Columbia hospital environment.
FIGURE 1

ENUMERATION OF COSTS

• TANGIBLE (QUANTITATIVE) COSTS

ONE-TIME SYSTEMS (HARDWARE AND SOFTWARE)

Hardware
- System major components
- Uninterruptible power supply (UPS)
- Video Display Terminals (VDTs)
- Printers (fast and moderate speed)
- Electronic Embossers
- Interfaces to equipment (e.g., Laboratory)
- Other

Software
- Operating Systems
- All application systems (by module, if appropriate)
- Interfaces
- Other

Licenses

Communications
- Multiplexers (if applicable)
- Modems
- Wiring (includes materials and labour)
- Other

Other
- Analyst and secretarial support
- Sales tax (Provincial)
- Freight charges

Hardware Installation
- Building renovations or space creation, including fire extinguisher system
- In-house staff support

Software Implementation and Installation
- This is vendor-supplied manpower and applies to each purchased systems application or module

Staff Training (Hardware and Software)
- Including relief staff, travel, manuals and audio visual aids for implementation of HIS modules

Conversion Costs
- Conversion from manual and/or status quo to proposed system
FIGURE 1—Continued

ON-GOING COSTS (HARDWARE AND SOFTWARE)

Lease Line(s) (if applicable)

Telephone
  - For data transmission, on-line trouble-shooting/repair and voice communications

Computer Room Services
  - Including electrical, heating, ventilating, air conditioning (if applicable)

In-house HIS Staff Support

Vendor and/or Third Party Support (usually by service contract)

Spare Equipment/Parts (if necessary)

Supplies (e.g., printer ribbons, etc.)

Modifications/Enhancements After Initial Implementation

Other Joint Institutional Costs
  - Includes security, administrative time, housekeeping (if applicable)

Research and Development (if applicable)

Opportunity Costs
  - Includes Space (if applicable)

INTANGIBLE (QUALITATIVE) COSTS

These are usually NOT included in the CBA, depending on the preference of the analyst or scope of the study.

Staff
  - System-induced frustration and stress, especially during implementation (identify only).
  - Other.
Benefits

The enumeration of benefits is perhaps more onerous than the cost-side of the analysis. As Warner and Luce point out in the broader context of health care programs, benefits are "...numerous, diverse, often obscure, and often hard to measure."\(^{16}\) They further note that "there is no single 'right' way to categorize benefits ..."\(^{17}\) As with costs, enumeration of benefits may be best categorized by tangible (costs avoided)\(^{18,19}\) or intangible (non-monetary benefits). Benefits in terms of cost-impacts have been discussed at length by Drazen.\(^{20-22}\) She notes that the methodologies used are affected by the institutional setting, the nature of the proposed computerized system and the perspective of the evaluator. She further argues that:

In some cases, cost savings alone are likely to be the major impetus for adopting a computer system. In others, cost considerations may be secondary to other benefits, but the evaluator may want to know what portion of the system costs will be offset by labor savings.

Consistent with the purpose of the evaluation and the objectives for the AHIS, specific impact areas must be identified and questions and/or hypotheses relating to the impacts posed.

The most common reasons for implementing an AHIS are to increase staff productivity (by removing time-consuming paperwork) and to make information flow more timely and reliable. Because of the difficulty of translating patient care benefits into dollar savings, most cost studies have been focused on changes in manpower productivity and the impact of these changes on personnel costs. Some studies have also assessed the nature and magnitude of other impacts, such as increased
accuracy of communications, but not the cost implications of these benefits. Therefore, most cost studies conducted to date have been focused on a limited number of the potential cost impacts of an AHIS.23

Drazen24 supports the position that labor savings are a major economic rationale for pursuing computerized systems. She identifies four different techniques that have been employed in various hospital settings in the United States for estimating labor savings. These include task analysis, job content analysis, work sampling and trend analysis.

Task analysis involves identification of all work activities that will be affected by computerization and measuring the time spent in the manual system. This is then compared to the time spent on the same activities using the computerized system (either measured if a retrospective study or predicted if a prospective study). This method is discouraged because unrealistic assumptions can easily be made (such as unrealistic upward transfer of tasks and unrealistic summation of saved staff between departments) which could negatively affect predicted labor savings.

Job content analysis25 overcomes some of the inherent problems in task analysis since it is the employee, not the task, which is of interest. This approach is recommended as being most efficient for non-nursing labor such as, for example, Radiology and Laboratory, because it is less time consuming than task analysis and the results can be more
easily translated into realistic staff reductions.

Work sampling\textsuperscript{26} (or direct observation) involves the periodic measurement of activities of personnel over an extended time period. Such data are used to describe how individuals or categories of staff spend their time. This approach is particularly useful for analyzing labor impacts in nursing units since nurses perform many information handling tasks during their care of patients; however, they do not spend large blocks of time solely on information handling tasks.

Finally, trend analysis\textsuperscript{27} involves the examination of trends in cost variables before and after implementation of a computerized system. This technique is more applicable in retrospective rather than prospective studies and essentially involves plotting historical versus predicted trends in labor productivity.

Other benefit elements that could be considered include:\textsuperscript{28} research and development spillovers, increase in the standard of quality of work-life, environmental improvements in the workplace and other positive technological externalities. While these could be quantified, in practice they often are not depending on the relative likely magnitudes. It is incumbent upon the analyst to explicitly enumerate them as a minimal requirement of the CBA.

Gall raises an important point with respect to CBA in
a non-research (for example, community hospital) setting:

... it is often very difficult to prove in a direct causal manner that a particular observed economic effect occurred because of the system. The problem exists in trying to isolate or separate the change in the variable being studied from the change in many other associated variables. ... Calculation of benefits is further complicated by lack of agreement not only upon the extent of savings due to the system, but also their proper valuation for the hospital. Opinion of what constitutes a system savings and the appropriate valuation that may be credited to the system may range widely from hospital to hospital. 29

Reduction in patient length of stay (LOS) is another potential benefit which merits consideration; however, it is only significant if matched with excess demand for beds or, as a result of implementation, beds are closed. The latter should then translate to labor and non-labor savings. Moreover, the causal link between system introduction and reduced LOS is very difficult, if not impossible, to demonstrate. 30,31 Perhaps the advent of a DRG-based prospective reimbursement methodology will more clearly show a cause-effect relationship; however, at the present time the annual operating grant system precludes proving any direct relationship between the introduction of an HIS and reduced LOS. Thus, this benefit is a difficult one to pursue.

As with the cost-side of the analysis and conditional on the initial question, it is the identification of differences or changes in benefits, not the determination of their absolute values that is important unless one is independently interested
in the actual costs of running either system. It is not necessary to fully enumerate all the benefits of the status quo and all the benefits of the proposed system. It is necessary to identify changes in benefits accruing solely as the result of implementation of the computerized system.

Intangible benefits also deserve special consideration by the analyst, who should again ask: "Does it appear likely in any particular instance that the values affected by the intangible effects could have been large enough, if they had in fact been quantified, to have substantially altered the findings of the benefit-cost study?"\(^{32}\) Such intangible effects, therefore, may be relatively unimportant under certain circumstances such as the willingness of decision-makers to proceed with the program for political reasons only or if there is a high probability that the intangible effects will not occur.\(^{33}\) Hamilton and Chervany\(^{34}\) note that such intangible, qualitative effects tend to be ignored in many cases. Dittman and Smith\(^{35}\) and Stoddart and Drummond\(^{36}\) indicate that they are often excluded from the analysis.

A suggested categorization of benefits is demonstrated in Figure 2 for use as a framework in enumerating benefits. As with costs, explicit identification is critical to a good analysis since the next steps, quantification and valuation, will only be as comprehensive as allowed by the initial enumeration of costs and benefits.
FIGURE 2
ENUMERATION OF BENEFITS

TANGIBLE (QUANTIFIABLE IN DOLLARS) BENEFITS

ONE-TIME
- Status quo equipment no longer required (e.g., resale value)
- Status quo forms/printing, etc. no longer required
- Others, e.g., space savings

ON-GOING
- Increased staff productivity and labor savings calculated by Job Content Analysis (non-nursing departments) and Work Sampling (nursing units)
- Reduction of outstanding accounts, e.g., reduction of bad debts (patient accounts) and foregone interest on those accounts
- Reduction of lost revenue in Cafeteria (staff and guests)
- Reduction of food wastage
- Reduction of misappropriated staff benefit entitlements
- Positive technological externalities, e.g., R & D spill-overs, such as software sales revenue, if applicable
- Reduction in patient length of stay
- Others, depending on modules proposed and HSP study which should precede the CBA stage

INTANGIBLE (QUALITATIVE) BENEFITS

These are usually NOT included in the analysis, depending on the preference of the analyst or scope of the study. Examples include:
- Improved staff morale
- More timely messages
- Patient satisfaction
- Integrated health records resulting in higher standard of patient care and better analysis of data
- Improved intra- and inter-departmental relationships
- Greater consistency in nursing care
- Improved Quality Assurance program
- Increase in standard of quality of work-life
Quantification of Costs and Benefits

Tangible Costs

Once the relevant costs have been identified, they must be quantified in appropriate physical units. For tangible costs this is fairly straightforward and may be combined with the valuation step. One special situation presenting a problem is that of joint resource utilization and allocation. This applies to shared overhead costs such as computer room services including heating, lighting, telephone, etc. In this case, Stoddart and Drummond recommend that "reasonable" criteria be used in the distribution of the common costs. Warner and Luce suggest that such measurement commonly consists of counting the number of hours or days required for plant maintenance labor, the physical quantities of supplies, the amount and use of capital goods and so on, used specifically by the information system and relative to the totals for these cost categories.

Intangible Costs

Intangible costs, because they are difficult to include in the CBA and provided they have been identified qualitatively, can be set aside from the actual analysis; however, they should not be dismissed completely since they may be of importance during the interpretation and presentation stage of the analysis and be useful during the decision-making process, particularly where tangible costs exceed tangible benefits.
Tangible Benefits

Efforts to quantify tangible benefits should be directed primarily at such things as staff labor savings, major equipment, apparatus, reduction of wastage and the like. There is an inherent danger in this stage of being too optimistic in the quantification of potential benefits which warrants a note of caution -- err on the side of moderation! In practice, because such health care resource benefits are commonly measured directly in monetary units, a blending of benefit measurement and valuation is possible.  

Intangible Benefits

As with quantification of intangible costs, intangible benefits can create major problems. Warner and Luce note "... analysts must accept the fact that some benefits cannot be quantified and find ways to proceed with the quantitative analysis without losing sight of these benefits. Thus, in practice, quantification of the intangible benefits is rarely attempted, but such benefits should at least be brought to the attention of the decision-makers along with some estimate of their importance and bearing on the decision.  

Valuation of costs and benefits

This step involves the conversion of quantified costs and benefits to monetary units. It is important that the sources and methods of valuation be clearly stated.
Tangible Costs

This is fairly straightforward and involves attaching dollar values to the identified and quantified tangible costs using market prices, current wage rates, benefit entitlements and cost per square meter of space, if applicable. The special problem of inflation of future costs will be discussed later. Any assumptions made must be clearly stated as should any exclusions from this step.

Intangible Costs

As in the quantification step, intangible costs should be set aside but not be dismissed completely since they may be of importance during the decision-making stage.

Tangible Benefits

This is perhaps the most difficult step of the CBA. As with costs, market prices should be used particularly as these relate to staff labor savings. In job content analysis and work sampling predictions, estimates of time savings can be made along with job realignments and staffing changes. If market prices are difficult to associate directly with realized benefits, imputed prices can serve to value the benefits. The use of hospital volunteer labor is one example of such productive activity which could be accounted for and valued.

Intangible Benefits

Again, intangible benefits should be set aside for possible use later.
Discounting of Costs and Benefits

Because all costs and benefits associated with the purchase and implementation of an HIS do not occur simultaneously but, rather, are typically staged over several years' duration, it is necessary to apply an accounting method known as discounting in order to compute the present value of streams of costs and benefits. This has been comprehensively discussed in the context of health care, medical technology and information systems by several authors.44-48

The basic principle in discounting is that, ceteris paribus, money has time value and individuals (or hospitals) have time preferences. Thus, from the perspective of the hospital, a dollar in the present is worth more than the same dollar in the future. This principle applies both to the cost-side of the analysis and the quantified benefit-side. In principle, the discounting process is relatively simple; in practice, it represents a number of calculations which could be set up on an electronic spreadsheet, a very few lines of code, or be handled by most hand calculators with minimal effort. Once the enumeration, quantification and valuation of costs and benefits has been accomplished, discounting can proceed. Simply stated, this consists of setting out the cost time stream and the benefit time stream for the duration of the computer project, say, five or eight years.
The formula for present discounted value (pdv) is simply the inverse of the compound interest formula, that is, a reverse interest rate. This applies to both the cost stream and the benefit stream. In its simple form, present discounted value for a single year is typified by the following equation:

\[ \text{pdv} = \frac{B \text{ or } C}{(1.0+r)^n} \]

- \( B \) = amount of benefits
- \( C \) = amount of costs
- \( r \) = discount rate
- \( n \) = year benefit or cost occurs

Thus, for the entire time stream this becomes:

For Costs:

\[ C_{pdv} = C_0 + \frac{C_1}{(1+r)} + \frac{C_2}{(1+r)^2} + \ldots + \frac{C_n}{(1+r)^n} \]

Where:

- \( C_{pdv} \) = present discounted value for entire stream of costs
- \( C_0 \) = immediate costs
- \( C_1 \) = costs in year 1
- \( C_2 \) = costs in year 2
- \( \ldots \)
- \( C_n \) = costs in year \( n \)

Or, more simply stated:

\[ C_{pdv} = \sum_{j=0}^{n} \frac{C_j}{(1+r)^j} \]

Where:

- \( \sum \) = summation
- \( j \) = the year from the immediate time
- \( n \) = the final year
For benefits, we simply substitute B for C; the calculations are identical.

Selection of an appropriate discount rate presents a problem because there is little or no consensus regarding the rate that should be used. Choice of an appropriate rate is very important, however, because of the impact it can have on the assessment of the alternatives under consideration. From the perspective of the hospital, Anderson and Settle caution that, in the tendency to discount at higher rates, the present value of future effects is quickly diminished, particularly for projects that have very long term benefits. With respect to hospital computer systems, the yield of benefits is, realistically, unlikely past the eight to ten year mark. While the discount rate is not a function of the type of project, there is a tendency to use higher discount rates in order to diminish the system costs, assuming implementation occurs over several years; however, because costs generally tend to precede benefits, higher discount rates would make the system appear economically less attractive.

If possible, the discount rate used by the MOH should be incorporated as one of several rates. Characteristic of good CBAs, several discount rates are used in order to test the sensitivity of the net benefits of the project to alternative rates.

Inflation raises a special concern. Warner and Luce
assert that while not a source of technical difficulty, dollar figures should be deflated to the price level of a single year before the discounting process is applied. They suggest that by bringing such dollar values to a single year, say, today's prices, the messiness of inflation is avoidable. The problem of inflation has also been discussed by Anderson and Settle who caution the analyst to avoid having purely inflationary effects influence the outcome of the CBA. They conclude that inflation is properly handled as follows:

(1) estimate all future benefits and costs in constant prices (that is, simply assume no inflation) and use, as the discount rate, an estimate of the private opportunity cost of capital in the absence of anticipated inflation, or (2) estimate all future effects in current (that is, inflated) prices and use as the discount rate an estimate of the private opportunity cost of capital in the presence of the anticipated rate of inflation.57

In practice, they suggest that most analysts probably estimate future benefits and costs in constant prices and thereby ignore inflation. This practice is acceptable providing the implied assumption that all costs and benefits inflate at the same rate over the duration of the project is deemed realistic. As a matter of common practice, some likely time-preference rate is arbitrarily selected for discounting the costs and benefits of public sector projects.

Sensitivity Analysis

The importance of sensitivity analysis in order to probe the impact of uncertainties in CBA has been discussed
Essentially, this step involves testing various assumptions and variables about which the analyst is uncertain and that are significant enough to alter the results if reasonable shifts in their value occur. One example is the discount rate and the overall impact it has on the economic feasibility of the project. This involves testing several possible discount rates, say, three, five and seven percent. If this value is predetermined by the MOH it may serve to be more an academic exercise than a practical one. As Warner and Luce emphasize with respect to the uncertainties posed by CBA:

Rather than viewing uncertainty as a source of despair, analysts and readers should accept it as a fact of analytical life and approach the determination of its importance as an interesting challenge.

On the other hand, the above-noted authors emphasize that studies which do not present some sensitivity tests cast considerable doubt on the methodology employed by the analyst. The real value of performing sensitivity analyses lies in satisfying the analyst and decision-makers that, over reasonable ranges of the "uncertain" variables, the results remain relatively unchanged. If they do change significantly, the assumptions and decisions made as a result of the study are somewhat tenuous.

Interpretation and Presentation of Findings

The final step in CBA is often obscure from the perspective of the analyst, eventual readers and decision-
makers. The foregoing principles carry major assumptions, and limitations of methodology that ultimately impact on the interpretation and presentation of the findings. Moreover, the limitations of CBA impact substantially on its interpretation and use. Thus, the more precise the study and the more explicitly stated the enumeration, quantification and valuation of costs and benefits, the less subject it is to interpretation. As Warner and Luce point out about analysts:

... [They] are in jeopardy of misinterpreting their own analyses because they may lose sight of, and eventually ignore, the assumptions and uncertainties that arise in the course of analysis. Unless they have tested these with sensitivity analysis, they cannot make a judgment on the usefulness of their findings.64

Moreover, as Stoddart and Drummond have pointed out:

... A good study should leave you more (rather than less) aware of the various technical and value judgements necessary to arrive at decisions on the allocation of resources in health care.65

It is beyond the scope of this thesis to enumerate each potential pitfall in doing each step of the CBA. Several major methodologic pitfalls have been identified in the foregoing discussion; however, the reader is directed to the literature cited for more complete discussions and elucidation of pitfalls and problems associated with the methodology. On the other hand, this is an appropriate place to identify and discuss in some detail the general limitations of predictive economic evaluation techniques for HIS, in particular, CBA.

Economic evaluation often assumes, rather than establishes,
program effectiveness. Second, from a policy perspective, economic evaluations do not usually consider the distribution of costs and benefits. Third, is the assumption that resources freed up or saved through benefit realization will not be wasted, but will be used in alternative and worthwhile programs. Each of these assumptions bears heavily on interpretation of the CBA and from it any recommendations made to the decision-makers.

Because benefits, in particular labor-related benefits, will undoubtedly constitute the most significant part of the benefit-side of an HIS evaluation, it is important that this be brought into the interpretation and presentation of the findings. In predictive CBAs such as that set out above, all potential benefits are enumerated. It falls to management to convert potential to reality and to convince funding agencies that this can and will be done. Once the necessary operational adjustments, say labor reductions, have occurred, benefits have been realized and cost-savings or cost-avoidances achieved.

Hodge, Norwood and Gall have categorized labor benefits into three classes: those which follow automatically; those which require explicit effort; and those spinoff benefits made possible, but which are not integral to the system and thus, presumably, may not be taken up. While the enumeration, quantification and valuation of benefits is one thing, it is yet another to ensure that they become realizable, realized
and translated to actual reductions in costs. While not a major limitation of CBA itself, the latter may very well prove to be the most difficult and critical step in the HIS project. It is incumbent upon decision-makers and policy-makers within the institutional setting (or at the government level for that matter) to ensure that, if decisions are made pursuant to a favourable study, the benefits are ultimately realized and translated into real dollar savings for the institutions.

If it is incumbent upon the hospital to guarantee savings prior to project approval by the MOH, a built-in incentive exists for the institution and the MOH to ensure that benefits will become realized and translated to actual savings in the hospital's gross operating budget. This may be the only significant form of pressure that the MOH can apply to preclude the proliferation of what, from their perspective, may be unwarranted and inefficient HISs. This would also be in the best interest of hospitals to avoid being strapped with the unexpected, expensive provision of inefficient computer services due to poor planning.

This appears to be at odds, however, with the previously discussed MOH's policies because their application priorities fall in areas where there are few realizable labor-saving benefits. It is in the area of nurse labor savings, for example, order processing activities and messaging, that substantial benefits are likely to accrue. This apparent in-
consistency in MOH reasoning must be reexamined. Again, the CBA process can facilitate such interaction and, hope­fully, effect policy changes to the benefit of participating hospitals and, ultimately, the MOH.
Footnotes


2Ibid., p. 21.


9Stoddart and Drummond, p. 1542.


11Stoddart and Drummond, p. 1542.

12Ibid., p. 1543.


14Drummond, pp. 20-2.

15Interview with D. Zilm, Kelowna General Hospital, Kelowna, British Columbia, May 22, 1985.
16 Warner and Luce, p. 82.
17 Ibid.
18 Lions Gate Hospital, "Statement of Benefit Potential," North Vancouver, B.C., October 30, 1981 (Typewritten.)
19 Paul R. Sulkers, notes, n.d.
23 Ibid., p. 428.
24 Ibid., p. 430.
26 Ibid.
30 Ibid., pp. 303-4.


32 Anderson and Settle, pp. 110-11.

33 Ibid., p. 111.


36 Stoddart and Drummond, p. 1545.

37 Ibid.

38 Warner and Luce, pp. 79-80.

39 Ibid., p. 85.

40 Ibid.

41 Stoddart and Drummond, p. 1546.


43 Warner and Luce, p. 87.

44 LaPlante and Durham, p. 40.

45 Anderson and Settle, pp. 77-90.

46 Warner and Luce, pp. 93-8.

47 Stoddart and Drummond, p. 1547.

48 Drummond, pp. 47-52.

49 LaPlante and Durham, p. 40.

51 Ibid., pp. 96-8.

52 Anderson and Settle, pp. 82-5.

53 LaPlante and Durham, p. 47.

54 Drummond, p. 50.

55 Anderson and Settle, p. 84.

56 Warner and Luce, pp. 95-6.

57 Anderson and Settle, p. 92.

58 Warner and Luce, pp. 100-3.

59 Drummond, pp. 52-8.

60 LaPlante and Durham, p. 51.

61 Anderson and Settle, pp. 90-1.

62 Stoddart and Drummond, pp. 1547-8.

63 Warner and Luce, p. 100.

64 Ibid., pp. 105-6.

65 Stoddart and Drummond, p. 1548.

66 Ibid.

67 Ibid.

68 Ibid., p. 1549.


70 Ibid.

71 Norwood, p. 152.

72 Gall, p. 306.
CHAPTER IV
THE CHILLIWACK GENERAL HOSPITAL'S EXPERIENCE

Description of the Hospital

The Chilliwack General Hospital (CGH), situated one hundred kilometres east of Vancouver, is a community general hospital serving an area population of approximately sixty thousand in the Fraser Cheam Regional Hospital District (FCRHD). Additionally, Parkholm Lodge (an Intermediate Care Facility incorporated as a separate society) is physically attached to the hospital and houses ninety intermediate care beds. The hospital's current rated capacity is 181 acute care beds and 95 extended care beds. It employs approximately 430 full-time equivalent staff and has an annual operating budget of approximately seventeen million dollars. Approximately thirty-five thousand dollars (excluding word processing) is expended annually on data processing activities associated with the Computer Services of BCHA. These activities include Payroll/Personnel, Data Entry programs for Accounts Payable, General Ledger, Medical Services Plan - Accounts Receivable and conversion to tape of Medical Abstracting data.

The Payroll/Personnel Department currently has installed an Alternate Time Code (ATC) Data Entry System and on-site payroll cheque printing project using an IBM Personal Computer via telephone line and modem, the latter having been recently piloted for BCHA. A Personnel Master File
Update project, using remote terminals and a lease line, was also recently piloted for BCHA but not installed because the hospital felt it was not cost-justifiable. The Pharmacy Department uses an IBM Personal Computer as the basis of its Modified Unit Dose Drug Distribution system. The Administrative Department just recently acquired an IBM Personal Computer for decision-support. Word processing (using IBM Displaywriters) is currently limited to medical stenography and Administration; however, the Laboratory Department has just acquired two IBM personal computers specifically for this purpose and more are being considered for use in other departments.

In September, 1985, the hospital received a long-awaited approval from the MOH to proceed with construction of a twenty-seven million dollar Phase I Acute Care Expansion project. Construction is scheduled to commence in May, 1986 and will include replacing the majority of existing acute care beds, Operating Rooms, Recovery Room, Doctors' Lounge, Radiology, Emergency, Ambulatory Care, Admitting/Switchboard, Purchasing, Supply and Distribution and Central Supply Departments. There will also be provision for a Physical Medicine Satellite area, expanded Boiler Plant, renovated Food Services Department and other plant renovations. The fortuitous timing of this building project was important with respect to the planned HIS, particularly for reasons of
possible funding as part of the expansion project, building systems requirements, staging of the application modules and the eventual relocation of some hardware and peripheral devices from existing to new areas of the hospital.

**Description of the Hospital's Planning Methodology**

The systems planning methodology used at CGH is a modified version of International Business Machines (IBM) Corp. Business Systems Planning (BSP) methodology established in 1970. This process-oriented methodology has undergone several revisions and has been successfully used in studies conducted by profit and non-profit organizations of varying size in many industries. It facilitates a top-down approach to planning by engendering commitment and active involvement starting with senior management and working down through the organization while simultaneously working from the overall to the detailed level; moreover, a bottom-up approach to implementation is facilitated. This structured methodology, proven in hundreds of studies, assists in the translation of the organization's business objectives to information system requirements.

The hospital, with the assistance of BCHA, used this approach as a guide only, recognizing that it would have been too complex and time-consuming to adapt all of its concepts to the hospital environment. Nonetheless, it proved to be a useful way to facilitate participant understanding of the status quo and associated problems.
Following an August, 1984 meeting with senior management of the hospital and BCHA, September, 1984 saw department heads, head nurses, care coordinators, members of the Computer Advisory Committee (including Medical Staff) and the Chairman of the Board attend a general orientation meeting on the proposed HSP methodology. Questionnaires were distributed to all departmental representatives who were asked to return them in two weeks. The intent was to use the questionnaires as a framework for staff to consider information handling issues and for the project team to use as a basis for interviews.

The next step consisted of interviewing a representative number of hospital staff including head nurses, department heads, medical staff, senior nursing and administrative staff. The purpose of the interviews was two-fold. First, it allowed the participants, as potential users of the proposed HIS, to appreciate the expectations of the project team. Second, it allowed the project team to learn more about individual areas of responsibility, about information that the potential users considered essential to manage their area and about the problems that they and others face.

During the interview sessions, the project team made a conscious effort to present an overview of the hospital to each participant and to explain the present information
handling activities and associated costs. The use of a process/organization two-dimensional matrix (Appendix 3) assisted the participants in examining the relationships of the current hospital departments, with various pre-defined information processes kindly provided by BCHA (Appendix 4). The matrix was based on IBM's BSP methodology. The project team identified relative levels of departmental involvement in information handling which afforded the participants an opportunity to examine their information handling activities in comparison to other departments. The project team gained a general impression of the activities that would likely require the greatest degree of attention and the greatest priority. The process of working through the matrix afforded the participants an opportunity to think about the flow of information in a logical fashion which, to many, was a new and educational experience.

Following problem identification (Appendix 5), potential benefits were discussed in order to give the participants a general sense of the scope of the project and to provide a basis for more detailed analysis. This information was recorded and returned to the interviewees for their perusal, verification and sign-off. Using a modification of a computer ranking methodology, identified priorities were ranked. This simple, generic approach allowed the project team to establish its priorities based on user-defined problems, needs and solutions.
This stage was considered to be the initial step in information systems development since it was recognized that more detailed and specific analyses would be required in the next stages of the project. The project team concluded that the planning process supported its suspicion that the predominantly manual methods of handling information (and non-integrated, stand-alone computer systems) were generally ineffective and inefficient. The team thus recommended that a computerized, integrated solution be pursued which would likely lead to greater effectiveness and efficiency of information processing and the realization of significant tangible and intangible benefits. It was felt that the solutions to these problems and attainment of benefits would be possible through modular computerization. Because there was a high level of staff participation, it was felt that the likelihood of successful implementation was greatly enhanced.

The systems planning study addressed potential benefits from the perspective of the users. It was never meant to replace the need for a detailed CBA. At this point in the study the departmental representatives were vaguely aware of the potential benefits of a computerized solution to their identified problems and needs; however, they did not yet have a working knowledge or hands-on experience with any installed systems. Thus, many of the perceived advantages to computerization were quite subjective and possibly some-
what illogical, several perhaps unattainable. On the other hand, delineation of the benefits from the perspective of the users was important at this stage of the study because these would form the basis of expected benefits that one would hope to realize upon implementation of an HIS. The main purpose of this stage was to identify and document the perceived advantages and discuss them with the project team as well as to fulfill the important aspects of participative planning. While identification of these advantages was not limited solely to tangible benefits, as much as possible, a gross valuation of them was sought. Any identified, intangible benefits were also documented. Appendix 6 lists the identified tangible and intangible benefits in their summarized, rough form as interpreted and documented by the project team. To ensure completeness, these were later returned to the participants for their perusal and sign-off.

Description of the Hospital's Options

The HSP study brought the hospital to a major decision point. It could continue with the status quo using a combination of manual methods and non-integrated microcomputers for information handling. If this was indeed the decision, it would clearly mean coping with the problems identified in the HSP study. Given the number and severity of these problems, this option made little sense even though the manual method typifies most community hospitals in British Columbia.
The second option was for the hospital to consider the implementation of part or all of an HIS by replacing the majority of the manual systems and the stand-alone microcomputer applications already in use.

A comprehensive planning report, along with recommended staging of computerized solutions including patient registration and tracking, financial and clinical applications as the highest priorities, was received and approved in December, 1984. Approval was also given to proceed to the next stages of planning.

In January, 1985 invitations were sent to twenty-one vendors to respond to a Request for Information (RFI) to assist the hospital in determining which vendors would receive a Request for Proposal (RFP). Following evaluation, nine suitable vendors were selected to receive RFPs. In May, 1985 a detailed RFP was distributed, including a profile of the hospital, general requirements for the RFP, technical capabilities of proposed systems, costs/benefits/financing, installation/implementation/live timetable and responsibilities, performance bond/warranty/contract, evaluation methodology and timetable, video display terminals and printers and detailed systems applications being requested. Appendix 7 represents a copy of the RFP to which the reader is directed for a greater appreciation of the RFP process and for a complete description of the detailed systems applications
being requested. CGH engaged the expertise of a HIS director in another hospital in order to help develop a comprehensive applications section. 4

Prior to receiving the completed RFPs, an Evaluation Subcommittee of the hospital Computer Advisory Committee was struck comprised of representation from Administration (the author), Medical Staff (the Director of Laboratory Medicine) and Board (a professional accountant). This Subcommittee was charged with evaluating the seven respondents (two vendors declined to respond), short-listing and recommending a finalist to the Hospital Board. This evaluation process culminated in a recommendation to proceed with cost-justifying Meditech's (MS/1200) Integrated Hospital Information System using Data General's latest hardware (MV4000DC) configuration.

With the foregoing information in hand, a decision was made to perform a CBA. The next chapter reviews the eight principles of CBA discussed in Chapter III and applies the steps to the CGH project.
Footnotes


2 Ibid.


4 Meeting with D. Zilm, Kelowna General Hospital, Kelowna, B.C., 22 May 1985.
CHAPTER V

ECONOMIC EVALUATION OF A HOSPITAL INFORMATION SYSTEM FOR THE CHILLIWACK GENERAL HOSPITAL

Using the general framework for economic evaluation as discussed in Chapter III, the purpose of this chapter is to apply the principles of CBA using data generated in planning an HIS for CGH as discussed in Chapter IV. This approach has been taken by the hospital because there is concern for the economic viability of the proposed system.

Figure 3 demonstrates the implementation, costs and tangible benefit streams of the hospital's proposed HIS over an eight year period. The applications are listed in order of implementation priority commencing in May, 1986. The costs and benefits of the CBA are based on these streams of activity.

The Principles of CBA are:

1. Defining the question
2. Delineation of objectives and identification and selection of alternatives
3. Enumeration of relevant costs and benefits
4. Measurement of costs and benefits in appropriate units
5. Valuation of costs and benefits in monetary units
6. Discounting of costs and benefits to their present value
7. Performing sensitivity analyses to reduce uncertainties
8. Interpretation and presentation of findings

These will now be specifically applied to CGH.

Defining the Question

Will an integrated HIS designed to computerize
FIGURE 3

IMPLEMENTATION, COSTS AND TANGIBLE BENEFITS
STREAMS OF A PROPOSED HIS FOR THE
CHILLIWACK GENERAL HOSPITAL

<table>
<thead>
<tr>
<th>APPLICATIONS</th>
<th>YEAR</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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<td>I</td>
<td>T</td>
<td>T</td>
<td>B NURSING</td>
<td>B CLINICAL DEPTS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A/D/T</td>
<td></td>
<td>C</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Outpatient Registration SQ</td>
<td></td>
<td>I</td>
<td>T</td>
<td>T</td>
<td>B NURSING</td>
<td>B CLINICAL DEPTS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health Records SQ</td>
<td></td>
<td>I</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HMRI</td>
<td></td>
<td>C</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Financials SQ</td>
<td></td>
<td>I</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clinical Lab SQ</td>
<td></td>
<td>I</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Pathology</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Order entry SQ</td>
<td></td>
<td>I</td>
<td>C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Results reporting Communications SQ</td>
<td></td>
<td>T</td>
<td>T</td>
<td>B NURSING</td>
<td>B CLINICAL DEPTS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food Services SQ</td>
<td></td>
<td>I</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pharmacy SQ</td>
<td></td>
<td>I</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radiology SQ</td>
<td></td>
<td>I</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

B = benefit streams for each application
I = implementation stage
C = cost stream for each application
T = transition period awaiting translation of potential benefits to realizable benefits
SQ = Status quo systems
information processing be cost-effective relative to the current non-integrated manual and stand-alone computerized methods, from the perspective of the Chilliwack General Hospital?

Delineation of Objectives and Identification of Alternatives

Recognizing that the objectives are to expedite hospital care in order to improve the health status of its patients and recognizing that the HSP study brought to light several areas of suspected ineffectiveness and inefficiencies with respect to the status quo methods of handling information, a computerized, integrated solution was pursued. The identified problems and other unidentified problems brought to light through the study can be solved. The hospital feels that solutions to these problems and the attainment of identified benefits are possible through modular computerization of the identified manual information processing systems and through integration or replacement of current stand-alone computerized methods of handling information. To some extent there was a presupposition that improved cost-effectiveness would be made possible through the implemented system.

The alternatives from the perspective of CGH are simply a hospital-wide computerized system versus the status quo methods of handling information.
Enumeration of Relevant Costs and Benefits

While separated in the text, in practice the three distinct steps of enumeration, quantification and valuation may occur simultaneously.

Tangible Costs

Using the typology of Figure I, the non-inflated and non-discounted one-time and on-going costs were tabulated (Tables 1 and 2) and were summarized over an eight year period assuming one hundred percent of the system costs would be borne by the hospital (Table 3). Care must be taken to ensure all tangible costs are included from the perspective of the hospital. While assistance from vendors is important, they have a tendency to miss relevant costs because of their perspective and desire to be competitive. Thus, input from several vendors and system users is helpful.
TABLE 1
ENUMERATION, QUANTIFICATION AND VALUATION
OF TANGIBLE ONE-TIME COSTS OF HIS
OVER EIGHT YEAR PERIOD FOR THE
CHILLIWACK GENERAL HOSPITAL

<table>
<thead>
<tr>
<th>ENUMERATED COMPONENTS</th>
<th>QUANTITIES</th>
<th>VALUES($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HARDWARE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>System major components, including:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- MV/4000DC each with 1 MB Memory, 120 MB Disc, IAC-16</td>
<td>3</td>
<td>227,132</td>
</tr>
<tr>
<td>- 1600 BPI Streamer Tape Subsystem</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>- Expansion Chassis, Power Supply Bus Repeater</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>- IAC-16</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>- Wall mount</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>- TP2 Printer Console</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>- CRT Console</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>- DG Band Printer</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Uninterruptible Power Supply (UPS)</td>
<td>3</td>
<td>19,110</td>
</tr>
<tr>
<td>Video Display Terminals (VDTs), including:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- System units</td>
<td>71</td>
<td>36,920</td>
</tr>
<tr>
<td>- Training/Back-up units</td>
<td>9</td>
<td>4,680</td>
</tr>
<tr>
<td>Printers</td>
<td>30</td>
<td>66,000</td>
</tr>
<tr>
<td>Electronic Embosser</td>
<td>1</td>
<td>20,000</td>
</tr>
<tr>
<td>Interfaces</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Sub-total</td>
<td></td>
<td>373,842</td>
</tr>
<tr>
<td>SOFTWARE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating Systems</td>
<td>3</td>
<td>57,850</td>
</tr>
<tr>
<td>All Application Systems, including:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Admissions and Comprehensive Statistics, Medical Records (including DRG/Abstracting/CMG)</td>
<td>1</td>
<td>71,500</td>
</tr>
<tr>
<td>- Financials (including Billing/Accounts Receivable, MSP, General Ledger/Statistics Reporting, Accounts Payable, Fixed Assets, Generalized outputs to tape, activity log</td>
<td>1</td>
<td>91,000</td>
</tr>
<tr>
<td>TABLE 1-Continued</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Laboratory (including Microbiology and Surgical Pathology)</td>
<td>1</td>
<td>97,500</td>
</tr>
<tr>
<td>- Nurse Station Communications</td>
<td>1</td>
<td>78,000</td>
</tr>
<tr>
<td>- Radiology</td>
<td>1</td>
<td>26,000</td>
</tr>
<tr>
<td>- Pharmacy</td>
<td>1</td>
<td>32,500</td>
</tr>
<tr>
<td>- Food Services (under development) estimate only</td>
<td>1</td>
<td>20,000</td>
</tr>
<tr>
<td>Interfaces</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Embosser</td>
<td>1</td>
<td>1,300</td>
</tr>
<tr>
<td>- Laboratory Equipment</td>
<td>3</td>
<td>7,800</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Interprocessor Communications</td>
<td>2</td>
<td>52,000</td>
</tr>
<tr>
<td>Sub-total</td>
<td></td>
<td>535,450</td>
</tr>
</tbody>
</table>

**OTHER**

*Hardware installation*

- Building renovations or additions $^{1}$ | $\emptyset$ | $\emptyset$ |

*Software implementation*

- Out-of-pocket living expenses for vendor personnel | $\emptyset$ | $\emptyset$ |

*Licenses* $^{1}$ | $\emptyset$ | $\emptyset$ |

*Communications* $^{1}$

- Multiplexers | $\emptyset$ | $\emptyset$ |
- Modems | 2 | 1,000 |
- Wiring installation | $\emptyset$ | $\emptyset$ |
- Other | $\emptyset$ | $\emptyset$ |

*Staff training during implementation period* | $\emptyset$ | 64,000 |

*Conversion costs (status quo to HIS applications)*

- Health Records index cards | 87,000 | 27,000 |

*Other* $^{1}$

- Analyst and secretarial support | $\emptyset$ | $\emptyset$ |
- Provincial sales tax (Hardware only) @ 7% | $\emptyset$ | 26,169 |
- Freight (Hardware only, FOB Chilliwack) | $\emptyset$ | 2,000 |
- System, Printers, VDTs

Sub-total | $\emptyset$ | 200,169 |

**Total** | 1,109,461 |

*NOTE:* 1.3 U.S. exchange rate used for all software costs.

$^{1}$ Not applicable in C.G.H. project.
TABLE 2
ENUMERATION, QUANTIFICATION AND VALUATION
OF TANGIBLE ON-GOING COSTS OF HIS
OVER EIGHT YEAR PERIOD FOR THE
CHILLIWACK GENERAL HOSPITAL

<table>
<thead>
<tr>
<th>ENUMERATED COMPONENTS</th>
<th>QUANTITIES</th>
<th>VALUES ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lease lines&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Ø</td>
<td>Ø</td>
</tr>
<tr>
<td>Telephone</td>
<td>-</td>
<td>13,500</td>
</tr>
<tr>
<td>Computer room services&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Ø</td>
<td>Ø</td>
</tr>
<tr>
<td>In-house HIS staff support</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 1.0 FTE Dir. of HIS Dept. (incl. benefits)</td>
<td>-</td>
<td>360,000</td>
</tr>
<tr>
<td>- 1.0 FTE DP staff (incl. benefits)</td>
<td>-</td>
<td>216,000</td>
</tr>
<tr>
<td>Vendor and third party support</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- H/W maintenance, incl. system contract</td>
<td>-</td>
<td>133,828</td>
</tr>
<tr>
<td>- Printers (x 30) estimate only</td>
<td>-</td>
<td>14,000</td>
</tr>
<tr>
<td>- VDTs (x 80) estimate only</td>
<td>-</td>
<td>6,000</td>
</tr>
<tr>
<td>- S/W Maintenance Contract, incl. all</td>
<td></td>
<td>419,761</td>
</tr>
<tr>
<td>Applications, Embosser Interface</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spare Equipment Parts (extra VDTs already included)</td>
<td>Ø</td>
<td>Ø</td>
</tr>
<tr>
<td>Miscellaneous, including:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Supplies</td>
<td>-</td>
<td>7,000</td>
</tr>
<tr>
<td>- Microfiche</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Postage/Courier</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S/W Enhancements</td>
<td>-</td>
<td>15,000</td>
</tr>
<tr>
<td>Other Joint Distribution Costs&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Ø</td>
<td>Ø</td>
</tr>
<tr>
<td>Research and Development&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Ø</td>
<td>Ø</td>
</tr>
<tr>
<td>Opportunity Costs&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Ø</td>
<td>Ø</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>1,185,089</td>
</tr>
</tbody>
</table>

NOTE: 1.3 U.S. exchange rate applies to all software costs.

<sup>1</sup>Not applicable in C.G.H. project.
TABLE 3
SUMMARY OF NON-INFLATED, NON-DISCOUNTED
COSTS OF HIS OVER EIGHT YEAR PERIOD
ASSUMING 100% FUNDED BY THE
CHILLIWACK GENERAL HOSPITAL

<table>
<thead>
<tr>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>ONE-TIME</strong></td>
<td>0 (1st 4 mos)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hardware (H/W)</td>
<td>223,814</td>
<td>35,520</td>
<td>114,508</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>373,842</td>
</tr>
<tr>
<td></td>
<td>Software (S/W)</td>
<td>16,250</td>
<td>213,850</td>
<td>183,300</td>
<td>122,050</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>535,450</td>
</tr>
<tr>
<td></td>
<td>S/W implementation(^2)</td>
<td>0</td>
<td>20,000</td>
<td>20,000</td>
<td>20,000</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>60,000</td>
</tr>
<tr>
<td></td>
<td>Communication and wiring(^2)</td>
<td>0</td>
<td>21,000</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>21,000</td>
</tr>
<tr>
<td></td>
<td>Staff training(^2)</td>
<td>0</td>
<td>22,000</td>
<td>22,000</td>
<td>20,000</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>64,000</td>
</tr>
<tr>
<td></td>
<td>Conversion(^2)</td>
<td>0</td>
<td>27,000</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>27,000</td>
</tr>
<tr>
<td></td>
<td>PST @ 7% H/W only</td>
<td>0</td>
<td>15,667</td>
<td>2,486</td>
<td>8,016</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>26,169</td>
</tr>
<tr>
<td></td>
<td>Freight H/W only</td>
<td>0</td>
<td>1,000</td>
<td>500</td>
<td>500</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2,000</td>
</tr>
<tr>
<td></td>
<td><strong>Sub-total</strong></td>
<td>223,814</td>
<td>35,520</td>
<td>114,508</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>373,842</td>
</tr>
<tr>
<td></td>
<td><strong>ON-GOING</strong></td>
<td>1,109,461</td>
<td>1,185,089</td>
<td>1,185,089</td>
<td>1,185,089</td>
<td>1,185,089</td>
<td>1,185,089</td>
<td>1,185,089</td>
<td>1,185,089</td>
<td>1,185,089</td>
<td>1,185,089</td>
</tr>
</tbody>
</table>

Sub-total 1,109,461

\(^1\)10% deposit for Stage I software applications upon signing contract with Meditech.

\(^2\)Budgetary estimate.

\(^3\)Includes 20% employee benefits package in addition to annual remuneration; excludes vacation and sick relief.

\(^4\)Applies to all software costs.

\(^5\)Some rounding of figures due to conversion.
Intangible Costs

It is recognized that there will be considerable system-induced frustration and stress, especially during implementation of the HIS; however, no attempt was made to measure these intangibles. It was felt that because there was such a high level of user participation during the initial HSP study and benefit identification phases of planning the likelihood of successful implementation would be greatly enhanced. Moreover, because the modular approach to implementation is being taken, frustration and stress should be minimized as users in subsequent areas become comfortable with the system and as change is incrementally effected.

Tangible Benefits

While identification of tangible and intangible benefits formed part of the HSP study, identification of benefits was again a major exercise following selection of the finalist vendor. Using Job Content Analysis, each non-Nursing department/area enumerated its major tangible benefits. The Nursing Department used Work Sampling techniques to analyze labor impacts of the proposed HIS over the status quo. Only the differences or changes in benefits of the proposed HIS over the status quo were enumerated; that is, only those changes in benefits accruing as a result of the implementation of the proposed HIS. For the most part, the greatest emphasis was on major impact areas such as
labor since this was the most significant potential on-going benefit. Each affected area was asked to review its current staffing patterns, ascertain if the proposed HIS could reduce staffing levels in each position and/or if staffing could be reorganized to take advantage of transfers of tasks if appropriate. Forms and printing costs were generally ignored because it was felt they would likely be offset by a similar amount required by the HIS. Elimination of outside data services and courier services were also included where applicable. Potentially reducible wastage under the status quo system was estimated and incorporated, particularly in the Food Services Department.

Table 4 summarizes the labor and non-labor benefit streams for each implementation stage of the HIS.
### TABLE 4

SUMMARY OF NON-INFLATED, NON-DISCOUNTED ESTIMATED SAVINGS (LABOR & NON-LABOR) OVER EIGHT YEAR PERIOD FOR THE CHILLIWACK GENERAL HOSPITAL

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>LABOR</td>
<td>Admit/Swbd/OP</td>
<td>$25,400</td>
<td>$25,400</td>
<td>$25,400</td>
<td>$25,400</td>
<td>$25,400</td>
<td>$25,400</td>
<td>$25,400</td>
<td>$25,400</td>
</tr>
<tr>
<td></td>
<td>Finance/Bus. Off.</td>
<td>$13,570</td>
<td>$13,570</td>
<td>$13,570</td>
<td>$13,570</td>
<td>$13,570</td>
<td>$13,570</td>
<td>$13,570</td>
<td>$13,570</td>
</tr>
<tr>
<td></td>
<td>Health Records</td>
<td>$25,400</td>
<td>$25,400</td>
<td>$25,400</td>
<td>$25,400</td>
<td>$25,400</td>
<td>$25,400</td>
<td>$25,400</td>
<td>$25,400</td>
</tr>
<tr>
<td></td>
<td>Radiology</td>
<td>$40,200</td>
<td>$40,200</td>
<td>$40,200</td>
<td>$40,200</td>
<td>$40,200</td>
<td>$40,200</td>
<td>$40,200</td>
<td>$40,200</td>
</tr>
<tr>
<td></td>
<td>Pharmacy</td>
<td>$40,200</td>
<td>$40,200</td>
<td>$40,200</td>
<td>$40,200</td>
<td>$40,200</td>
<td>$40,200</td>
<td>$40,200</td>
<td>$40,200</td>
</tr>
<tr>
<td></td>
<td>Food Services</td>
<td>$40,200</td>
<td>$40,200</td>
<td>$40,200</td>
<td>$40,200</td>
<td>$40,200</td>
<td>$40,200</td>
<td>$40,200</td>
<td>$40,200</td>
</tr>
<tr>
<td></td>
<td>Sub-total</td>
<td>$38,970</td>
<td>$79,170</td>
<td>$132,170</td>
<td>$132,170</td>
<td>$132,170</td>
<td>$132,170</td>
<td>$132,170</td>
<td>$132,170</td>
</tr>
<tr>
<td>NON-LABOR</td>
<td>Admit/Swbd/OP</td>
<td>$13,000</td>
<td>$13,000</td>
<td>$13,000</td>
<td>$13,000</td>
<td>$13,000</td>
<td>$13,000</td>
<td>$13,000</td>
<td>$13,000</td>
</tr>
<tr>
<td></td>
<td>Finance/Bus. Off.</td>
<td>$400</td>
<td>$400</td>
<td>$400</td>
<td>$400</td>
<td>$400</td>
<td>$400</td>
<td>$400</td>
<td>$400</td>
</tr>
<tr>
<td></td>
<td>Health Records</td>
<td>$13,000</td>
<td>$13,000</td>
<td>$13,000</td>
<td>$13,000</td>
<td>$13,000</td>
<td>$13,000</td>
<td>$13,000</td>
<td>$13,000</td>
</tr>
<tr>
<td></td>
<td>Radiology</td>
<td>$31,000</td>
<td>$31,000</td>
<td>$31,000</td>
<td>$31,000</td>
<td>$31,000</td>
<td>$31,000</td>
<td>$31,000</td>
<td>$31,000</td>
</tr>
<tr>
<td></td>
<td>Pharmacy</td>
<td>$44,400</td>
<td>$44,400</td>
<td>$44,400</td>
<td>$44,400</td>
<td>$44,400</td>
<td>$44,400</td>
<td>$44,400</td>
<td>$44,400</td>
</tr>
<tr>
<td></td>
<td>Food Services</td>
<td>$44,400</td>
<td>$44,400</td>
<td>$44,400</td>
<td>$44,400</td>
<td>$44,400</td>
<td>$44,400</td>
<td>$44,400</td>
<td>$44,400</td>
</tr>
<tr>
<td></td>
<td>Sub-total</td>
<td>$52,370</td>
<td>$92,570</td>
<td>$176,570</td>
<td>$176,570</td>
<td>$176,570</td>
<td>$176,570</td>
<td>$176,570</td>
<td>$176,570</td>
</tr>
</tbody>
</table>

1. Includes employee benefits @ approx. 23% (average) of gross annual remuneration rounded to nearest .1 FTE and $100.

2. Includes reduction of wastage, elimination of BCHA data services (except for Payroll/Personnel), courier service. Only differences relative to the status quo are included in figures.
Intangible Benefits

Considerable time was spent during the HSP stage of planning in enumerating intangible benefits and these were not reviewed at this stage since the CBA focusses on tangible benefits. This does not preclude emphasizing their importance. On the contrary, many of these intangible benefits may prove to be most important. Examples (drawn from Appendix 6) include the following:

- Improved patient care services
- Improved patient satisfaction and morale
- Increased quality of care
- Greater continuity and consistency of care
- Improved order communication process
- Improved interdepartmental relationships
- More timely decision-making
- Improved staff morale
- Improved retrieval of patient records and processing of reports
- Integrated patient records
- Improved decision-making and communication abilities
- More timely and accurate messages
Quantification and Valuation of Costs and Benefits

Tangible Costs

This step proved to be straightforward, the information being gained from the RFP process, communication with the vendor, other system users and plain common sense. It can be combined with the enumeration process. Care must be taken again in relying too heavily on vendor input because of their non-hospital perspective and inherent desire to sell their product.

Intangible Costs

No attempt was made to quantify and value the identified intangible costs identified as system-induced frustration and stress, particularly during the implementation period.

Tangible Benefits

This step was combined with the enumeration of tangible benefits and was directed primarily at staff labor savings and other major, non-labor benefits (Table 4). There may be a tendency to over-estimate these benefits in order to create a better benefit case; however, it is far safer to be conservative if uncertain and pleasantly surprised in a few years rather than relying on a false sense of benefit security and unpleasant surprises if the benefits do not accrue.
Intangible Benefits

In practice quantification of intangible benefits is rarely attempted and for the purposes of CGH's study they were identified only and brought to the attention of the decision-makers.

Discounting of Costs and Benefits

Once the costs and benefits have been enumerated, quantified and valued, discounting can be applied. For ease of discounting, the non-inflated, non-discounted costs and benefits should be tabulated in summary form (Table 5). Initially, a three percent discount rate was applied to the streams of costs and benefits (Table 6). Prior to discounting, the dollar figures for costs and benefits were in constant (today's) prices and the three percent rate represents an estimate of the private opportunity cost of capital in the absence of anticipated inflation. Inflation was ignored throughout the analysis.

Sensitivity Analysis

Finally, the analysis was subjected to various tests including U.S. exchange rates (applicable to all one-time and on-going software costs), scenarios for funding from the MOH and/or Regional Hospital District, discount rates and system costs as a percentage of the hospital's gross annual operating budget (Tables 7-13).
# TABLE 5

**SUMMARY OF NON-INFLATED, NON-DISCOUNTED COSTS AND BENEFITS OF HIS OVER EIGHT YEAR PERIOD FOR THE CHILLIWACK GENERAL HOSPITAL**

<table>
<thead>
<tr>
<th>YEAR</th>
<th>COSTS $</th>
<th>BENEFITS $</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1986 (1st 4 mos)$^1$</td>
<td>17,501</td>
</tr>
<tr>
<td>1</td>
<td>1986</td>
<td>591,753</td>
</tr>
<tr>
<td>2</td>
<td>1987</td>
<td>386,384</td>
</tr>
<tr>
<td>3</td>
<td>1988</td>
<td>466,211</td>
</tr>
<tr>
<td>4</td>
<td>1989</td>
<td>186,713</td>
</tr>
<tr>
<td>5</td>
<td>1990</td>
<td>181,328</td>
</tr>
<tr>
<td>6</td>
<td>1991</td>
<td>181,328</td>
</tr>
<tr>
<td>7</td>
<td>1992</td>
<td>181,328</td>
</tr>
<tr>
<td>8</td>
<td>1993</td>
<td>181,328</td>
</tr>
</tbody>
</table>

5 year Cumulative Total 1,829,890 498,080

8 year Cumulative Total 2,373,874 1,027,790

$^1$10% deposit for Stage I software applications upon signing contract with Meditech.

$^2$1.4 U.S. exchange rate applies to all software costs.
TABLE 6
PRESENT DISCOUNTED VALUES (CALCULATED AT 3% DISCOUNT RATE) FOR ENTIRE STREAM OF COSTS AND BENEFITS FOR THE CHILLIWACK GENERAL HOSPITAL

\[
P_{\text{pdv}} = C_0 + \frac{C_1}{(1+r)} + \frac{C_2}{(1+r)^2} + \ldots + \frac{C_n}{(1+r)^n}
\]

\[
P_{\text{pdv}} = B_0 + \frac{B_1}{(1+r)} + \frac{B_2}{(1+r)^2} + \ldots + \frac{B_n}{(1+r)^n}
\]

<table>
<thead>
<tr>
<th>YEAR</th>
<th>COSTS</th>
<th>BENEFITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1986 (1st 4 mos)</td>
<td>17,501</td>
</tr>
<tr>
<td>1</td>
<td>1986</td>
<td>574,517</td>
</tr>
<tr>
<td>2</td>
<td>1987</td>
<td>364,204</td>
</tr>
<tr>
<td>3</td>
<td>1988</td>
<td>426,660</td>
</tr>
<tr>
<td>4</td>
<td>1989</td>
<td>165,893</td>
</tr>
<tr>
<td>5</td>
<td>1990</td>
<td>156,412</td>
</tr>
<tr>
<td>6</td>
<td>1991</td>
<td>151,853</td>
</tr>
<tr>
<td>7</td>
<td>1992</td>
<td>147,433</td>
</tr>
<tr>
<td>8</td>
<td>1993</td>
<td>143,139</td>
</tr>
</tbody>
</table>

5 yr. Cumulative Total 1,705,187 443,269
8 yr. Cumulative Total 2,147,612 874,086

1 All costs and benefits are estimated in constant prices (i.e., no inflation) and discount rate is private opportunity cost of capital in the absence of inflation.

2 1.4 U.S. exchange rate applies to all software costs.
### TABLE 7
SUMMARY OF NON-INFLATED, NON-DISCOUNTED COSTS AND BENEFITS OF HIS OVER EIGHT YEAR PERIOD ASSUMING ALL COSTS 100% FUNDED BY THE CHILLIWACK GENERAL HOSPITAL

<table>
<thead>
<tr>
<th>YEAR</th>
<th>COSTS 1</th>
<th>BENEFITS</th>
<th>NET</th>
<th>CUM. COSTS</th>
<th>CUM. BENEFITS</th>
<th>CUM. NET</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>17,501</td>
<td>Ø</td>
<td>(17,501)</td>
<td>17,501</td>
<td>Ø</td>
<td>(17,501)</td>
</tr>
<tr>
<td>1</td>
<td>591,753</td>
<td>Ø</td>
<td>(591,753)</td>
<td>609,254</td>
<td>Ø</td>
<td>(609,254)</td>
</tr>
<tr>
<td>2</td>
<td>386,384</td>
<td>52,370</td>
<td>(334,014)</td>
<td>995,638</td>
<td>52,370</td>
<td>(943,268)</td>
</tr>
<tr>
<td>3</td>
<td>466,211</td>
<td>92,570</td>
<td>(373,641)</td>
<td>1,461,849</td>
<td>144,940</td>
<td>(1,316,909)</td>
</tr>
<tr>
<td>4</td>
<td>186,713</td>
<td>176,570</td>
<td>(10,143)</td>
<td>1,648,562</td>
<td>321,510</td>
<td>(1,331,810)</td>
</tr>
<tr>
<td>5</td>
<td>181,328</td>
<td>176,570</td>
<td>(4,758)</td>
<td>1,829,890</td>
<td>498,080</td>
<td>(1,336,810)</td>
</tr>
<tr>
<td>6</td>
<td>181,328</td>
<td>176,570</td>
<td>(4,758)</td>
<td>2,011,218</td>
<td>674,650</td>
<td>(1,336,568)</td>
</tr>
<tr>
<td>7</td>
<td>181,328</td>
<td>176,570</td>
<td>(4,758)</td>
<td>2,192,546</td>
<td>851,220</td>
<td>(1,341,326)</td>
</tr>
<tr>
<td>8</td>
<td>181,328</td>
<td>176,570</td>
<td>(4,758)</td>
<td>2,373,874</td>
<td>1,027,790</td>
<td>(1,346,084)</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>2,373,874</td>
<td>1,027,790</td>
<td>(1,346,084)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


1.4 U.S. exchange rate applies to all software costs.
### TABLE 8

**SUMMARY OF NON-INFLATED, NON-DISCOUNTED COSTS AND BENEFITS OF HIS OVER EIGHT YEAR PERIOD ASSUMING ONE-TIME CAPITAL COSTS 100% FUNDED BY OTHERS**

<table>
<thead>
<tr>
<th>YEAR</th>
<th>COSTS¹</th>
<th>BENEFITS</th>
<th>NET</th>
<th>CUM. COSTS</th>
<th>CUM. BENEFITS</th>
<th>CUM. NET</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1986 (1st 4 mos)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1986</td>
<td>29,416</td>
<td>0</td>
<td>(29,416)</td>
<td>29,416</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>1987</td>
<td>106,924</td>
<td>52,370</td>
<td>(54,554)</td>
<td>136,340</td>
<td>52,370</td>
</tr>
<tr>
<td>3</td>
<td>1988</td>
<td>170,200</td>
<td>92,570</td>
<td>(77,630)</td>
<td>306,540</td>
<td>144,940</td>
</tr>
<tr>
<td>4</td>
<td>1989</td>
<td>186,713</td>
<td>176,570</td>
<td>(10,143)</td>
<td>493,253</td>
<td>321,510</td>
</tr>
<tr>
<td>5</td>
<td>1990</td>
<td>181,328</td>
<td>176,570</td>
<td>(4,758)</td>
<td>674,581</td>
<td>498,080</td>
</tr>
<tr>
<td>6</td>
<td>1991</td>
<td>181,328</td>
<td>176,570</td>
<td>(4,758)</td>
<td>855,909</td>
<td>674,650</td>
</tr>
<tr>
<td>7</td>
<td>1992</td>
<td>181,328</td>
<td>176,570</td>
<td>(4,758)</td>
<td>1,037,237</td>
<td>851,220</td>
</tr>
<tr>
<td>8</td>
<td>1993</td>
<td>181,328</td>
<td>176,570</td>
<td>(4,758)</td>
<td>1,218,565</td>
<td>1,027,790</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>1,218,565</td>
<td>1,027,790</td>
<td>(190,775)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

¹.4 U.S. exchange rate applies to all software costs.
### Table 9

**Summary of Non-Inflated, Non-Discounted Costs and Benefits of His Over Eight Year Period Assuming All Costs 100% Funded by the Chilliwack General Hospital**

<table>
<thead>
<tr>
<th>YEAR</th>
<th>COSTS&lt;sup&gt;1&lt;/sup&gt;</th>
<th>BENEFITS</th>
<th>NET</th>
<th>CUM. COSTS</th>
<th>CUM. BENEFITS</th>
<th>CUM. NET</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>16,250</td>
<td>0</td>
<td>(16,250)</td>
<td>16,250</td>
<td>0</td>
<td>(16,250)</td>
</tr>
<tr>
<td>1</td>
<td>573,747</td>
<td>0</td>
<td>(573,747)</td>
<td>589,997</td>
<td>0</td>
<td>(589,997)</td>
</tr>
<tr>
<td>2</td>
<td>367,829</td>
<td>52,370</td>
<td>(315,459)</td>
<td>957,826</td>
<td>52,370</td>
<td>(905,456)</td>
</tr>
<tr>
<td>3</td>
<td>450,784</td>
<td>92,570</td>
<td>(358,214)</td>
<td>1,408,610</td>
<td>144,940</td>
<td>(1,263,670)</td>
</tr>
<tr>
<td>4</td>
<td>181,188</td>
<td>176,570</td>
<td>(4,618)</td>
<td>1,589,798</td>
<td>321,510</td>
<td>(1,268,288)</td>
</tr>
<tr>
<td>5</td>
<td>176,188</td>
<td>176,570</td>
<td>382</td>
<td>1,765,986</td>
<td>498,080</td>
<td>(1,267,906)</td>
</tr>
<tr>
<td>6</td>
<td>176,188</td>
<td>176,570</td>
<td>382</td>
<td>1,942,174</td>
<td>674,650</td>
<td>(1,267,524)</td>
</tr>
<tr>
<td>7</td>
<td>176,188</td>
<td>176,570</td>
<td>382</td>
<td>2,118,362</td>
<td>851,220</td>
<td>(1,267,142)</td>
</tr>
<tr>
<td>8</td>
<td>176,188</td>
<td>176,570</td>
<td>382</td>
<td>2,294,550</td>
<td>1,027,790</td>
<td>(1,266,760)</td>
</tr>
</tbody>
</table>

**TOTAL**

|      | 2,294,550       | 1,027,790 | (1,266,760) |

<sup>1</sup>. U.S. exchange rate applies to all software costs.
<table>
<thead>
<tr>
<th>YEAR</th>
<th>COSTS¹</th>
<th>BENEFITS</th>
<th>NET</th>
<th>CUM. COSTS</th>
<th>CUM. BENEFITS</th>
<th>CUM. NET</th>
</tr>
</thead>
<tbody>
<tr>
<td>1986 (1st 4 mos)</td>
<td>ø</td>
<td>ø</td>
<td>ø</td>
<td>ø</td>
<td>ø</td>
<td>ø</td>
</tr>
<tr>
<td>1986</td>
<td>29,416</td>
<td>ø</td>
<td>(29,416)</td>
<td>29,416</td>
<td>ø</td>
<td>(29,416)</td>
</tr>
<tr>
<td>1987</td>
<td>104,023</td>
<td>52,370</td>
<td>(51,653)</td>
<td>133,439</td>
<td>52,370</td>
<td>(81,069)</td>
</tr>
<tr>
<td>1988</td>
<td>165,710</td>
<td>92,570</td>
<td>(73,140)</td>
<td>299,149</td>
<td>144,940</td>
<td>(154,209)</td>
</tr>
<tr>
<td>1989</td>
<td>181,188</td>
<td>176,570</td>
<td>(4,618)</td>
<td>480,337</td>
<td>321,510</td>
<td>(158,827)</td>
</tr>
<tr>
<td>1990</td>
<td>176,188</td>
<td>176,570</td>
<td>382</td>
<td>656,525</td>
<td>498,080</td>
<td>(158,445)</td>
</tr>
<tr>
<td>1991</td>
<td>176,188</td>
<td>176,570</td>
<td>382</td>
<td>832,713</td>
<td>674,650</td>
<td>(158,063)</td>
</tr>
<tr>
<td>1992</td>
<td>176,188</td>
<td>176,570</td>
<td>382</td>
<td>1,008,901</td>
<td>851,220</td>
<td>(157,681)</td>
</tr>
<tr>
<td>1993</td>
<td>176,188</td>
<td>176,570</td>
<td>382</td>
<td>1,185,089</td>
<td>1,027,790</td>
<td>(157,299)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1,185,089</td>
<td>1,027,790</td>
<td>(157,299)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

¹3 U.S. exchange rate applies to all software costs.
### Summary of Present Value Costs and Benefits at Various Present Discounted Values

**One-Time Capital Costs**

<table>
<thead>
<tr>
<th>Year</th>
<th>3% Discount Rate</th>
<th>5% Discount Rate</th>
<th>7% Discount Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 1986 (1st 4 mos)</td>
<td>(17,501)</td>
<td>(17,501)</td>
<td>(17,501)</td>
</tr>
<tr>
<td>1 1986</td>
<td>(574,517)</td>
<td>(592,018)</td>
<td>(563,574)</td>
</tr>
<tr>
<td>3 1988</td>
<td>(341,943)</td>
<td>(1,248,001)</td>
<td>(322,772)</td>
</tr>
<tr>
<td>4 1989</td>
<td>(9,012)</td>
<td>(1,257,813)</td>
<td>(8,345)</td>
</tr>
<tr>
<td>5 1990</td>
<td>(4,104)</td>
<td>(1,261,917)</td>
<td>(3,728)</td>
</tr>
<tr>
<td>6 1991</td>
<td>(3,985)</td>
<td>(1,265,902)</td>
<td>(3,550)</td>
</tr>
<tr>
<td>7 1992</td>
<td>(3,869)</td>
<td>(1,269,771)</td>
<td>(3,381)</td>
</tr>
<tr>
<td>8 1993</td>
<td>(3,756)</td>
<td>(1,273,527)</td>
<td>(3,220)</td>
</tr>
</tbody>
</table>

**One-Time Capital Costs**

<table>
<thead>
<tr>
<th>Year</th>
<th>3% Discount Rate</th>
<th>5% Discount Rate</th>
<th>7% Discount Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 1986 (1st 4 mos)</td>
<td>(28,559)</td>
<td>(28,559)</td>
<td>(28,015)</td>
</tr>
<tr>
<td>1 1986</td>
<td>(51,422)</td>
<td>(79,981)</td>
<td>(49,482)</td>
</tr>
<tr>
<td>3 1988</td>
<td>(9,012)</td>
<td>(160,037)</td>
<td>(8,345)</td>
</tr>
<tr>
<td>4 1989</td>
<td>(4,104)</td>
<td>(164,141)</td>
<td>(3,728)</td>
</tr>
<tr>
<td>6 1991</td>
<td>(3,869)</td>
<td>(171,995)</td>
<td>(3,381)</td>
</tr>
<tr>
<td>7 1992</td>
<td>(3,756)</td>
<td>(175,751)</td>
<td>(3,220)</td>
</tr>
<tr>
<td>8 1993</td>
<td>(3,756)</td>
<td>(175,751)</td>
<td>(3,220)</td>
</tr>
</tbody>
</table>


1 U.S. exchange rate applies to all software costs.
TABLE 12
SUMMARY OF PRESENT VALUE COSTS AND BENEFITS AT VARIOUS PRESENT DISCOUNTED VALUES

1 ONE-TIME CAPITAL COSTS 100% FUNDED BY THE CHILLIWACK GENERAL HOSPITAL

<table>
<thead>
<tr>
<th>YEAR</th>
<th>3% DISCOUNT RATE</th>
<th>5% DISCOUNT RATE</th>
<th>7% DISCOUNT RATE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NET CUM. NET</td>
<td>NET CUM. NET</td>
<td>NET CUM. NET</td>
</tr>
<tr>
<td>0</td>
<td></td>
<td>(16,250)</td>
<td>(16,250)</td>
</tr>
<tr>
<td>1</td>
<td>(1986 (1st 4 mos))</td>
<td>(16,250)</td>
<td>(16,250)</td>
</tr>
<tr>
<td>2</td>
<td>(557,036)</td>
<td>(573,286)</td>
<td>(546,426)</td>
</tr>
<tr>
<td>3</td>
<td>(297,350)</td>
<td>(870,636)</td>
<td>(286,131)</td>
</tr>
<tr>
<td>4</td>
<td>(327,825)</td>
<td>(1,196,461)</td>
<td>(309,445)</td>
</tr>
<tr>
<td>5</td>
<td>(4,103)</td>
<td>(1,202,564)</td>
<td>(3,799)</td>
</tr>
<tr>
<td>6</td>
<td>330</td>
<td>(1,202,234)</td>
<td>299</td>
</tr>
<tr>
<td>7</td>
<td>320</td>
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<td>271</td>
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<tr>
<td></td>
<td>302</td>
<td>(1,201,301)</td>
<td>259</td>
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</table>

1 ONE-TIME CAPITAL COSTS 100% FUNDED BY OTHERS

<table>
<thead>
<tr>
<th>YEAR</th>
<th>3% DISCOUNT RATE</th>
<th>5% DISCOUNT RATE</th>
<th>7% DISCOUNT RATE</th>
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<tr>
<td></td>
<td>NET CUM. NET</td>
<td>NET CUM. NET</td>
<td>NET CUM. NET</td>
</tr>
<tr>
<td>0</td>
<td>1986 (1st 4 mos)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>(28,559)</td>
<td>(28,559)</td>
<td>(28,015)</td>
</tr>
<tr>
<td>2</td>
<td>(48,688)</td>
<td>(77,247)</td>
<td>(46,851)</td>
</tr>
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<td>3</td>
<td>(66,935)</td>
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<td>(147,324)</td>
<td>271</td>
</tr>
<tr>
<td>8</td>
<td>302</td>
<td>(147,022)</td>
<td>259</td>
</tr>
</tbody>
</table>

1.3 U.S. exchange rate applies to all software costs.
### TABLE 13

SUMMARY OF NON-INFLATED, NON-DISCOUNTED NET COSTS OF HIS OVER EIGHT YEAR PERIOD AS PERCENTAGE OF NON-INFLATED, NON-DISCOUNTED GROSS ANNUAL OPERATING BUDGETS FOR THE CHILLIWACK GENERAL HOSPITAL

<table>
<thead>
<tr>
<th>YEAR</th>
<th>100% FUNDED BY CGH</th>
<th>50% ONE-TIME CAPITAL COSTS&lt;sup&gt;1&lt;/sup&gt; FUNDED BY CGH</th>
<th>0% ONE-TIME CAPITAL COSTS FUNDED BY CGH</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.455%</td>
<td>1.841%</td>
<td>0.172%</td>
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<tr>
<td>2</td>
<td>1.924%</td>
<td>1.128%</td>
<td>0.319%</td>
</tr>
<tr>
<td>3</td>
<td>2.147%</td>
<td>1.308%</td>
<td>0.454%</td>
</tr>
<tr>
<td>4</td>
<td>0.060%</td>
<td>0.060%</td>
<td>0.060%</td>
</tr>
<tr>
<td>5</td>
<td>0.028%</td>
<td>0.028%</td>
<td>0.028%</td>
</tr>
<tr>
<td>6</td>
<td>0.028%</td>
<td>0.028%</td>
<td>0.028%</td>
</tr>
<tr>
<td>7</td>
<td>0.028%</td>
<td>0.028%</td>
<td>0.028%</td>
</tr>
<tr>
<td>8</td>
<td>0.028%</td>
<td>0.028%</td>
<td>0.028%</td>
</tr>
</tbody>
</table>

Mean = 0.962% p.a. 0.556% p.a. 0.140% p.a.

NOTE: 1985/86 approved budget adjusted annually to reflect additional costs incurred by HIS.<sup>1</sup>

<sup>1</sup>Actual costs can be determined from previous tables.
Interpretation and Presentation of Findings

Tables 1 and 2 detail the enumeration, quantification and valuation of one-time and on-going tangible costs for CGH's proposed HIS over an eight year period, forming the basis of the cost-side of the CBA. All pertinent costs were considered, but not all were included because they either did not apply to the current CGH proposal or they were inconsequential to the analysis.

Table 3 summarizes the non-inflated, non-discounted costs assuming that one hundred percent of the one-time and on-going costs would be funded by the hospital. Two U.S. exchange rates (1.3 and 1.4) are shown, applicable to all one-time and on-going software costs. An eight year period was used because it was felt this represented a realistic life-span of the system, as opposed to the five year period supported by the MOH. Not surprisingly, the most significant costs (largely due to one-time hardware and software) occur in the early years of the project, during the implementation staging. Thus, one way to ease the front-end burden is to spread out the staging of applications; however, the benefit streams will suffer accordingly.

Table 4 summarizes the anticipated savings for labor and non-labor tangible benefits after implementation of each stage of the HIS. Because these figures have been generated by the potential system users (participants in the entire
planning process) they are felt to be conservative, but valid, predictions. No one-time savings are shown because it is felt that any status quo microcomputer equipment would be re-used in other departments. Non-labor savings include elimination of BCHA data services and courier services and waste. For the most part, reduction of forms and printing costs were not included because it was felt that these costs would likely be offset by the printing and forms costs of the HIS. The greatest savings are in labor, particularly clerical as opposed to patient care related staff. Future labor cost-avoidances were not included in this study due to inherent excess capacity in the system and minimal expected growth in CGH's service activity. Had annual inpatient and outpatient activities been increasing significantly this would have been a much greater factor in the benefit case.

The table also demonstrates a significant jump in benefits commencing at Year Four, immediately following the implementation of all three stages. Notably, benefits in Nursing are not fully achievable until the Order Processing component becomes functional. These savings carry on in perpetuity and themselves approach the general operating costs of the HIS.

Table 5 demonstrates the summarized, non-inflated, non-discounted costs and benefits by year, by the five year cumulative total and by the eight year cumulative total based on a 1.4 U.S. exchange rate assuming the hospital
funds one hundred percent of the one-time capital costs.

Table 6 shows the present discounted values for the entire streams of tangible costs and benefits, using a three percent discount rate. The non-discounted streams are summarized in Tables 7-10 in order to test sensitivity against varying U.S. exchange rates and funding scenarios. It is important that the data be tabulated in this fashion for ease of calculation with respect to varying the discount rate. The effects of varying the discount rate at three percent, five percent and seven percent based on two U.S. exchange rates are shown in Tables 11 and 12.

Tables 7-10 demonstrate the effect that various funding scenarios have on the cumulative totals from the perspective of the hospital and the effect of the U.S. exchange rate. Not surprisingly, the analysis is very sensitive to funding of one-time capital costs. The U.S. exchange rate, while impossible to predict over the eight year period, clearly affects software purchase and support categories. The cost-side of the CBA, apart from the uncertainties of the U.S. exchange rates, would appear to be fairly tight. A deliberate effort was made to err on the side of over-costing if there was uncertainty with respect to actual costs. Examples of this included the conversion of patient record index cards, training costs, and on-going staff support. There are always uncertainties when costing; however, it was felt that a margin
for error would be appropriate.

From the perspective of the hospital, the best-case scenario would be one hundred percent funding by others of the one-time capital costs. While a more favourable cost-benefit ratio would be obtained by raising the discount rate, a three percent discount rate provides a margin of safety in terms of cumulative net costs. While a 1.3 U.S. exchange rate offers a better scenario, a 1.4 rate seems more realistic presently. Perhaps the most significant finding in CGH's analysis is that even if all one-time costs are one hundred percent funded by others, costs still exceed benefits over the eight year period, even from the narrow hospital-only perspective. Naturally, any benefits that do accrue hinge on the hospital's realizability of the predicted benefits through reductions in staffing levels. The hospital took a conservative estimate of these potential labor savings. Actual experience may increase the savings in this area.

As part of the overall decision-making process, a funding proposal is yet to be carried out using the previously referenced MOH guidelines. At the time of writing, the guidelines are still calling for a maximum expenditure level of 0.5 percent for community general hospitals into which category CGH falls. Based on the hospital's current approved gross annual operating budget of approximately seventeen million dollars, this upper limit amounts to approximately
eighty-five thousand dollars per annum for all costs associated with the HIS. The maximum expenditure level is apparently exclusive of any potential savings made possible through the benefit case; moreover, the level is an averaged one over the expected lifespan of the HIS, whatever that is deemed to be in the eyes of the MOH. While not stated explicitly in the guidelines, these are very important provisos for the hospital.

Table 13 shows three funding scenarios using the summarized non-inflated, non-discounted net costs as a percentage of non-inflated, non-discounted gross annual operating budget, assuming the latter remains constant over eight years. Of particular interest is the scenario depicting fifty percent of the one-time capital costs funded by CGH and fifty percent by others. The annual costs (net of benefits) averaged over the eight year period are just in excess of the 0.5 percent level.

While not presently included in the hospital's HIS proposal, other available application modules including Payroll/Personnel, Materials Managements, Nurse Acuity/Workload Management and Office Automation may be incorporated. The Payroll/Personnel application has been deliberately excluded due to the uncertainties posed by BCHSSS' recent endeavour to develop a Payroll/Personnel application which is purported to substantially reduce payroll processing costs to hospitals. Moreover, just how it will link to the activities of HLRA (if necessary, at all) is unknown. The Materials Management
module was not included largely because the HSP study, while identifying certain problems and potential solutions in this area, relegated it to a low priority. In retrospect, this was likely an error; however, it is correctable and will likely be incorporated as the project proceeds. Ironically, in both the Payroll/Personnel and Materials Management applications, substantial tangible benefits will accrue, thus placing the hospital in an even better cost-benefit position providing these incremental benefits exceed the incremental costs of these application modules. The additional application costs are marginal since there is excess capacity in the hardware configuration. The Nurse Acuity/Workload Management and Office Automation modules, while desirable applications, have not received high priority to date. Likely, this will change through iterative discovery\(^2\) once system users have had some experience with the initial applications. In fact, they would be a real boon to acceptance of the HIS. Thus, while the hospital has the basis for its long-range HIS plan and CBA, these too will evolve as hospital staff and others discover additional requirements. This points to the need, as in any planning process, for deliberate, periodic review and revision based on ever-changing political, economic, social and technological factors.

Moreover, future Meditech developments include Nurse Care Plans, Elimination of Nurse Kardex, Cost-Accounting...
Module and General Ledger Forecasting and Modelling, all of which are of interest to the hospital. Each will need to be evaluated for incremental costs and benefits.
Footnotes


CHAPTER VI
GUIDELINES FOR GENERAL USE BY
BRITISH COLUMBIA HOSPITALS

This chapter will focus on the development of generic guidelines to assist other hospitals in British Columbia in developing their own comprehensive cost-benefit cases. There are eight general steps that hospitals should follow as they consider moving from their status quo methods of handling information to an integrated HIS. Each of these eight steps will be discussed in order to build a practical framework, the processes for which are depicted in a flowchart (Figure 4).

While it is recognized that information systems planning is a complex, tortuous and difficult process, the divergent directions currently being taken by BCHSSS and BCHA do not assist hospitals in planning their own systems. It is important that hospitals understand the planning roles of both these organizations as they pertain to hospital computerization, and the questionable likelihood of their ultimate convergence. Moreover, it is important that hospitals recognize their own limitations and roles in the overall planning process. Failure to do so will result in costly, repetitious and ineffective planning on all sides. This is at least one reason why development of information systems continues to progress comparatively slowly in British Columbia hospitals as opposed to private industry or in other provinces. Other reasons are not entirely clear,
FIGURE 4
FLOW CHART DEMONSTRATING PLANNING, COST-BENEFIT ANALYSIS AND DECISION-MAKING PROCESSES

PLANNING PROCESS

START

PERFORM RFI

WILL HSP LIKELY IDENTIFY PROBLEMS AND ACHIEVE IDENTIFIED BENEFITS?

YES

NO

PERFORM RFI PROCESS BASED ON HSP RESULTS

IDENTIFY AND SELECT ALTERNATIVES TO MEET NEEDS

PERFORM RFP PROCESS

NO

YES

ARE ALTERNATIVES STABLE?

YES

NO

AT LEAST ONE ALTERNATIVE LEFT?

YES

NO

AT LEAST ONE ALTERNATIVE LEFT?

YES

NO

COST-BENEFIT ANALYSIS PROCESS

SELECT APPROPRIATE DISCOUNT RATE

CONDUCT PRELIMINARY ANALYSIS

CONDUCT SENSITIVITY ANALYSIS INCLUDING DISCOUNT RATES

INTERPRET FINDINGS OF CBA

IS FURTHER ANALYSIS OF ASSUMPTIONS AND UNCERTAINTIES REQUIRED?

YES

NO

INCREASE OTHER DECISION-MAKING CRITERIA

COMPARISON ALTERNATIVES ACCORDING TO DECISION-MAKING CRITERIA

SELECT BEST ALTERNATIVE

VALUE ALL COSTS AND BENEFITS FOR EACH ALTERNATIVE

CONFIRM PROJECT COSTS AND BENEFITS

IS STATUS QUO ALTERNATIVE?

YES

STOP

NO

but could include such factors as the level of knowledge of top management, hospital size, degree of past experience with computerization, availability of and confidence in outside resource experts, level of understanding of manual information processes and how these may be improved upon, inadequate funding for planning, developing, implementing and evaluating such systems and the extent of evidence purporting to support information systems. Each hospital will have to decide if it wants to use the services of outside information systems consultants, the example of HISs in other hospitals, and/or vendors to assist in each step of the planning process. Typically, most hospitals in British Columbia do not yet have adequate in-house human resources.

The main purpose behind using the HSP methodology is its structure/process approach which provides an excellent framework to facilitate management's understanding of the current information processes and associated problems. Moreover, it provides an opportunity to discuss these with the staff and facilitates identification and discussion of benefits associated with solving these problems through computerized solutions. This approach also fosters the concept of managing information as a corporate resource and further fosters the orientation of the project around the hospital's information handling processes. It does not preclude the use of other strategies for determining requirements; on the other hand, it accommodates
alternative approaches to identifying needs of respective hospitals which, according to Davis is necessary. HIS planning should be an eclectic exercise.

Identification of Problems

This step consists of gaining an understanding of how each hospital department/area manually processes information and, further, identifying any problems associated with such manual methods. This could take the form of direct observation, examination of existing documentation, questionnaires, interviews or any combination of such survey methods. Experience at CGH, with the assistance of BCHA, demonstrated that a combination of these methods, but predominantly questionnaires and interviews, proved to be effective. This approach gave the potential users of the HIS an opportunity to participate in the project and gave the HSP Project team an opportunity for face-to-face discussions and the use of probing questions where problems, needs, and perhaps solutions and priorities, appeared unclear. The users should know best how the manual, or any other, system works in their respective settings. The best that the HSP team can do is to try to understand it in the broader context of the hospital. To some extent, it may be beneficial to have some members of the HSP team initially somewhat limited in their understanding of respective user departments in order that necessary, perhaps naive, questions could be asked. It is essential,
however, that the team gain an understanding of the integrated flow of information in the broader context of the hospital system and its external interfaces. This does not necessarily mean that a gigantic flowchart must be constructed. On the contrary, to accommodate discussion and incremental understanding of how complex information is handled in the hospital, it behooves the project team to keep things as simple as possible at this stage. Of key importance is the incremental building of knowledge, understanding and commitment.

**Identification of Benefits**

This step requires a great deal of involvement by a person knowledgeable in the concept of automating manual methods and integrated information systems. Hospital staff generally understand how this relates to their own departments but typically have trouble understanding how such information relates to and flows throughout the rest of the hospital. At this point, it would be useful for the staff to attempt to subjectively quantify benefits they feel would accrue to their respective departments. Intangible benefits should also be identified. These should be recorded and, to some extent, used as the basis for a future benefit study which is so integral to the CBA stage of the planning process. Equally important at this stage is the need to lay the groundwork for staff commitment to these identified benefits. It should be
emphasized at this point that there must be an eventual translation of these identified benefits into realized savings. Hodge, in his promotion of information as a resource for hospitals, reiterates that it is the realization of planned benefits which is the purpose of implementing an HIS, a process which cannot be taken for granted. He warns that it is easy to forget why the HIS was put in place and that benefits do not occur automatically; rather, they occur through planned action. Thus, while identification of potentially realizable benefits is important during the planning stage, it is the realized benefits toward which the hospital must strive or the implemented HIS will be rendered practically useless.

Identification of Priorities

The next step consists of consolidating all the problems and benefits (tangible and intangible) into logical categories by functional area. At this stage of the analysis benefits, as perceived by the users, represent preliminary estimates based on a fully-integrated, hospital-wide information system in full operation which, in all likelihood, would require implementation over several years. This is not generally easy for users to grasp; however, the project team can facilitate its understanding.

This step also includes the need for using a structured priority ranking approach, the criteria for which may include tangible benefits, intangible benefits, technical
sequencing, and fit with hospital goals and objectives. This process is important and gives the project team an opportunity to develop a reasonable list of implementation priorities. The current MOH policy requires that financial systems should be hospitals' priorities when, in fact, hospitals, by their very goals, must consider clinical and related systems as the top priority. The importance of this step lies in the hospitals' ability to identify and justify their own needs and resultant priorities. Ultimately, this is important to the CBA because if a case cannot be made on a financial basis, and it becomes the overriding reason for rejection, it is essential that lesser, as opposed to higher, priorities be axed.

Request for Information Process

Once the identification of problems, benefits and priorities has been completed, the next step consists of finding potential solutions to the identified needs. This Request for Information (RFI) stage consists of surveying vendors to determine, on a subjective basis, who could fulfill the needs of the hospital. Essentially, this consists of selected vendors and the hospital exchanging pertinent information in an attempt to gain suitable matches of needs and solutions. Of the twenty-one RFIs sent out in the CGH context, nine were ultimately selected to receive RFPs. At this stage, some vendors will merely tell the hospital that they cannot or do not wish to be involved in submitting RFPs;
others will state that they can, which may or may not turn out to be the case. The turn-around period for this process should be in the order of three to four weeks.

**Request for Proposal Process**

This stage consists of choosing from the returned RFIs those vendors most likely able to meet the needs of the hospital. Typically, this consists of sending documentation similar to Appendix 7 to selected vendors. The following major categories of information should be included in the RFP:

- Introduction
- Hospital Profile
- General Requirements of the RFP
  - Conditions
  - Canadian users' list
  - Presentation/site visits timetable
- Technical Capabilities of Proposed Systems
  - Software
  - Hardware
  - Security
  - Data Integrity
- Cost/Benefits/Financing
  - One-time systems costs
  - Hardware installation costs
  - Software implementation and installation costs
  - Training costs
  - Conversion costs
  - On-going maintenance costs
  - Future modifications costs
  - Projected tangible and intangible benefits
  - Financing options
- Installation/Implementation/Live Timetable and Responsibilities
- Performance Bonds/Warranties/Contract
Evaluation Methodology and Timetable

Video Display Terminals and Printer Requirements

Detailed Systems Applications
- These are all of the applications as identified by the HSP in order of priority.

The typical turn-around time for the RFP is four to six weeks depending on the complexity of the proposal. It is important that this part of the planning process be well thought out because it will form the basis of the cost-side of the CBA and will save much repetitious work if the instructions are explicitly stated and followed by the responding vendors. Of particular value is to request the vendor to provide a spreadsheet of costs, say, for five or eight years. Such a breakdown will greatly assist in developing the cost-side of the proposal and save much redundancy of work during the CBA. The tradeoff here is between having the hospital provide as much structure as possible within the RFP, at considerable up-front costs but savings later, versus giving the vendors a freer hand, thus making comparison more costly and difficult. Figure 2 provides a useful framework for such costing. It is essential that the vendors clearly demonstrate whether they can provide the applications since this will form the basis of rejection, acceptance or possible future modifications.

The returned RFPs should be evaluated by an RFP Evaluation Team (or similar group) which could be a subcommittee of the hospital's Computer Advisory Committee.
This group's responsibility is to comprehensively review the returned RFPs in order to recommend a finalist vendor to the Computer Advisory Committee for its ratification. This process includes meeting with marketing representatives of the short-listed vendors and site visits to installed systems. It is absolutely essential that any uncertainties be clarified at this stage because they will form the basis of the cost-side of the CBA. At this point it is also useful to do a preliminary cost analysis if it can be ascertained that the benefit-side of the CBA is constant across vendors; if not, a preliminary CBA should be performed on each of the short-listed vendors. Criteria such as functionality (will the system do what is required?), integration (is it truly an HIS?), flexibility (is there room for future growth and modifications?) and cost (is it affordable, given the potential for realizable benefits?) should be used to assist the Evaluation Subcommittee in its selection process.

**Cost-Benefit Analysis**

Once the finalist vendor has been selected, it is necessary to perform a detailed CBA using all costs as identified and stipulated by the selected vendor, any other costs from the perspective of the hospital and all benefits as enumerated by the hospital. Typically, the vendor-supplied RFP response will not include all hospital costs, for example, electronic embosser, interfaces, staff training/
relief, staff support, hospital overhead, record conversions and so on. Thus, it is incumbent upon the analyst to further identify these costs and not totally rely on the vendor. The vendor has an interest in minimizing the apparent costs of the system and, in fact, expects the hospital to seek out and account for any pertinent additional costs. There is little point in asking the vendor for assistance in the benefit case. Care must be taken that this process is applied consistently across the short-listed vendors prior to selection of the finalist. The CBA should be performed using the generic framework discussed in Chapter III.

Decision-making Process

Once the CBA has been performed and the results clearly delineated, the planning stage reaches a major decision point: to proceed or not to proceed. If the former, should the whole system be considered or just part of it? To some extent this rests on the cost-benefit ratio which, if favourable, makes the decision-making process far easier. On the other hand, CBA is just part of the overall process of planning and not an end in and of itself. At this point, CBA remains a planning tool to assist decision-makers choose between the two original competing alternatives (status quo versus HIS) in order to allocate the hospital's scarce fiscal resources.

Decision-making is always fraught with problems of
change, uncertainty and ambiguity. The value of CBA lies in the ability of the analyst to first enumerate all costs and benefits relevant to the decision-making process. Then, by using sensitivity analyses, the impact of uncertainties can be assessed using various scenarios that the hospital might encounter. Again, these reflect only the monetary aspect of the decision and should be thought of as only one of several tools at the decision-maker’s disposal. If the CBA is unfavourable (that is, benefits less than costs) the hospital must reexamine the intangible benefits to determine if they justify the net costs, or examine the incremental costs and benefits associated with successive modules.

Part of the decision-making process may include considering which modules would be most appropriate or, perhaps, most favourable from a cost-benefit perspective if obtaining funding from other agencies is an issue. This largely depends on the maximum allowable expenditure levels, the scope of the project and the benefit case of the hospital.

**Government Approval and Funding Proposal**

The final step in the acquisition of an HIS in British Columbia consists of seeking government approval and securing funding via the MOH and/or the Regional Hospital District (RHD) or other sources. Of seeming great impact currently are the MOH's funding guidelines and computer policies discussed earlier. One of the most difficult hurdles
from the hospital perspective is adequate sources of funding for the one-time capital costs. The current guidelines allow for several options with respect to funding and, depending on the hospital's financial situation, the CBA should be tested for sensitivity to different funding scenarios. Perhaps realization of the benefit stream should be the *sine qua non* for receiving and retaining funding from the MOH, RHD or other sources. It would certainly be a built-in incentive for the hospital to provide accurate benefit cases and follow through with their claims. Of further import, however, is the fact that British Columbia hospitals have now pared staffing levels down so far that to effect further labor savings is very difficult. This negatively impacts the benefit-side of the CBA. In effect, the relatively efficient hospitals could be at a comparative disadvantage because their efficiency implies a harder time justifying the proposed HISs on net benefit grounds. Paradoxically, these are the very hospitals that require computerized information systems because they have the least staff to manage information. It is unlikely that the MOH approval of and funding for such systems will rest on such perceived inequity. Nonetheless, the hospital must make its best case for funding and, if there are uncertainties, the hospital should err on the side of higher costs and lesser benefits in order to provide some cushion for error in the post-implementation stages. It will be of no surprise
to the MOH that HISs may generate net costs as opposed to net benefits in individual hospitals. It is up to hospitals, however, to minimize those net costs by implementing the benefits (particularly labor savings) they purport will accrue and translating them into monetary savings through operating budget reductions. Then, and only then, will the MOH give credence to the claims of hospitals who embark on such programs in the name of cost-justification.
Footnotes


CHAPTER VII
SUMMARY AND CONCLUSIONS

For The Chilliwack General Hospital

The Chilliwack General Hospital, by following a planning framework, was able to identify several problems associated with manual and other status quo methods of handling information. Identification of benefits, tangible and intangible, has been possible through active participation by potential system users who are experts in their respective fields. Identification of priorities, from the perspective of the hospital, was done in consultation with the users and in concert with previously established hospital goals and objectives. From the perspective of the hospital, the process of working through problem identification, benefit identification and priority setting and solutions enabled staff to better appreciate and understand how the flow of information within the hospital occurs and gain a better understanding of how their respective departmental subsystems fit in the overall HIS.

The RFI and RFP processes proved to be effective methods of narrowing down the large number of potential vendors. The success of the RFP process lies, to a large extent, in how well the RFP is written and how well the vendor responds. While it is very time-consuming to write a detailed proposal there are great dividends during the analysis
of the returned proposals, especially if a spread-sheet has been requested and is properly completed.

During the evaluation of the RFPs, four main criteria must be considered—functionality, integration, flexibility and cost. In essence, the HSP stage of planning forms the basis of the cost-side of the analysis.

Once the finalist was selected on the basis of the four above-noted criteria, the former's ability to meet each application was once again thoroughly reviewed by the users. This was to ensure that any application that could not be supplied was not vital to the integrity of the entire system and could either be eliminated completely or modified prior to implementation.

Once the foregoing was completed, a comprehensive CBA was performed using several sensitivity tests including U.S. exchange rates, grant scenarios and discount rates. As the findings in Chapter V indicate, the best-case scenario from the perspective of the hospital is when the hospital obtains one hundred percent funding for all of the one-time costs. To allow a margin of safety, the higher U.S. exchange rate (1.4) was used and the lowest reasonable discount rate of three percent. The Payroll/Personnel module was not included even though it would have offered very substantial benefits in the long-run. The reasons for this have been identified earlier.
For the most part, CGH has focussed on labor-related benefits since this is the most significant part of the benefit-side of the analysis. In the HSP stage, potential benefits were identified by the users on a rather subjective basis. As the CBA proceeded these potential benefits were fine-tuned. They will ultimately be translated into saved work and thus dollars (realizable benefits). It is the hospital's full intention to ensure that these potential benefits are realized by taking the necessary action in the workplace such as staff reduction through attrition, use of part-time personnel and the like.

The decision-making stage, based on the CBA, was fairly straightforward. As discussed in Chapter V, a benefit case is not surfacing in Chilliwack General's particular case; however, from the CGH perspective it was not a matter of how much money could be saved, but rather how little money would be needed to obtain the greatest number of applications to meet the identified needs, the greatest extent of integration and the greatest degree of flexibility. By implication, there are a number of non-cost criteria that the hospital decision-making team holds out as of greater importance than cost. Nonetheless, this rests on the ability of the hospital to pay either through using surplus operating dollars or surplus capital dollars and obtaining as much funding for the hospital equipment as possible. Because the CBA was approached on the
conservative side a cushion for error exists. Moreover, realization of the identified benefits is fundamental to the success of the HIS.

Assuming that the MOH policy guidelines prevail, the hospital must face either altering its priorities to accommodate the priorities of financial management or justify proceeding with the non-financial priorities, commencing with the Admitting/Discharge/Transfer/Central Registry module. Paradoxically, this is one of the areas producing the least monetary benefits. Where the MOH has included Payroll/Personnel as part of the financial management applications this is one module that CGH has ironically, but justifiably, elected to exclude for the time being, even though its greatest monetary benefit case may lie in this application.

**Policy and Broader Implications for British Columbia Hospitals**

One of the most crucial questions facing hospitals is whether they will be able to justify their information systems on economic grounds in the future. If hospitals could so justify information systems, decision-making will become far easier. But those hospitals who are presently able to justify on economic grounds alone, can do so likely because of present status quo inefficiency.

The cost-benefit case will also be dependent upon the status quo systems in any given hospital. Hospitals who are still totally in the manual mode of handling information
likely have more staff and likely are able to generate more convincing benefit cases than those who have partially automated through stand-alone systems, thereby already effecting a reduction of staff in the departments housing the stand-alone systems. Thus, the cost-benefit process works against hospitals who are already running efficiently, be they with manual and/or stand-alone automated systems. Moreover, decisions are made on the basis of individual hospitals. It is unknown whether inter-hospital comparative analyses are done by the MOH as proposals are reviewed. It is likely that this is the case even though they do not have any way of knowing exactly what was included or excluded in the proposal by respective hospitals or by the consultants retained to do the study. What one hospital assumes, another may make explicit or ignore altogether.

Another challenge facing hospitals as they consider information systems will be the impact of Diagnosis Related Groups and the national Management Information Systems project of the Canadian Hospital Association. While to some extent these are independent projects, they are information-based and of necessity must integrate with the HIS to be of value to the hospital and to the users of such information. These two projects alone will force hospitals towards information systems sooner rather than later.

Another major factor is that of inter-hospital information systems. This subject is more often talked about
than acted upon, but for good reason. It is a complex venture requiring extreme cooperation from planning through implementation. The major advantage is in reduced system costs of both hardware and software; however, the trade-off is a potential loss of autonomy by the respective hospital users. For this reason alone this avenue is not yet being pursued too seriously.

While this thesis has concerned itself only with the perspective of the hospital, and the results are only from that perspective, further research is required from the perspective of the MOH, society as a whole and from the perspective of joint hospital ventures with respect to shared information systems. There is no question that computerized information systems in hospitals are here to stay and, like other technologies, may tend toward rapid proliferation. If this is the case, decision-makers must ensure that implemented systems, ceteris paribus, are the least-cost solutions and able to provide the greatest benefits, both quantitative and qualitative. This will only be possible if HISs are examined from a multi-perspective approach including the MOH, society and hospitals, jointly and individually. These would be useful topics for future research.

Another field of fruitful research is that of retrospectively examining the utility of such systems on delivery of health care services and on health status, again from the perspectives of the MOH, society and hospitals. Much techno-
logy continues to diffuse into the health care delivery system with little or no assessment. This is equally applicable to computerization in health care; thus, progress may be stifled in this area. To some extent it is unfortunate that some decisions are based solely on economic grounds. Perhaps this is one area where justification should not be based solely on the economic perspective. If this technology had a more direct impact on patient care and patient health status, decision-making would be easier; however, computerization is often wrongly perceived as an administrative rather than clinical function. Perhaps the greatest potential for tapping benefits lies in the further integration of HISs to biomedical technology, particularly diagnostic systems which are characterized by such equipment. Much of the recent equipment is already supplied with the potential and expectation of interfaceability to such systems.

Generally, it would appear that while much progress has been made in the area of HIS development and acceptance by the hospital environment, its full potential is far from being realized. Hospitals, by their conservative nature, are generally not prone to being on the leading edge of technological innovation, unless there is a direct clinical application. HISs are somewhere in between purely administrative and purely clinical applications. The greatest contribution that economic evaluation can make may lie in the area of assisting policy-makers in better understanding the advantages of HISs
in Canadian hospitals. To date there has been little available literature on such economic evaluation and none on validation. Hopefully, this thesis will fulfill its mission by providing the basis for a potential framework to assist hospitals commence proper economic evaluation before they implement systems and, further, will provide a basis for post-implementation evaluation and validation.
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Hospital Programs

Guidelines

for

Computer Funding Proposals

December 1984
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<th>Purpose</th>
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<tr>
<td>Funding Options</td>
<td>2</td>
</tr>
<tr>
<td>Procedures</td>
<td>3</td>
</tr>
<tr>
<td>Proposal Content</td>
<td>4</td>
</tr>
<tr>
<td>Sample Proposal</td>
<td>5</td>
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</table>
1. Purpose

The purpose of the "Computer Funding Proposal" is to:

- describe the system and equipment being requested;
- provide costs for hardware, software, installation and operation;
- identify benefits both tangible and intangible;
- provide a level of detail that is appropriate for the cost of the request (i.e. a submission for $1,000,000 system should contain significantly more detail than for a $30,000 system);
- if one exists, relate the specific request to the Information Systems Plan for the hospital. (In the long term (1986/87), each hospital should have in place a basic long range plan for data processing. It is expected that many of the hospitals will have very similar plans.)

2. Funding Options

- All computer equipment acquisitions shall be funded from capital funds.
- Items costing $10,000 or less should be funded from the hospital's Secondary Equipment Allocation or other hospital capital funds. Hospital Programs approval of these items is not required.
- Items costing over $10,000 can be funded in the following ways:
(1) 33 1/3% equipment grant and balance funded as a one
time operating to capital transfer (new policy).

(2) 33 1/3% equipment grant and balance funded by
the Regional Hospital District or other capital
resources (no change).

(3) 100% equipment grant based on recovery of operating
savings over 2 years. Savings revert permanently to
the Ministry of Health (no change).

3. Procedures

The following steps are to be completed if a hospital wishes to
acquire computer systems.

(1) Determine the feasibility of the project. Normally this
requires the completion of a Feasibility Study (this
includes a description of the current system, limitations
and constraints for proposed system, objectives of proposed
system, scope of proposed system, analysis of alternatives,
and recommending the most suitable solution). The amount of
work involved in the Feasibility Study is a function of the
cost and complexity of the system.

(2) Obtain Board of Trustee approval authorizing capital and
operating funding associated with the computer project.
The actual approval procedures for computer systems will
differ from hospital to hospital but will include approval
of the project (e.g. Computer Steering Committee), approval
of capital funds (e.g. Capital Appropriations Committee) and
approval of operating funds (e.g. Computer Steering
Committee).
(3) If the system costs less than $10,000, and funds are available within the Secondary Equipment Grant or other hospital capital funds, the hospital may proceed with the acquisition.

(4) If the system cost is greater than $10,000, the hospital must:
- prepare a Computer Funding Proposal and grant application HIA 39 (if an equipment grant is being requested).
- submit it to the Ministry for approval.
- if approval is received, proceed with the acquisition.

4.0 Proposal Content
The level of detail contained in the Computer Funding Proposal is a function of the cost of the equipment. For purposes of explanation the following levels have been defined:

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4.1 Information Required
The information required by the Ministry, broken down by level, is:
4.2 Computer Funding Proposal

All computer funding proposals should include the following sections:

(1) System Requested

This section should contain a concise statement of all the equipment and software you are planning to acquire or develop and its relationship to your information requirements.

(2) Options Evaluation

a) This section should describe the systems that were considered prior to making a decision on the system of choice. It is anticipated that hospitals will evaluate systems marketed by at least three alternatives. A comparative analysis of costs should be provided in chart format (see sample chart, page 7).

b) Please submit a copy of all price quotations with the funding proposal.

c) Full documentation should be provided to justify the system being requested as well as to explain the
reasons for rejecting the competitive system proposals.

(3) **Anticipated Budget Requirements and Cost**

**Justification: Business Case**

This section should be prepared in the form of a chart indicating the anticipated costs associated with your planned system. Equipment, software, staffing, facilities and miscellaneous operating costs for each year must be stated using a cost/benefit worksheet like that shown on page 8. This section should also state all the benefits which would be derived from the implementation of the system. All possible benefits should be quantified and compared to the anticipated possible costs. All tangible and intangible benefits should be listed at the end of this section. (The "Net Present Value" method of analysis will be used by the Ministry for review of the submission).

(4) **Planned Schedule**

A schedule of proposed activities must be included in this section.

(5) **Equipment Requirements**

This section should highlight the type of equipment you anticipate acquiring, including its growth potential. You should indicate the relationship of this equipment to your information systems objectives. If old equipment is being replaced, you should indicate disposal plans.
(6) **Software Requirements**

This section should indicate the software system you anticipate installing. The relationship of this software to the information systems objectives should be indicated. You should also indicate whether the software is to be developed in-house or acquired from alternative sources.

(7) **Staffing Requirements**

The number of staff members and their skill levels will probably change when you acquire computerized systems. Plans for the hiring, re-assignment and re-training of staff should be included in this section.

(8) **Facilities Requirements**

During the life of the system you may require some major or minor renovations to your facilities because of the equipment or staffing required. This information should be included in this section along with the anticipated costs.

(9) **Operating Costs**

This section should contain any anticipated operating costs that may be associated with the system which have not been outlined in the previous sections.
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<td>OTHER INTANGIBLE COSTS/BENEFITS</td>
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This section contains a sample proposal for a Dietary System costing $40,000. It is assumed a feasibility study has been completed and internal hospital approval has been received.

Computer Funding Proposal

Dietary System

Sample Hospital

A. System Requested

Sample Hospital is seeking funding approval for the acquisition of a Dietary System from B.C.H.S.S.S. running on a Micro VAX computer. The Dietary System consists of:

Hardware

- Micro VAX I
- 0.5 MB memory
- 31 MB fixed disk
- 2 removable floppy diskettes
- 2 VT220 terminals
- 1 LA100 printer $30,000

Dietary Software $10,000 $40,000

The Dietary software interfaces to our existing ADT System extracting pertinent patient dietary and location information. There are plans within B.C.H.S.S.S. to have the system interface to our Materials Management system
B. Options Evaluation

Three alternatives were considered for the Dietary System. The comparative cost analysis chart attached provides a breakdown of the costs for the various alternatives.

Alternative 1
Acquisition of a Dietary System from B.C.H.S.S.S. running on a micro VAX computer.
Advantages:
- interfaced to our existing ADT system.
- plot for interface to our Materiels Management.
- consistent with our architecture.
- the overall risk is low as the software is presently running in three hospitals in B.C.
- The ADT and Materiels Management systems were acquired from B.C.H.S.S.S. resulting in a greater level of compatibility.
Disadvantages:
- slightly higher cost than alternative 3.

Alternative 2
Acquisition of a Dietary System presently be developed by ABC company on Data General hardware.
Advantages:
- the ABC company has developed various other software packages for hospitals.
Disadvantages:
- higher cost than the other two alternatives.
- no interface exists to our ADT/Materiels Management systems.
- the application is in development and therefore is not proven.
- inconsistent with our architecture.
- the overall risk is medium to high as the system is partially written but not operational.

Alternative 3

Custom develop the Dietary system with our own staff on our existing VAX 11/750 hardware.

Advantages:
- our staff is familiar with the Dietary operation at our hospital.
- consistent with our architecture.

Disadvantages:
- an interface must be developed to our ADT and Materiels Management systems.
- the overall risk is high due to custom development of a system.

C. Anticipated Budget Requirements and Cost Justification

The cost/benefit worksheet attached provides a breakdown of all anticipated costs and benefits for implementing the new Dietary System. The following points should be considered when reviewing the worksheet:

- At present there are 3.0 staff completing the functions.
  With the automated system this number will be reduced
to 2.0. The system is planned for implementation mid-year which will result in 0.5 staff savings in the first year and 1.0 in subsequent year.

- Implementation costs include:
  - one week outside consulting time $2,000
  - room preparation 100
  - hardware 30,000
  - software 10,000
  $42,000

- At present it is estimated that $5,000 worth of meals are spoiled annually, due to patient movement or discharge.

Tangible benefits:
- the system will pay for itself in less than three years from implementation.
- staff will be reduced by 1.0 F.T.E.
- spoiled meals will be reduced by $5,000/year.

Intangible benefits:
- the system will allow for better meal planning.
- interfacing to the ADT will reduce nursing and clerical effort in tracking patient location.
- timely and accurate food production forecasting will be possible.
D. Planned Schedule

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<td>system test &amp; parallel</td>
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<tr>
<td>system in production</td>
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E. Equipment Requirement

The Micro VAX I was announced by Digital in the Fall of 1983. The hardware can be expanded to eight terminals and 65 MB of fixed disk storage, which will easily meet the Dietary System's long term requirements. The same Operating System (VMS) is used for all VAX line of computers from the Micro VAX at the low end to the VAX 11/785 at the high end. This will allow the software to be transferred to a larger machine in the future, if desired.

F. Software Requirements

The Dietary System software is being purchased from B.C.H.S.S.S. as a package. It is presently running in three hospitals in B.C. and the users are very pleased. The software interfaces to our ADT. As well, there are plans to interface it to our Materiels Management System.

G. Staffing Requirements

The two staff that will run the system will be trained by B.C.H.S.S.S. as part of the purchase price. The training
will cover the application as well as basic computer operations.

B.C.H.S.S.S. is available if additional technical support is required.

H. Facilities Requirements

Minimal.

I. Operating Costs

The estimated operating costs are:

- staff $40,000
- supplies 300
- hardware maintenance 3,000

$43,000
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</table>

**NOTATIONAL COMMENTS**

1. Estimated 2 man years for development at $30,000/year = $60,000.
2. Relative cost of hardware.
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In order to assist hospitals in planning computer acquisitions, Hospital Programs has developed the following computer policies.

Priorities

In considering requests for the approval of computer applications in hospitals the Ministry will consider the following priorities.

Of highest priority are those dealing with the financial management of the hospital such as:

1. General Ledger
2. Accounts Payable
3. Financial & Statistical Reporting (HLTH 1535)
4. Budgeting
5. Accounts Receivable (including M.S.P.)
6. Personnel/Timekeeping
7. Materials Management

The next level of priority will be those areas which will continue to improve the financial operation of the hospital and enhance the patient support areas. These will include:

8. Laboratory
9. Radiology
10. Pharmacy
11. Medical Record Abstracting
12. Admitting/Discharge/Transfer
13. Dietary Production Management
14. Fixed Assets
Proposals for any of the systems outlined above will be considered for capital funding by the Ministry through the normal equipment grant request procedures.

At the present time, the Ministry may not be in a position to provide capital funding for systems other than those of highest priority.

**Maximum Acceptable Expenditure Level**

Hospital Programs in conjunction with the Systems Development Staff of the Ministry have developed a series of formulas which are designed to indicate the maximum acceptable expenditure level for computers in hospitals.

While these formulas are still under review we are utilizing them to establish the maximum acceptable computer expenditure guideline in hospitals as follows:

- **major referral hospitals**: three quarters of one percent of gross operating income
- **community hospitals**: one half of one percent of gross operating income

Where hospitals choose to exceed these expenditure guidelines or to proceed with systems without Ministry approval the consequences of such action will not be funded.

**Accounting Treatment**

In order to be in a position to measure computer expenditures it is necessary that these expenditures be uniformly identified and reported.

The capital costs of computers which are purchased shall be recorded in the capital fund and amortized in the capital fund as outlined in Schedule A attached.
The operating and maintenance costs of owned computers together with the costs of computer services provided through service bureaus or the costs associated with leasing a computer shall be paid from operating funds and reported as outlined in Schedule B attached.

The total computer expenditures for each hospital will be determined by adding together computer expenditures recorded in the operating fund and the amortization of the capital cost of computer equipment recorded in the capital fund.

**Acquisition Alternatives for Computers and Computer Services**

Computer systems/services may be acquired and funded in any or all of the following ways:

- by the purchase of the service from a service bureau or data centre - such contracts will be paid through operating funds
- by leasing the equipment - such leases will be paid for through operating funds
- by purchasing the equipment - purchases shall be paid for by the hospital from capital funds. Hospitals may apply for equipment grants in the normal manner from the province and the Regional Hospital District.

All hospitals considering systems/services acquisitions costing more than $10,000 must obtain the approval of the Executive Director of Hospital Programs prior to entering into any agreement. Such approval will only be granted if the system proposal meets the stated priorities of the Ministry, is within the guidelines for the hospital and the hospital can clearly establish that they have selected the most suitable product for a reasonable price.
SCHEDULE A
REPORTING AND AMORTIZATION OF COMPUTER PURCHASES

A. REPORTING OF CAPITAL EXPENDITURES:

The following items should be included as capital costs.

1) Hardware (CPU, terminals, printers, storage devices, etc.)

2) Software (operating systems), professional tools (word processing, Lotus 1, 2, 3, etc.), application software (payroll, general ledger, etc.)

3) Training costs

4) Equipment installation fees

5) Preparation of computer site (cabling, wiring, raised floor, air conditioning, etc.)

B. AMORTIZATION

Capital expenditures which total less than $10,000 will be amortized in the capital fund in the year of acquisition.

If the components being acquired are part of a "computer system" the total of these expenditures will be treated as a single unit irrespective of the number of single purchases or that the individual items may have cost less than $10,000.

For expenditures totalling more than $10,000 the following formula will be used to calculate the annual costs to be amortized in the capital fund.

Total expenditures x .0167 for each month the system will be installed: e.g. for a computer system whose total capital costs for 1) through 5) above are $300,000, the annual cost would be $300,000 x .0167 x 12 months = $60,120.

- The .0167 is based on a five year lease cost.
SCHEDULE B

REPORTING OF COMPUTER COSTS IN THE OPERATING FUND

OPERATING COSTS

Items to be included in operating costs are:

1) Operating staff salaries plus benefits

   - Operating staff consist of systems staff including computer programmers and system operations staff. System end users would not be included.

2) Hardware and software maintenance charges

3) Purchased services, e.g. payroll services, microfiche costs, HMRI/PAS, etc.

4) Leasing payments and associated costs
### APPENDIX 3

**CHILLIWACK GENERAL HOSPITAL**

**SYSTEMS PLANNING PROJECT SEPT 84**

**LEGEND:**
- **X** Major responsibility and decision-making
- **X** Major involvement in the process
- **/** Some involvement in the process

### PROCESSES

#### PATIENT ADMINISTRATION:
1. **1.1 Patient identification**
2. **1.2 Admission/booking**
3. **1.3 Census control**
4. **1.4 Utilization review**
5. **1.5 Abstracting**

#### COMMUNICATION:
- **2.1 Order Entry**
- **2.2 Worklist control**
- **2.3 Results reporting**

#### TREATMENT PLANNING:
1. **3.1 Assessment/History Taking**
2. **3.2 Care preparation**
3. **3.3 Evaluation & Classification**

#### QUALITY ASSURANCE:
1. **4.1 Health Care Audit**
2. **4.2 Environmental Control**
3. **4.3 Quality Control**
4. **4.4 Standards Management**

#### MATERIALS MANAGEMENT:
1. **5.1 Purchasing**
2. **5.2 Production Control**
3. **5.3 (Supplies) Inventory Control**
4. **5.4 Capital Equipment Control**

#### FACILITY MANAGEMENT:
1. **6.1 Maintenance**
2. **6.2 Operations**

#### PERSONNEL ADMINISTRATION:
1. **7.1 Applicant Tracking**
2. **7.2 Skills, Privileges Control**
3. **7.3 Personnel Management**
4. **7.4 Position Control**
5. **7.5 Time Reporting and Analysis**

#### STAFFING MANAGEMENT:
1. **8.1 Staff Scheduling**
2. **8.2 Workload Management**

#### RESEARCH AND PLANNING:

#### PUBLIC RELATIONS MANAGEMENT:

#### MESSAGE MANAGEMENT:

#### FINANCIAL SERVICES:
1. **13.1 Budget & Financial Control**
2. **13.2 Accounts Payable Management**
3. **13.3 Accounts Receivable Management**
4. **13.4 Resource Costing**
5. **13.5 Statistics Management**
PROCESS DEFINITIONS

1.0 PATIENT ADMINISTRATION

The Patient Administration process deals with the information associated with administratively controlling the patient's case or encounter with the hospital. The process includes the subprocesses of patient identification, admission/booking, census control, utilization review and abstracting.

1.1 PATIENT IDENTIFICATION

This subprocess controls information regarding basic biographic and demographic data on each patient encountering the hospital. The main objective is to ensure that each patient appears only once in the patient identification index, or registry, regardless of the reason (inpatient, emergency, etc.) for the encounter.

Basic data includes name, sex, date of birth, address, telephone number, provincial health number, next of kin, area of birth, language, last date of update and, most important, a central hospital medical or health record number.

Functions include the registration of new patients, update and display of existing patients. Access to this data may be via patient's name (exact spelling or phonetically), medical record number or provincial health insurance number. Reports produced from this information could include a demographic distribution report, and a back-up master listing of all registered patients.

1.2 ADMISSION/BOOKING

The Admission/booking subprocess relates to the control of treatment and resources information, including beds, waiting rooms, OR rooms, describing each case or encounter with the hospital, regardless of the type of patient (inpatient, emergency, etc.). The information controlled describes the time and type of service for each case, and utilizes information from the patient identification process to identify each patient.
Basic information includes the expected and actual date/time of admission/arrival, service area, admitting/attending or consulting physician, arrival information, type of patient (emergency or elective) and insurance/payment data. Specialty information includes date/time of accident, isolation information and whether the appointment was on-time/late.

Functions include the admission/documentation of inpatient, outpatient and emergency encounters, printing of associated forms, checking and updating of insurance data, and updating of patient/physician information.

Access to this information could be via patient identification access methods, encounter/case number, or patient location/nursing census.

Reports could include the admission/discharge/transfer list, OR list, emergency list, appointment list, nursing station census, clergy reports, census summaries by unit and service (both daily and monthly). Daily appointment list by service and physician, and waiting list analysis.

1.3 CENSUS CONTROL

This subprocess deals with the reservation, assignment and tracking (transfer) of patients while in hospital. Basic information includes current and previous location, date and time of movement, status of beds, pending discharge, discharge status, and discharge data. Functions include display of nursing unit census, ambulatory rosters, available beds by service.

Access to this information could be via existing patient identification functions, or via admission/booking functions.

Reports include census listings, available beds and patient-days statistics.

1.4 UTILIZATION REVIEW

Deals with the review of a current patient's LOS and condition, together with assessment of an extended LOS and coordinating external resources in order to plan a discharge.

Basic data includes expected date of discharge, discharge needs for discharge planning, date of last/next review.

Reports include a list of patients scheduled for discharge or a list of patients scheduled for another review.
1.5 ABSTRACTING

The Abstracting subprocess is a summarization of data collected in patient treatment areas. Information from the patient identification and admission/booking processes are used to produce the abstract. In British Columbia this abstract generally meets the requirements of the Hospital Medical Records Institute. It also includes discharge summaries, O.R. notes, P.A.R. notes and transfer summaries for other agencies. In addition to information from patient identification, admission booking, procedures, physician and diagnosis information is also collected.

Reports from the Abstracting subprocess includes discharge statistics by service, physician, procedure, diagnosis, time, area, or combination thereof, or optional data as requested by hospital.

2.0 ORDER COMMUNICATIONS

The Order Communications process deals with the communication of medical information, both treatment and diagnostic, between the patient treatment areas and the support ancillaries of the hospital. This process includes the subprocesses of order entry, worklist control, result entry.

2.1 ORDER ENTRY

The Order Entry subprocess enables the display and communication of all patient related orders on a nursing unit or patient treatment area. The objective of the order entry process is to ensure complete and accurate information for order communication to either diagnostic or treatment departments, including integration with nursing care procedures.

Functions include the display, entry, verification, correction, cancellation, updating of all orderable procedures (including requests to borrow or review patient charts or x-ray films), along with the indication or required data for each procedure. Information may be printed in either the ancillary or the nursing unit. A key function of the order entry function is the ability to review and verify information.

Basic information includes procedure name, start date/time, and date/time, frequency, ordering physician, entered by, verified by, performing department and category of order. Textual order comments are also included. Specialty information includes strength, dosage and route. Accurate information from the patient identification and admission/booking processes is a prerequisite.

Access to order entry is via the patient identification or the census control. Reports or documents produced by this process include requisitions, flash cards, standard labels and order lists.
2.2 **WORKLIST CONTROL**

The Worklist Control subprocess utilizes information from the order entry process to support clerical service and care planning. Functions include the production of work station reports, collection schedules, and work status reports. The main factor of the Worklist Control subprocess is the control of the order status, from unverified order through to completed and documented result. Worklist Control closely interfaces with the result entry.

Access to this subprocess is via patient identification, department, order type of requisition number, or date and time by patient.

Functions include the recording of a completed test, cancelled procedure and indication of management control data. The key function of worklist control is the tracking and status checking of any order from entry through to completion and reported. Status indications should include all major stages in the order life cycle.

2.3 **RESULT-ENTRY**

The Result Entry subprocess deals with the entry of both textual and numerical information as a result of the performance of a diagnostic procedure. Reports produced from this subprocess include radiology impressions, cumulative laboratory summaries and interim laboratory results, medication profiles, therapy and dietary documents, and nursing care plans, as described under the care planning process. Information from the patient identification subprocess is used to accurately return results. Information from the order entry process describes the procedure. Basic information for the result entry process indicates date/time performed, performing/entering technologist, reading/staff physicians, fee code, date/time result entered, numerical and textual information. A result is entered for each occurrence of a procedure according to order entry information such as frequency and duration. Textual information may be entered by the result entry process via either standard phrases, pre-selected standard paragraphs or word processing capabilities. Numerical results may be entered by either selected values, direct entry by technologist, or via connection to instrumentation.

Access to the result entry subprocess is by patient identification or census control information, performing department or requisition number.

Functions include the result entry capabilities of text and numerical data, production for interim and final results at both ancillary and nursing locations updating of interim results, and display of all results by department or patient.
3.0 TREATMENT PLANNING

Deals with the assessment of patient treatment needs, preparation of a treatment or a care plan, followed by the evaluation of the plan. The documentation of a patient listing would be included in assessment, and evaluation could include classification of patients.

3.1 HISTORY TAKING AND ON GOING ASSESSMENT

Deals with the initial recording of health history and ongoing documentation of assessment notes regarding the patient current health problems.

3.2 CARE PLAN PREPARATION

Deals with the preparation and updating of a plan of care to deal with patient health problems documented during assessment.

3.3 EVALUATION AND CLASSIFICATION

Deals with the charting of patient progress relative to care plans, and the classification of the patient to determine the resources required and the patient's condition.

4.0 QUALITY ASSURANCE

This process deals with the measurement of outcomes versus standards to monitor quality of work performed. Included as subprocesses would be health care audit, environmental control, quality control and standards management.

4.1 HEALTH CARE AUDIT

Deals with the retrospective retrieval (random or complete) of departmental records or patient charts based on predetermined criteria, and comparison of these records/charts against standards.

4.2 ENVIRONMENTAL CONTROL

Deals with the recording of deficient structural standards (e.g. building deficiencies) and follow-up control. Areas covered may include fire prevention, security, radiation protection and infection control.
4.3 QUALITY CONTROL

Deals with the comparison of results versus standards to ensure the current accurate service functioning, e.g. equipment, instrumentation.

4.4 STANDARDS MANAGEMENT

Deals with the establishment and recording of required levels of operation and protocols in the areas of patient care, resource management and administration, the establishment and documentation of hospital and departmental policies and procedures. A key function is the ability to extract textual information on keyword or phrase basis, and to produce documents and manuals via text processing.

5.0 MATERIALS MANAGEMENT

This process considers the acquisition, production control, identification and maintenance of supplies and capital equipment.

5.1 PURCHASING

Process of ordering and obtaining materials and/or services necessary to carry out the hospital's operational functions, and ensuring favourable cost with quality and service. The process includes tracking of the request from order-entry to filling by purchasing, current outstanding orders by department are supported.

5.2 PRODUCTION CONTROL

Deals with the monitoring of work-in-progress which processes raw materials and produces finished goods.

5.3 SUPPLIES INVENTORY CONTROL

Process of establishing a supply of materials needed to carry out services, ensuring that appropriate levels of materials are available and distributed as requested.

5.4 CAPITAL EQUIPMENT INVENTORY CONTROL

Process of recording the receipt, identification and tracking, and possibly the recording of preventative maintenance of capital inventory items such as office equipment, kitchen equipment and patient related equipment.
6.0 FACILITY MANAGEMENT

This process deals with the management of buildings, grounds, building services and equipment to support the operation of the hospital. This may include some capital equipment.

6.1 MAINTENANCE

Deals with the preventative and on-going maintenance of the buildings, grounds, building service equipment and other capital equipment.

6.2 OPERATIONS

Deals with controlling and monitoring of the building service equipment.

7.0 PERSONNEL ADMINISTRATION

This process deals with the requisition and recruitment of staff, monitoring of skills and privileges, position control and general personnel management, including payroll related functions.

7.1 APPLICANT TRACKING

Deals with the request for recruitment and the tracking of applicants versus the request, through to filling the position.

7.2 SKILLS, PRIVILEGES CONTROL

Deals with the recording of skills, award recognition, qualifications and privileges of staff (employees, auxiliary members, board members, volunteers, medical staff) in order to ensure up-to-date and accurate records.

7.3 PERSONNEL MANAGEMENT

Deals with the recording of personnel data including demographics, benefit entitlement and utilization (e.g. sick or vacation use), union affiliation, seniority, performance evaluations and other labour relations matters.
7.4 POSITION CONTROL

Deals with the monitoring of authorized positions against authorized incumbents, including classifications, contract level, F.T.E. value, status.

7.5 TIME REPORTING AND ANALYSIS

Deals with the collection and entry of time for hours worked, paid or unpaid, and producing for a given period a pay cheque and/or labour distribution analysis.

8.0 STAFFING MANAGEMENT

The process deals with the preparation of staffing schedules or rotations for approved positions, assignment of additional staff to account for workload or relief situations and the recording of time, based on these schedules and assignments, in order to produce a pay cheque.

8.1 STAFF SCHEDULING

Deals with the creation and maintenance of staff schedules or rotations for approved positions within contract guidelines to meet baseline coverage.

8.2 WORKLOAD MANAGEMENT

Deals with providing staff with skill requirements to meet unexpected workload changes.

9.0 RESEARCH AND PLANNING

Deals with the documentation and analysis subsequent to research into alternate procedures, equipment and organization. Inherent in the process is the ability to extract and analyze information from patient, personnel, and resource (facility and financial) data bases. Modelling and forecasting may be components.

10.0 PUBLIC RELATIONS MANAGEMENT

Deals with the documentation and extraction of data related to correspondence, complaints, acknowledgements and fund-raising.
11.0 MESSAGE MANAGEMENT

Deals with the process of handling messages (not order entry related) which would include the switching, tracking and locating within the hospital. In many instances this is presently covered by telephone, paging systems, interdepartmental memos and messengers.

12.0 FINANCIAL SERVICES

This process deals with the collecting, recording and disbursing of funds for day-to-day operational functions of the hospital.

12.1 BUDGET AND FINANCIAL CONTROL

Deals with the establishment of budgets (hospital and departmental), and the comparison of actual costs/revenues with forecasted costs/revenues.

12.2 ACCOUNTS PAYABLE MANAGEMENT

Deals with the paying for supplies, services and equipment received.

12.3 ACCOUNTS RECEIVABLE MANAGEMENT

Deals with the collection and receipt of funds for services rendered by the hospital.

12.4 RESOURCE COSTING

Deals with the analysis of all costs involved in providing a service.

12.5 STATISTICS MANAGEMENT

Deals with the collection, analysis, and distribution of data relating to costs, revenue and performance (present or past) of services, departments or the hospital as a whole.
APPENDIX 5
CHILLIWACK GENERAL HOSPITAL
SUMMARY OF PROBLEMS IDENTIFIED THROUGH HSP STUDY
OCTOBER, 1984

Administration

- Inability to manage and forecast financial, physical and human resources due to poor utilization measurement tools.

- Difficulty accessing and forecasting cost comparative statistical data from all departments due to manual error prone format of reporting.

- Reports are not timely and therefore not reliable and often not useful (statistical and financial).

- Difficulty accessing and analyzing timely information from external sources (e.g. FCRHD, municipality, national, Telidon Info) influencing decision-making in the operation of the hospital.

- Inability to cost/forecast different scenarios in order to make decisions in regard to hospital operations. This is accentuated by late and inadequate budget info by the M.O.H.

- Difficulty accessing and analyzing up-to-date hospital-wide inventories due to lack of control of decentralized materials management system.

- Current status of equipment list and funding of same is hard to track (i.e. outstanding PO commitment status).

- Excessive volume, detail and repetition of required reporting information to external agencies is time consuming and frustrating due to lack of opportunity to present it in any other way.

- Difficulty in maintaining and accessing medical staff administrative matters such as privileges, policies, procedures, rules and regulations.

- Difficulty in maintaining and accessing hospital-wide policies and procedures.

- Excessive volume of clerical work; scheduling of meetings, space, equipment, etc. is time consuming.
- Current method of message management is slow and error-prone.

**Admitting/Switchboard**

- Repetitious recording of patient demographic data on repeat visits.
- When emergency visit transferred to inpatient or day care, etc. duplication of recording of patient demographic data takes place.
- Incomplete essential information for all categories of patients due to physical layout and accessibility to patient.
- Incorrect data and sometimes incorrectly filed patient index cards; requires need to verify or repeat information already recorded.
- Initially recorded incorrect data gets perpetuated to many departments.
- Much time spent on advising other departments of errors, changes and updated information and uncertainty remains that all departments affected have been notified and that they have all updated their lists.
- Incorrect ADT information and census data from ward reports causes frustration, wasted time, etc. to Switchboard, Admitting, Business Office and Health Records.
- Uncoordinated discharge procedure causes losses in collectable patient revenue and time-consuming effort on part of verification clerk.
- Volume and mechanics of message management through switchboard.

**Central Sterile Department**

- No control over distribution of stock creating sporadic demands on department.
- Not notified of supply shortage by Supply & Distribution and Linen Departments creating workload scheduling problems.
- Lack of communication between work-related departments causing scheduling problems.
Community Resources

- Getting up-to-date discharge/transfer information for Information Booth or TV Rentals.

- Access to statistical information for all areas of Service League, Auxiliary and Junior Volunteers.

Finance/Business Office

- Lack of integrated system within Business Office causes duplication of paperwork (e.g. when patient demographic information changes).

- Inaccurate documentation from Admitting/Switchboard because of misinformation, clerical errors, or lack of information leads to difficulty in processing record.

- Delays in billing and payments due because of these errors.

- Time consuming and error-prone manual system in Accounts Receivable.

Food Services

- Communication system is inadequate, impacting on all other problems.

- Production sheets: incomplete and inaccurate information from wards; complexity of information; too time consuming to compile; errors lead to costly food wastage and staff time.

- Diet lists: incomplete and inaccurate information from wards; changes not communicated in a timely fashion, e.g. diet changes, D/T; admissions; nourishment errors.

- Record keeping is not centralized causing record duplication, errors, inaccessibility, staff time wastage, space constraints.

- Menus: last minute changes cause rewriting of therapeutic and identifier menus (either true changes or human error). Transcribing errors and time involved in preparing menus.

- Poor inventory control system: voluminous paper work, human error/"eyeball" ordering, difficulty in getting up-to-date vendor prices for goods.
- In-house catering: unpredictability of demand, changes not communicated in timely fashion.

- Loss of potential revenue in cafeteria.

**Health Records**

- The current manual admitting process perpetuates patient information errors and causes excessive time to be spent by Health Records staff in identifying and correcting these errors.

- Inaccurate information on unit reports causes excessive staff time in correcting these errors and delays census distribution.

- Current master patient index file system results in clerical errors such as misfiling which causes staff to spend excessive time locating chart and index card.

- The current non-integrated patient encounter system creates major difficulties in obtaining complete patient records.

**Housekeeping**

- Lack of notification of patient discharges/transfers.

**Laboratory**

- Delays in order entry and results reporting due to awkward paper flow.

- Excessive time spent on manually monitoring quality control procedures.

- Human error in O.E./R.R. such as transcription, lost requisition reports and in-transit losses.

- Incomplete orders and mis-scheduling of lab tests.

- Technologists spend too much time on results transcription and verbal transmittal of results.

- Difficulty in locating inpatients due to transfer of incomplete data.
Laundry/Linen

- Time required by department head to compile operating statistics.

Long Term Care

- Lack of integrated information for each resident.
- Lack of accessibility of information for each resident.
- Lack of concise chronological summary of history of each resident.

Medical Staff

- Diagnostic results reporting is too slow; format is not easily readable; format is not cumulative; accessibility is difficult outside of normal hours due to distribution errors and geographic layout of hospital.
- Non-integrated patient records causes incomplete patient assessment.
- Lack of timely inpatient listings.
- Clinical reporting/reference retrieval is difficult to access, not current or not know if current.
- Lack of diagnostic department(s) worklist such as patient scheduling.
- Existing manual message management system is error-prone and sometimes slow.

Nursing Administration

- Present manual and uncoordinated information handling system results in hampered decision-making. Required information is absent, incomplete, inaccurate, inaccessible and slow. This is both intra- and inter-departmental. This results in costly decisions and poor relationships with other departments regarding such information as condition reports, census and statistical information.
- Repetitive nature of reporting mechanism is time consuming and error-prone.
- Present manual staffing system results in inaccurate schedules; changes not communicated between departments; lack of standard format for requests for changes.

- Lack of access to word processor results in slowness of producing typed materials (including policies and charting procedures, etc.) and circulating updated information.

- Lack of integrated inventory system.

- Inability to have immediate access to a workload index resulting in inappropriate decision-making at unit, care coordinator and administrative level.

- Lack of coordinated hospital-wide inservice education systems such as: library resources are limited; manual monitoring of staff utilization of services is time consuming; unable to assess learning needs; mechanism for unit-based programs and rapid feedback; no centralized accessible storage; lack of self-paced learning opportunities.

**Nursing - General**

- Present manual system of processing and retrieving laboratory orders is time consuming, error prone and repetitious. Reports are often difficult to access, non-comparative and not immediately cumulative.

- Present manual system of processing dietary orders is repetitive, error prone and time consuming.

- Demographic, biographic and clinical information needed to initiate care is often difficult to access, not timely and often incomplete.

- Present drug information is difficult to obtain (hours of service), slow to access and time consuming.

- Present timekeeping system is time consuming and error prone.

- Present system of scheduling relief staff is time consuming, error prone, difficult to maintain including such factors as: where last worked, when, how long, qualifications, preferences, recording of hours worked and availability.

- Present library system is inadequate including no access to list of educational materials, books, periodicals, audio-visual programs, location of equipment and references.
- Ill-defined decentralized stock distribution system causes confusion and time wastage.

- Present system of compiling statistics is time consuming.

- Present system of transmitting ADT information interdepartmentally and outside is slow and time consuming.

- Present manual system of care plan preparation and updating is time consuming, slow and often omitted.

- Repetitious information distribution is time consuming including clinical summaries, discharge, transfer, basic demographic information and daily reports.

- Difficult to access policies and procedures.

Nursing - Special

- Present manual system for processing and retrieving of laboratory orders is time consuming, error prone and repetitious. Reports are often difficult to process, non-comparative and not immediately cumulative.

- Present manual system for processing dietary orders is repetitious, error-prone and time consuming.

- Information needed to initiate care is often difficult to access, not timely and often incomplete, lost or incorrect.

- Present drug information is difficult to obtain (hours of service), slow to access and time consuming. No access to drug inventory with cross-references.

- Present timekeeping system is time consuming and error-prone.

- Present system of scheduling relief staff is time consuming, error-prone and difficult to maintain including where last worked, when, how long, qualifications, preferences, recording of hours worked and availability.

- Present library system is inadequate including: no access to list of educational materials, books, periodicals, audio-visual materials, location of equipment and references.

- Ill-defined decentralized stock distribution system causes confusion and time wastage.

- Present manual system of registering patient information in OR, OBS and Emergency is time consuming.
- Present system of compiling statistics in OR, OBS, ICU and Emergency is time consuming.

- Present system of transmitting ADT information interdepartmentally and outside is slow and time consuming.

- Present system of booking and scheduling OR, Emergency and other procedures is slow, time consuming, frustrating and incorrect.

- Present manual system of care plan preparation and updating is time consuming, slow and often omitted.

**Pastoral Care**

- Incomplete information such as religious denomination, on census list.

- Delay in receiving census list.

- No notice of discharges/transfers.

- Clerical staff have no access to word processor.

**Pathology**

- Incomplete requisitions such as date of birth and case history (inpatient, outpatient).

- Internal cross-referencing identification. Ambiguities on index cards for new and existing patients.

- Time consuming retrieval of workload status including: incomplete and where; complete and where.

**Personnel/Payroll**

- Incomplete, old and frequently inaccessible personnel information.

- Known and unknown errors in timekeeping.

- Known and unknown errors in benefits administration.

- Retrieval and analysis of information from general file is slow, error-prone, inaccessible and difficult to update.

- Employee termination files are inadequately purged and occupy too much space.
Pharmacy

- Slow transmittal of doctors' orders.
- Too much time spent preparing purchase orders and posting invoices to Purchasing.
- Too much demand on existing computer terminal.
- Lack of consensus for purchasing order format.

Physical Medicine

- Manual system of retrieving clinical and statistical information is hindering the effectiveness of the department including missing potential referrals; managing workload volumes and workload measurements; monitoring quality assurance; unable to do resource costing.
- Time consuming and unorganized inventory control system.
- Manual handling of requests from outside agencies/in-house requests is time consuming and error-prone.
- Current method of entering patient documentation is repetitious, time consuming and error-prone.
- Department not notified of patient ADT status.
- Delay in typing reports.

Plant and Maintenance

- Time involved in clerical functions.
- Limited preventive maintenance program.
- No centralized method of tracking inventory information and historical maintenance of building, building service and other capital equipment.
- Incomplete repair requisition forms and delays in receiving many of them.
- Not notified of all newly purchased equipment.
Purchasing/Supply & Distribution

- Inventory analysis: month-end pricing of goods issued versus inventory levels creates month-end clerical log jam.

- Inability to correlate price increases with inventory items causes incorrect reporting to business office and incorrect financial balancing.

- Inability to predict fluctuations in workloads through hospital.

- Purchase order requisitions inaccurate and incomplete.

Radiology

- Inaccurate and incomplete patient demographic and clinical information from other departments in hospital and other outside sources causes errors and duplication in Radiology files.

- Manual transportation of results reporting is too slow causing too much clerical and technical time being spent on finding and communicating the results.

- Untimely and erratic nature of bookings causes inefficient use of clerical and technical staff time.

- Delay in receipt of orders from nursing units causes delay in procedures.

- Too much time is spent in compiling and maintaining the patient index card file.

- Too much time spent compiling daily statistical data.

- Inadequate notification of patient ADT status.

- Repetitious recording of patient data.

- Difficulty in locating films out of department.

- Difficulty obtaining and correlating outside results with in-house.

- Difficulty retrieving historical/clinical information for quality assurance.
Social Work Services

- Insufficient and incorrect social and demographic information on patient chart.

- Delay and inaccessibility of patient data particularly emergency patients.

- Retrieving patient information for research/program evaluation time consuming and difficult.

- Lack of notification of patient ADT status.

- Repetitious recording of patient information.

- No access to word processing.
APPENDIX 6

CHILLIWACK GENERAL HOSPITAL

SUMMARY OF BENEFITS (TANGIBLE AND INTANGIBLE)
IDENTIFIED THROUGH HSP STUDY

OCTOBER, 1984

Administration

- Time saving in assembling information for senior management review.
- Improved ability to monitor the internal and external environments and plan/manage strategically.
- Possible administrative staff savings resulting in cost-avoidance.
- Better/improved ability to allocate financial, physical and human resources could result in improved productivity and savings in many departments.
- Improved ability to evaluate program effectiveness (including prospectively).
- Faster and more accurate decision-making and communication.

Admitting/Switchboard

- Improved and immediate access to patient data will enable time saving in admitting process.
- Greater dependence on patient data being accurate and complete in all departments.
- Definite but hard to define time savings in Switchboard, Admitting, Business Office and Health Records.
- Generally less frustration in departmental functions and procedures.
- Messages will be handled in a more timely and accurate fashion.
Central Sterile Department
- Department will run more efficiently, for example, increased sterilizing loads.
- Could plan to use alternate/substitute supplies to carry on workload.

Community Resources
- Information Booth will run more efficiently.
- Improved public relations.
- Improved revenue.
- More accurate and up-to-date profile of Community Resources enabling better planning, volunteer recruitment and administrative reporting.

Finance/Business Office
- Improved turn-around time from agencies responsible for payment.
- Reduce rejections by thirty-five percent.
- Staff time savings.
- Better use of personnel resources for orientation, vacation, sick relief and others.

Food Services
- Ward and dietary staff time savings.
- Less raw and processed food wastage.
- Better use of staff time.
- Patient satisfaction (gets right food at right time in right place).
- Improved patient safety.
- Better use of staff time.
- Savings in paper and printing costs (involves six documents).
- Could reduce annual inventory.
- Produce more accurate meal day costs which may impact revenues.
- Simplifies pricing of processed foods in, for example, hospital cafeteria.
- Increased revenue.

**Health Records**

- Staff time savings.
- Census prepared and distributed more quickly.
- Could provide more timely and comprehensive patient record retrieval resulting in higher standard of care.

**Housekeeping**

- More efficient use of on-duty staff (housekeeping and nursing).
- Will contribute to some future cost-avoidance.
- Increased staff morale.

**Laboratory**

- Reduction in LOS of some patients.
- Reduction in some surgical cancellations.
- Could save technologist time and provide for more reliable quality control and system of Delta checks.
- Reduction in number of repeat procedures.
- Reduces patient anxiety.
- Better use of technologist time resulting in reduction in number of tests sent out and increase in number of tests sent in.

**Laundry/Linen**

- Reduction of time required providing multiple use can be made of data to produce statistics.
Long Term Care

- Potential staff time savings.
- Better utilization of staff.
- Improved resident care.
- Potential monetary savings including: less WCB claims, increased safety to residents and less staff orientation time due to shorter time required.

Medical Staff

- Could reduce repeat orders.
- Could reduce some patients' LOS.
- Increases commitment to efficient resource utilization.
- Improves morale of patients and physicians.
- Reduced resource utilization in Laboratory and Radiology, for example.
- Assures continuity of patient care and improved patient relations.
- Improves patient care and reduced physician and hospital culpability.

Nursing Administration

- Staff time savings.
- Decision-making more appropriate and timely.
- Potential cost savings.
- Improved intra/inter departmental relationships.
- Improved quality assurance.
- Improved patient care.
- Greater consistency of nursing care.
- Stronger interdisciplinary sense and more appreciation of the hospital organization.
- More effective and cost-effective teaching methods.
- Provides a greater variety of programs.

**Nursing - General**

- Staff time savings.
- Improved patient satisfaction.
- Improved relationships between departments.
- Improved patient care and safety.
- Improved staff morale.
- More up-to-date nurses resulting in improved patient care, improved patient teaching and potential monetary savings (through in-house training).
- Decreased frustration.
- Improved quality assurance.

**Nursing - Special**

- Staff time savings.
- Ability to initiate appropriate care sooner.
- Improve patient-nurse-doctor relationship.
- Improve patient safety.
- Better relationship between nursing administration and staff on nursing units.
- Better opportunity for staff to participate in educational programs.
- Improved accessibility to staff and patient teaching tools.
- Improved use of resources leading to potential monetary savings.
Pastoral Care

- More time can be spent with clients.
- Prioritize clients needing to be seen.
- Provide timely lists to community clergy thereby improving morale, public relations and quality of care.

Pathology

- Savings in clerical time.
- Better use of Pathologist time.
- Better and more timely statistical information for internal purposes, for example, accurate documentation of biopsies.

Personnel/Payroll

- More accurate and up-to-date reports.
- Problems could be acted on more quickly.
- Better use of all staff.
- Cost savings.
- Greater employee awareness of benefits.
- Reduction of employer liability.
- Personnel functions could be run more efficiently.
- Space will be saved.

Pharmacy

- Improved patient care, especially with timeliness of medication distribution.
- Staff time savings.
- Flexibility of scheduling and workloads.
- Improves purchasing process.
Physical Medicine
- Department staff time savings.
- Better utilization of staff.
- Better forecasting of patient treatment priorities and resource costing.
- Reduction in potential errors in processing requests for information.
- Better quality assurance (especially related to charting).
- Timeliness of reports increases quality of care.

Plant and Maintenance
- Savings in department head and staff time.
- More detailed worklists and improved workload management.
- Less equipment breakdowns.
- Reduction in equipment downtime.
- Decreased turnaround time for repairs.
- Improved coordination with Purchasing department.

Purchasing/Supply & Distribution
- Staff time savings.
- Work up-to-date.
- More accurate financial reports.
- Allow Director of S & D more time to negotiate better deals with vendors.
- Streamline paper flow from purchase request to accounts payable.
- Potential savings in communication and transportation costs for unexpected requests.
- Decreased turn-around time.
- Cost savings in returning incorrect goods.

**Radiology**
- Savings in clinical time.
- More timely basis for decision-making for patient care.
- Will save reading reports on telephone.
- More efficient use of time.
- More expedient order communication process.
- Savings in filing time.
- More accurate filing system.
- Savings in clerical time.
- Better utilization of technologist time.
- Minimization of delays in patient procedures and repeat Radiology procedures.
- Improved quality assurance of in-house results reporting.

**Social Work Services**
- Time savings.
- More expedient interventions.
- More efficient and effective use of social work skills.
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1. INTRODUCTION

Recognizing that hospital staff spend, as a conservative estimate, approximately 25% of their working time processing information and that the current manual methods of handling or processing information could be made more effective and efficient through computerization, the Board of Trustees of the Chilliwack General Hospital approved formation of a Hospital Systems Planning Project Team in the Fall, 1984. The Project Team, comprised of senior management of the hospital and representatives of the British Columbia Health Association used a modified version of a Business Systems Planning methodology and adapted it to our hospital environment.

This methodology has facilitated and fostered the concept of participative planning throughout the organization and the Project Team feels it accomplished its mandate for this stage of planning. Participating staff have been very cooperative and candid. Their input is integral to the success of this study and, indeed, to the ultimate success of proposed solutions through computerization.

Through a general staff orientation meeting, questionnaires and interviews, the Project Team was able to gain an overall understanding of the degree of involvement of various departments in information processing activities. More importantly, major problems and benefits (tangible and intangible) were identified, documented and analyzed.

Following this, a prospective evaluation, using the major components of cost-benefit analysis combined with a structured priority ranking approach, was undertaken. This enabled the Project Team to rank priorities according to financial benefits, intangible benefits, technical importance/sequencing and fit with hospital goals. Overall priorities were then ranked.
The study, which was completed November, 1984, verified that the current manual methods of handling information are ineffective and inefficient, although this is not unique to the Chilliwack General Hospital. If the identified problems can be solved, thus leading to greater effectiveness and efficiency in information processing, the hospital will realize significant benefits. The solutions to these problems and attainment of identified benefits are possible through modular computerization of the identified manual information processing problems. Because there has been a high level of user participation the likelihood of successful implementation is greatly enhanced.

It was beyond the scope of the report to investigate the pros and cons of the four general approaches to technical planning of computerized information systems: in-house; turnkey; shared service; and facilities management. It was our intention that the contents would facilitate discussion and decisions with respect to the most appropriate way to approach technical planning and the implementation of the best system. Equally, the report did not address the four general approaches to systems implementation: non-integrated stand-alone; modular; distributed processing; and total, fully integrated systems. Again, it was intended that the contents would facilitate discussion and decision-making with respect to the best approach to technical implementation of the systems.

The report, along with its recommended staging of computerized solutions, was approved by the Board of Trustees in December, 1984. Patient registration and tracking, financial and clinical applications were the highest priorities.
The applications that must be addressed in this proposal include:

1. Central Registry/Admission, Discharge, Transfer
2. Outpatient Registration
3. Accounts Payable, General Ledger, Accounts Receivable
4. Clinical Laboratory/Pathology
5. Radiology
6. Pharmacy
7. Food Services
8. All Nursing Units/Emergency/Operating Room/Day Care Surgery/Ambulatory Care/Nursing Admin.
9. Extended Care Unit
10. Health Records/HMRI

11. Pastoral Care
12. Social Work Services
13. Physical Medicine
14. Administration
15. Medical Staff
16. Housekeeping

17. Payroll/Personnel
18. Office Automation/Word Processing
19. Parkholm Lodge Intermediate Care Facility
20. Future modules (interfaceability only)

Address and COST OUT IN FULL these application as complete modules

Address these applications as future capabilities only. DO NOT COST OUT
2. CHILLIWACK GENERAL HOSPITAL PROFILE

2.1 Current

The Chilliwack General Hospital is a general community hospital 100 km east of Vancouver, which serves an area population of approximately 60,000 people. We are situated in the Fraser Cheam Regional Hospital District in which the Fraser Canyon Hospital is also located. Our current rated capacity is 181 acute care beds and 95 extended care beds. (Additionally, Parkholm Lodge is physically attached to the hospital and houses 90 intermediate care beds; however, it is not included in the present proposal). The hospital employs approximately 430 full-time equivalent staff and has an annual operating budget of approximately $16 million. Some $35,000 is currently spent annually on data processing activities largely associated with the Computer Services of the British Columbia Health Association (BCHA). These activities include Payroll/Personnel, Data Entry Programs such as Accounts Payable, General Ledger and Medical Services Plan Accounts Receivable. We also subscribe to the Hospital Medical Records Institute (HMRI) Medical Abstracting Program through BCHA. We have word processing ability (IBM Displaywriters) in Health Records and Administration. Payroll is piloting an Alternate Time Code (ATC) Data Entry System in conjunction with BCHA using the IBM PC. The Business Office uses an IBM PC for Direct Data Entry for Accounts Payable/General Ledger/Medical Services Plan - Accounts Receivable. An IBM XT has just been acquired for Pharmacy as part of a revised Drug Distribution System. An IBM PC has been recently installed in Health Records to facilitate automated patient medical record abstracting with HMRI. Administration uses an IBM AT for centralized RJE for Payroll/Health Records, Finance and micro-based decision support. We are also considering subscribing to the BCHA "Information Centre" using structured Query Language (SQL). This will allow us query and reporting capabilities using our data in the BCHA mainframe computer system for Medical Abstracts/Utilization, Finance and Payroll.
SUMMARY OF INPATIENT, OUTPATIENT, DAY CARE AND EMERGENCY VISITS
TO THE CHILLIWACK GENERAL HOSPITAL FOR THE PERIOD APRIL 1, 1984
- MARCH 31, 1985

<table>
<thead>
<tr>
<th>PATIENT DAYS</th>
<th>AVERAGE LENGTH OF STAY</th>
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<tbody>
<tr>
<td><strong>Acute Care</strong> 47821</td>
<td><strong>Acute Care</strong> 7.6</td>
</tr>
<tr>
<td><strong>Extended Care</strong> 34778</td>
<td><strong>Newborn</strong> 4.1</td>
</tr>
<tr>
<td><strong>Newborn</strong> 3397</td>
<td><strong>Newborn</strong> 56.4</td>
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</table>

<table>
<thead>
<tr>
<th>ADMISSIONS</th>
<th>% OCCUPANCY</th>
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<tbody>
<tr>
<td><strong>Acute Care</strong> 6171</td>
<td><strong>Acute Care</strong> 80.6</td>
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<tr>
<td><strong>Extended Care</strong> 59</td>
<td><strong>Extended Care</strong> 100.3</td>
</tr>
<tr>
<td><strong>Newborn</strong> 836</td>
<td><strong>Newborn</strong> 56.4</td>
</tr>
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</table>

<table>
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<th>DISCHARGES</th>
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</thead>
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<tr>
<td><strong>Acute Care</strong> 6164</td>
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<tr>
<td><strong>Extended Care</strong> 59</td>
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<td><strong>Newborn</strong> 833</td>
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<table>
<thead>
<tr>
<th>EMERGENCY/AMBULATORY CARE</th>
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</thead>
<tbody>
<tr>
<td><strong>Emergency visit</strong> 20881</td>
</tr>
<tr>
<td><strong>Laboratory visits</strong> 6253</td>
</tr>
<tr>
<td><strong>Laboratory tests</strong> 15000 (est.)</td>
</tr>
<tr>
<td><strong>Radiology exams</strong> 5563</td>
</tr>
<tr>
<td><strong>Ultrasound exams</strong> 1348</td>
</tr>
<tr>
<td><strong>Psychiatric Day Care visits</strong> 1828</td>
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<tr>
<td><strong>Diabetic Day Care visits</strong> 278</td>
</tr>
<tr>
<td><strong>Dietetic Counselling</strong> 373</td>
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<td><strong>Physiotherapy visits</strong> 4747</td>
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<table>
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<th>INPATIENT DIAGNOSTIC/ THERAPEUTIC</th>
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<tr>
<td><strong>Radiology exams</strong> 6080</td>
</tr>
<tr>
<td><strong>Ultrasound exams</strong> 333</td>
</tr>
<tr>
<td><strong>Laboratory tests</strong> 66000 (est.)</td>
</tr>
<tr>
<td><strong>Pathology specimens</strong> 1500 (est.)</td>
</tr>
<tr>
<td><strong>Physiotherapy attendances</strong> 8933</td>
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<tr>
<td><strong>Occupational Therapy attendances</strong> 2027</td>
</tr>
</tbody>
</table>
2.2 Future

The Chilliwack General Hospital is currently awaiting approval from the Ministry of Health to proceed with construction of a $26 million Phase I Redevelopment Project which replaces the majority of our existing acute care beds, Operating Rooms, Recovery Room, Radiology, Emergency, Ambulatory Care, Doctors' Lounge, Admitting/Switchboard, Purchasing, Supply & Distribution and Central Supply Department. As well, there will be provision for a Physical Medicine Satellite department, expanded Boiler Plant and expanded Food Services department.

The following excerpt from our Master Plan will assist you in understanding the proposed growth pattern of the hospital. Thus, the vendor must appreciate and account for the eventual relocation of video display terminals and printers in the affected departments/areas.
OUTLINE OF MASTER PLAN

There are three phases. The $26 million project refers to Phase I only.

Phase One
This includes all the work prior to new construction and relocation such as: changing Menholm Street and adding to the ICU. Then, in order to off-load the beds and diagnostic services so that renovation can take place, the major piece of new work is commenced. This contains all acute Nursing service beds, Emergency, Obstetrics/Nursery, Operating Rooms, PAR, Radiology, Ambulatory Care, Admitting/Switchboard, Main Lobby/Entrance, Purchasing/Supply & Distribution. The renovation of several existing areas occurs simultaneously. When the new block is completed, beds, surgery and the other departments are relocated.

Phase Two
This is divided into four stages or can be completed as one whole program up to the projected requirements. The first stage of work generally includes renovation to vacated areas and relocation of such departments as Social Work Services, Administration and staff facilities. The next stage includes new construction by adding to areas which have been relocated in the earlier stage to provide for departments such as Laboratory, Pharmacy, Psychiatry, Clinical Data Centre and Medical Staff. The third stage includes renovation and relocation of further vacated spaces to accommodate Physical Medicine and Occupational Therapy, Respiratory Technology and Dental/Head Unit. The final stage provides for expansion to Food Services, Psychiatric Day Care and Extended Care if appropriate.
Phase Three

All the work in Phase Three is the expansions of departments to carry the hospital workload to the cap-off phase. It would be developed as a series of stages at a later date but include such new construction as additions to the Inpatient Building, Laboratory, Food Services, Radiology, Emergency, Physical Medicine/Occupational Therapy, plus filling of shelled spaces for ICU/CCU, Surgical Day Care, Outpatient Clinics, staff facilities and Central Supplies.
3.1.6 The proposal must be developed using the same methodological framework, numbering and sequencing as this document in order to facilitate comparative evaluation of the proposals.

3.1.7 The vendor must include an executive summary including the major components of this proposal.

3.1.8 This is a Request for Proposal only and in no way obligates the Chilliwack General Hospital.

3.2 Canadian Users List

3.2.1 The vendor must supply a list of Canadian hospitals currently using all of the applications in the proposed totally integrated system (Article 1, Items 1-10).

3.3 Presentation/Site Visits Timetable

3.3.1 Vendors who have been short-listed following our evaluation process must arrange for presentations and/or site visits to take place during the period June 28, 1985 - July 10, 1985 inclusive. (Short-listed vendors will be advised by telephone by June 27, 1985).
4. TECHNICAL CAPABILITIES OF PROPOSED SYSTEMS

4.1 Software
   4.1.1 Describe operating systems
   4.1.2 Describe application systems
   4.1.3 Describe future developmental plans and outline what major modules you intend to market within the next 5 years

4.2 Hardware
   4.2.1 Describe computer room design considerations
   4.2.2 Describe video display terminals and printers required for these applications
   4.2.3 Describe upgradeability
   4.2.4 Comment on response times during peak periods
   4.2.5 Describe future developmental plans

4.3 Security
   4.3.1 Describe methods used to ensure confidentiality and security of information

4.4 Data Integrity
   4.4.1 Describe techniques used to ensure integrity of the data base
5. COSTS/BENEFITS/FINANCING

In order to assist us in evaluating the proposals, please consolidate the following items into a spread sheet summary over a five (5) year span, April 1, 1985 - March 31, 1990. Use categories identical to those below and break down the items as much as possible. Do not provide costs of future applications referred to in Article 1 - Items 11-18.

5.1 One time systems costs (show taxes separately where applicable)

5.1.1 Software
   5.1.1.1 Operating Systems
   5.1.1.2 Applications
   5.1.1.3 Interfaces
   5.1.1.4 Any other

5.1.2 Hardware
   5.1.2.1 Uninterruptable power supply
   5.1.2.2 Terminals
   5.1.2.3 Printers
   5.1.2.4 Embossers
   5.1.2.5 Interfaces to Lab equipment
   5.1.2.6 Any other

5.1.3 Licenses

5.1.4 Communications (internal and external to the hospital)
   5.1.4.1 Multiplexers
   5.1.4.2 Modems
   5.1.4.3 Wiring
   5.1.4.4 Any other
5.2 Hardware installation (include likely building renovations)
   5.2.1 In-house, one-time installation staff support
       (describe likely duties for each position, anticipated
        number of FTEs and expected remunerations at current
        B.C. wage rates)

5.3 Software implementation and installation

5.4 Training
   5.4.1 Training (include all relevant travel requirements,
                  manuals and audiovisual aids)

5.5 Conversion costs
   5.5.1 Conversion from manual to computerized health records
         index. We wish to convert our entire file of
         approximately 87,000 cards generated over the past
         28 years (describe how this will occur).

   5.5.2 Conversion from current automated financial system to
         new one (describe how this will occur).

5.6 On-going maintenance (software and hardware)
   5.6.1 Lease line costs, if applicable
   5.6.2 Monthly phone costs for data transmission and on-going
         voice communication
   5.6.3 Computer room services (electrical, mechanical, plumbing,
       etc.)
   5.6.4 In-house, on-going staff support (describe likely duties
       for each position, number of FTEs, expected remuneration
       at current B.C. wage rates)
   5.6.5 Vendor and/or third party support
   5.6.6 Describe service facility arrangements and proximity to
         hospital
   5.6.7 Comment on need for and location of spare equipment/parts
5.7 Describe policy regarding costs of future modifications/enhancements after implementation of initial applications.

5.8 Describe projected tangible and intangible benefits based on previous accomplishments in similarly sized Canadian community general hospitals.

5.9 Describe financing options available to the hospital.
6. INSTALLATION/IMPLEMENTATION/LIVE TIMETABLE AND REQUIREMENTS

6.1 Describe likely timetable for each stage and module (see Table 2)

6.2 Describe vendor manpower and other responsibilities for each stage and module

6.3 Describe hospital manpower and other responsibilities for each stage and module

6.4 Describe the orientation/training programs supplied by vendor for each stage and module

TABLE 2

<table>
<thead>
<tr>
<th>STAGE I</th>
<th>Anticipated implementation period</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADT, Central Registry, Health Records/HMRI, Outpatient Registration</td>
<td>8 months</td>
</tr>
<tr>
<td>G/L, A/P, A/R</td>
<td></td>
</tr>
</tbody>
</table>

| STAGE II                                          |                                   |
| Clinical Laboratory/Pathology                      |                                   |
| Order Entry/Reporting/Communications               | 8 months                         |

| STAGE III                                         |                                   |
| Radiology, Pharmacy                               |                                   |
| Food Services                                     | 12 months                       |

7. PERFORMANCE BONDS/WARRANTIES/CONTRACT (Software and Hardware)

7.1 Describe performance assurances and system warranties. Attach samples

7.2 Attach sample contracts

7.3 Attach copy of most recent corporate financial statement
8. EVALUATION METHODOLOGY AND TIMETABLE

8.1 Following the June 21, 1985 deadline for receipts of the RFPs, the hospital's Computer Advisory Committee will evaluate each proposal in detail using the methodological framework contained herein. Thus, if each vendor follows this framework, the evaluation process will be more accurate and greatly expedited.

8.2 Short-listed vendors will be selected and contacted by telephone by June 27, 1985.

8.3 On-site demonstration/presentations and/or site visits must take place during the period June 28, 1985 - July 10, 1985 inclusive.

8.4 A finalist will be selected by July 11, 1985 and a recommendation made to the Board of Trustees of the Chilliwack General Hospital for consideration.

9. VIDEO DISPLAY TERMINALS AND PRINTERS

9.1 Please comment on number and distribution of video display terminals, e.g. departmental need for stand-alone applications in addition to routine work performed on integrated system and data base.

9.2 Please comment on number and distribution of printers

9.3 Please comment on adequacy of list below. This list represents our understanding of our needs at this point in the project. A need for the fine-tuning of the numbers is recognized and expected once the proposals are evaluated and a finalist is selected.
<table>
<thead>
<tr>
<th>Location</th>
<th>VIDEO DISPLAY TERMINALS</th>
<th>PRINTERS</th>
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10. DETAILED SYSTEMS APPLICATIONS

10.1 The following applications represent our understanding of our needs at this point in the project. A need for fine-tuning of the applications is recognized and expected once the proposals are evaluated and a finalist is selected.

10.2 Please review each item. Following each section is a space entitled "comments". In this space please note which item(s) you cannot supply and any other comments you wish to make regarding the applications. If there are no comments we will assume you can meet without qualification all of the applications as stated.

10.3 Please return this entire section as completed with your response.
1. Ability to flag individuals admitted to a specific bed charge category who wish to change to the first available of another bed charge category, e.g. individuals occupying a private wishing to transfer to a semi-private or vice versa and to have this information indicated on the nursing unit bed profile.

2. Ability to indicate "Do Not Move From Preferred Accommodation" for non-paying patients who have been placed in private or semi-private for medical reasons, e.g. dying, isolation, disruptive, odor, etc.

3. Ability to NOT automatically assign bed charge category according to semi or private rooms, i.e. an override capability.

4. Ability to provide a transfer bed function and cost adjustment.

5. Ability to link this function with Accounts Receivable.

6. Ability to communicate patient transfer and discharge to "need to know" areas (Lab, Pharmacy, Food Services, Health Records, Radiology, Housekeeping, Doctors' Lounge, Switchboard, Cashier, Accounting, Social Services, Physical Medicine, Care Coordinators' office, Pastoral Care and others).

7. Ability to print or display summaries and occupancy statistics by total hospital, nursing unit, physician, etc. on a continuous basis daily, weekly, monthly and annually. Time of admission should be available in these statistics.

8. Ability to provide notification to Admitting Office of a patient scheduled for surgery at the time the appointment is made. Although this may be redundant for our purposes since ADT is Admitting, so we should have all this information at our fingertips.

9. Ability for Housekeeping to notify Admitting Department of "bed ready" rooms status.

10. Ability to pre-admit patients for an unlimited period prior to admission and admit those patients from the pre-admit file without rekeying data.

11. Ability to reverse or change admissions, discharges and transfers done in error without distorting statistics.

12. Ability to delete both cancelled admissions and cancelled previously pre-admitted surgical patients without distorting statistics. This would also include cancelled outpatients and emergency patients.
13. Ability to automatically assign the next sequential hospital number and to override this capacity if necessary.

14. Ability to reuse cancelled admission numbers.

15. Ability to assign a "down time" hospital number for manual input of patient admitting data at some time after the patient admission.

16. Ability to retrieve a patient's prior visit information.

17. Ability to access prior and current admission, test results and referrals, information obtained from other departments such as Social Services, O.T./P.T., etc. to tie in with Discharge Planning in the future.

18. Ability to record the date, and identification of operator making changes to the patient file information and a summary of the changes made.

19. Ability to admit newborns using mother's admission information.

20. Ability to maintain up to 5 physician/patient per admission on the patient profile.

21. Ability to enter "pending" discharges and transfers as "pending" bed availability.

22. Ability to distinguish between discharges and deaths in sending notices and maintaining statistics.

23. Ability to open and close beds on-line.

24. Ability to add and delete nursing stations.

25. Ability to provide census reports on demand, and with the ability to tailor-make the census to our needs. i.e. unit census and hospital census currently being done by individual units and Health Records respectively.

26. Ability to specify a patient type and relate this type with a charge and internal charge number for agency billing, e.g. "P" number received from ambulance service dispatcher to bill Provincial Ambulance Service.

27. Ability to notify physicians of patient location, messages, meetings, appointments, etc.
28. Ability to retain and print a Medical Waiting List.

29. Ability to produce embossed cards for all Inpatients, Day Care Patients and selected Outpatients.

30. Ability to display and print alphabetic patient listing including location by nursing unit.

31. Ability to flag and print out inpatients the day before they reach their "expected date of discharge".

32. Ability to generate a "Religion List", i.e. a list by religion, ward, room, patient name and indicate "out of town" patients.

33. Ability to list by ward patients requesting visits from community clergy.

34. **FUTURE CAPABILITY** to generate microfiche of patient record information.
COMMENTS RE ABOVE SECTION:
OUTPATIENT EMERGENCY DEPARTMENT AND DAY CARE REGISTRATION

1. Ability to automatically assign the next sequential hospital number and override this capability if necessary. This should include numbering for different types of patients separately, i.e. emergency patients, day care surgery patients, etc. with a different numbering sequence, i.e. different stacks of numbers.

2. Ability to admit outpatients from Outpatients, Emergency, Day Care files without rekeying data.

3. Ability to generate standard visit charges for clinic and emergency patients that can be transferred directly to the Accounts Receivable.

4. Ability to book outpatient visits for Ambulatory Care and to print a copy of the booking list.

5. Ability to print and/or display statistics and summaries by selected data fields, i.e. time of admission, type of patient, etc. in order to develop staffing schedules and quality assurance.

6. Ability to delete or change Day Care, Outpatient or Emergency admission without distorting the statistics.
COMMENTS RE ABOVE SECTION:
FINANCIAL

ACCOUNTS RECEIVABLE - INPATIENTS

1. Ability of automatic billing based upon bed designation.

2. Ability to adjust billing to reflect bed availability, e.g. lower billing rate for patient in private bed awaiting a semi-private.

3. Ability to report number of patient occupying beds without charge even though (s)he may be in preferred accommodation. Ability to state reason for occupancy.

4. Ability to adjust billing to account for proportions paid by various agencies (e.g. Workers' Compensation, DVA, etc.)

5. Ability to provide statement of charges due at time of patient discharge.

6. Ability for the system to handle multiple and miscellaneous charges such as telephone calls, splints, etc.

7. Ability for the system to calculate charges as follows:

7.1 Per diem charge - length of stay x rate (for the patient type)

7.2 Co-insurance charge - length of stay x rate (for the patient type)

7.3 Room differential - stay in the room x room rate; however, a patient is not charged if preferred accommodation is due to a medical reason, nor is (s)he charged for accommodation which (s)he has not requested.

7.4 Above charges calculated automatically from ADT dates

7.5 Non-resident surcharge calculated automatically

7.6 Miscellaneous charges added as applicable

7.7 Patient may have more than one agency responsible for payment of the account

8. Ability reverse or correct any charges.

9. Ability to correct ADT dates.

10. Ability to correct prior periods shown in the current period receivable/revenue and statistics (i.e. closed month not reopened).
11. Ability to make corrections in current period but to use rates from previous periods.

12. Ability to calculate new charges and reverse old charges when transferring from one agency to another.

13. Ability to handle billing of multiple agencies.

14. Ability to distinguish between residents and non-residents.

15. Ability for system to interface, on-line, to the ADT and central patient index and to have access to the following information:
   15.1 Maximum room differential patient agrees to pay
   15.2 Agency responsible for room differential
   15.3 Addition I.D. numbers up to 15 alpha-numeric digits
   15.4 Financially responsible person and address
   15.5 Agency responsible for per diem

16. Ability for the system to handle retroactive transfers from one payment responsibility to another, where the total revenue changes as a result.

17. Ability for system to record deposit collected upon admission.

18. Ability to bill for long stay patients.

19. Ability to bill upon discharge for accounts outstanding.

20. Ability to rebill for patients or agencies from whom payments are not received for up to 90 days.

21. Ability to bill agencies on special forms.

22. Ability to prepare special billing reports required by billing agencies.
COMMENTS RE ABOVE SECTION:
ACCOUNTS RECEIVABLE - OUTPATIENTS

1. Ability for the system to accommodate charges that vary by paying agency rather than by the service provided.

2. Ability for the system to provide for Day Care Services where the charges are as follows:
   2.1 Set by the government
   2.2 Primary charge paid by B.C. Hospital Programs for eligible patients
   2.3 Paid by Department of Veteran Affairs (DVA), Workers' Compensation Board (WCB), Indian Affairs, Social Welfare, Self, RCMP and agencies from other provinces

3. Ability for system to provide for Laboratory and Radiology where charges are as follows:
   3.1 Set by Medical Services Plan (MSP)
   3.2 Paid by MSP for insured services
   3.3 Paid by individual patients, DVA, WCB, Social Welfare and agencies from other provinces

4. Ability for the system to provide for other services and charged as follows:
   4.1 Charges for B.C. residents approved but not paid for by BCHP
   4.2 Hospital Board determined non-resident charges to be paid by the patient

5. Ability to calculate charges for:
   5.1 Fee code for most service provided by HSP. Each fee divided into a technical and professional component
   5.2 Fee code remaining services determined by hospital staff
   5.3 Non-Canadian residents; automatic surcharge added or different flat rates can apply. Flat rate plus miscellaneous charges such as lab, x-ray, meds, splints, etc.

6. Ability to provide for billings to multiple agencies.

7. Ability of on-line verification of MSP numbers using check digit calculation.
8. Ability of on-line verification of doctor's number, fee code, date, etc.

9. Ability of on-line validation of billing agencies (i.e. MSP bill not processed without valid MSP number, no billing permitted to MSP for day care services, etc.

10. Ability to enter all transactions and then prompt for missing patient information.

11. Ability to correct patient information.

12. Ability to differentiate between optional and required information.

13. Ability to alter patient MSP number if this is to be used as the patient ID.

14. Ability to automatically transfer self charges to MSP billing when patient supplies correct billing number (and vice versa).

15. Ability to prepare MSP billings by tape or on-line.

16. Ability to receive and process MSP tapes on-line for reconciliation of charges.

17. Ability to bill on special forms used by billing agencies.

18. Ability of self billing specifying the outpatient department service received from as well as test/service performed and showing balance forward, new charges and payments.

19. Ability to rebill patients and agencies from whom payments are not received.

20. Ability to bill other hospitals and clinics with a monthly invoice with details regarding a patient's treatment and services performed.

21. Ability to interface with the outpatient registration module and provide the following information on-line:

   21.1 Diagnosis
   21.2 Agency(s) to bill
   21.3 Fee code
   21.4 Date of service
   21.5 Number and type of services
21.6 Financially responsible person and address

21.7 Other ID number for WCB, DVA, etc.

22. Ability of on-line inquiry of statement of account showing all charges and payments for self patients.

23. Ability to rebill delinquent accounts for all agencies.

24. Ability to generate a writeoff review and writeoff.

25. Ability to specify individual accounts which are not to be rebilled and/or written off.

26. Ability to state, on rebilling, the status (i.e. a rebill of the bill and the amount overdue.

27. Ability to print a message on the age of an account or the number of the previous billing.

28. Ability to print several different messages on one billing run.

29. Ability to transfer receipts from outpatient to inpatient receivables.
COMMENTS RE ABOVE SECTION:
MISCELLANEOUS RECEIVABLES

1. Ability to provide accounts to the bill which are calculated externally (e.g. in payroll).

2. Ability to provide more detailed descriptions of "services" (items being billed) required than for patient billing.

3. Ability to provide automatic statements once a month.

4. Ability to have items billed quarterly.

5. Ability to prepare invoices for selected accounts.

6. Ability for refund cheque run to update cash, payables, receivables and G/L.

CASH RECEIPTS

1. Ability to batch cash by cash page and date.

2. Ability to post to inpatient, outpatient and miscellaneous accounts.

3. Ability to receive cash that cannot be identified.

4. Ability for direct entry of cash receipt information by the cashier's or mail receipt area.

5. Ability to day-end total cheques and cash and to print out receipt information to balance to bank deposit.

6. Ability to enter cash from other areas of the hospital (e.g. emergency).

7. Ability of on-line correction of all input errors.

8. Ability to maintain an audit trail of corrections.

9. Ability to handle an MSP cheque received on a separate date from the remittance list to credit suspense account (DR cash CR suspense).

10. Ability to handle a remittance list on tape from MSP (except for some manual billing).

11. Ability to handle remittance list to debit suspense account for MSP (DR suspense CR receivables).
12. Ability to process patient refunds.

13. Ability to list patients whose accounts are overpaid.

14. Ability to interface to accounts payables for cheques to patients.

15. Ability to interface with General Ledger to post cash receipts to the G/L.
COMMENTS RE ABOVE SECTION:
REPORTS

1. Ability to maintain an audit trail of all financial transactions by batch.

2. Ability to maintain an audit trail of all postings to G/L.

3. Ability to maintain an audit trail of patient master information updates.

4. Ability to provide daily census reports.

5. Ability to generate an inpatient long stay report (i.e. list all patients in hospital over 30 days).

6. Ability to trial balance by agency for inpatient, outpatient and miscellaneous receivables.

7. Ability to purge "old" patients to history tapes.

8. Ability to retrieve these "old" patients.

9. Ability to print out any account.

WRITE-OFFS

1. Ability to list the old accounts under a specified agency, with specific dollar limits and age limits or number of billings.

2. Ability to have automatic writeoff or writeoff to collector.

3. Ability to suspend individual accounts from writeoffs.

4. Ability to list accounts paid directly to hospital that are in collector's hands (by collection agency).

STATISTICS

For inpatient statistics, does the system handle:

1. Ability to gather statistics for government reporting.

2. Ability to feed statistics to the management reporting module.

3. Ability to provide number of billings of accounts in categories less than $10, $10-$20, $20-$50, etc.

4. Ability to provide number and amount of accounts by revenue types, e.g. co-insurance, room differentials.
For outpatient statistics, does the system handle:

1. Ability for dollars billed vs dollars collected for each outpatient revenue area to pinpoint bad debt problems.

2. Ability to handle dollars of professional fees vs technical fees billed to each outpatient area.

3. Ability to provide number of billings of amounts in categories less than $10, $10-$20, $20-$50, etc.

CENSUS

1. Ability for daily census to provide a summary by inpatients in each ward, number in paid private beds, number in paid semi-private beds and total.

2. Ability for daily census to provide the beds held.

3. Ability for monthly census to provide the number of patient days by paying agent.

4. Ability for monthly census to provide information to complete government form HIA35.

5. Ability for monthly census to provide patient days by service (wards grouped).

TABLES

1. Ability for the system to provide tables for the following:
   1.1 Inpatient per diem rates
   1.2 Inpatient co-insurance
   1.3 Room rates
   1.4 Outpatient services - fee codes, rates for technical professional component
   1.5 Agency codes
   1.6 Aging criteria
   1.7 Doctor table
1.8 Debit/credit codes
1.9 Automatic agency billing (inpatients)
1.10 Transaction codes
1.11 Report parameters that change infrequently
1.12 Security level to be assigned
1.13 Other (please list)

2. Ability for table maintenance to be handled on individual entries or a series of entries by users.

3. Ability for printouts of tables available on demand.

4. Ability for table entries to be dated when updated (especially rates).

5. Ability for historical rates to be stored.

SECURITY AND CONTROL

1. What levels of security are available:
   1.1 By user
   1.2 By function

2. Does the system provide control totals and audit trails for:
   2.1 Billings
   2.2 Cash receipts

GENERAL

1. Ability to list the module names on which you based your responses to this application checklist. Indicate whether the module is your packaged software or is based on another hospital's (or company's) system.
COMMENTS RE ABOVE SECTION:
ACCOUNTS PAYABLE

Includes features common to the "BCHA Interdata" program as well as:

1. Ability to prepare cheques by vendor.
2. Ability to prepare daily cheque run by vendor.
3. Ability to prepare tapes/invoices to various agencies (e.g. Workers' Compensation, MSP).
4. Ability to interface with inventory program.
5. Ability to prepare public bodies information act reports.
6. Ability to interface with Radiology, Laboratory, Materiel Management, Pharmacy, Central Supply.

Interfacing with Materiel Management:

1. Ability to maintain a common vendor file.
2. Ability to mail cheques to a purchase address which is different than the address on the vendor file.
3. Ability to have the latter address appear in the vendor master file.
4. Ability to have address above automatically used by the accounts payable system.
5. Ability to price, at the time of receipt, from the pricing information on the purchase order.
6. Ability for inventory and non-inventory items to be distributed from one purchase order.
7. Ability to match, on-line, receiving and purchase order information.
8. Ability to report quantity and price variances.
9. Ability to reject an invoice if price variances are beyond user set parameters.
10. Ability for materiel management system to provide for allocation of provincial sales tax to appropriate items and freight where priced.
INVOICE PROCESSING

1. Ability to process invoices where there is no purchase order in the following ways:

   1.1 Multiple expense entries made by one invoice
   1.2 Provincial sales tax and freight be allocated to item cost(s).

2. Ability to process one time vendor invoices in the preparation of the "Public Bodies Report" which lists payments to all suppliers.

3. Ability to excuse payments that should not be included in this report, e.g. patient refunds.

4. Ability to modify/delete invoices after entry.

5. Ability to modify/delete after payment.

6. Ability to handle debit and credit memos.

7. Ability to edit for duplicate invoices.

8. Ability to handle prepaid expenses over a user specified time period.

9. Ability to handle cash discounts.

10. Ability to report on discounts not taken.

11. Ability to assign a high payment priority code for invoices with discounts.

12. Ability to enter a recurring invoice and generate a cheque on a monthly, quarterly, or other time sequence.

13. Ability to print a report at the time such cheque is prepared.

14. Ability to interface with a general ledger system.

15. Ability to interface with an accounts receivable system with respect to producing refund cheques for patients.

16. Ability to enter and validate next period's transactions before closing the current period.

17. Ability to override due dates and generate payments on the following criteria:

   17.1 On demand
   17.2 All invoices through a certain date
   17.3 All invoices for a specific vendor
18. Ability to hold invoices at the vendor level.

19. Ability to make partial payments for specific vendors and for all vendors.

20. Ability to suppress cheque preparation to vendors with zero or negative balances due.

21. Ability to produce a proposed cheque list prior to running the cheques.

22. Ability to make changes to the proposed cheque run.

23. Ability to prepare one cheque per vendor, listing multiple invoices on the remittance advice.

24. Ability to allocate consecutive cheque numbers for each bank account.

25. Ability to have separate cheque runs for each bank account.

26. Ability to prepare the cheque register during each payment cycle to control all cheques generated during the period.

27. Ability to enter annual cheques.

28. Ability to enter a manual cheque regarding an invoice not on file.

29. Ability to enter spoiled cheques to maintain control over pre-numbered cheque forms.

30. Ability to record discounts to be recorded when manual cheques are entered.

31. Ability to provide an independent register for manually written cheques.

32. Ability for above register to show the debt distribution for each cheque.

33. Ability to generate a schedule of invoices by due date for each vendor.

34. Ability to produce a report of invoices due with user-determined selected time periods.
35. Ability to provide a vendor history including:

35.1 Vendor number
35.2 Vendor name/address
35.3 Cheque address
35.4 Telephone number
35.5 Contact
35.6 Month-to-date/year-to-date purchase dollars and volumes.
35.7 Date of last purchase
35.8 Amount paid year-to-date
35.9 Public Bodies Report support

36. Ability to move a vendor history to a new vendor number and name when a vendor changes its name.

37. Ability to recompute sales tax.

38. Ability to prepare a monthly summary report of purchases, tax status, and sales tax paid. (e.g. purchase journal)

39. Ability to provide a cheque reconciliation feature from cancelled cheque information.

40. Ability to generate bank reconciliation reports.

41. Ability to make available year-to-date transaction detail by account, by vendor, on-line and by P.O. outstanding.

42. Ability to apply journal entries to the general ledger on a daily, weekly or monthly basis.

43. Ability to maintain vendor contracts.

44. Ability to prepare vendor labels.
45. Ability to generate the following reports:
   45.1 Month-end aged trial balance at cut-off date tied to Accounts Payable control account balance at month-end for:
      45.1.1 Summary by vendor
      45.1.2 Detail by vendor
   45.2 Alphabetic vendor lists
   45.3 Numeric vendor lists

46. Ability to generate list of payments (invoices/vouchers) due by a specified date of aged category; vendor and grand totals.

47. Ability to list vendors with credit balances.

48. Ability to produce cheques in U.S. funds and clear invoices for which foreign money orders have been obtained.

49. Ability to produce an inventory audit trail, which indicates all activity for the month on all or selected catalogue items.

50. Ability to produce an inventory usage report reflecting quantities and dollars.

51. Ability to report on all non-inventory items and services, including debit/credit memos and any other charges to a department not included in the inventory usage report.

52. Ability for the system to provide reasonable edits over such entries as:
   52.1 Invoice date
   52.2 Due date
   52.3 General Ledger date
   52.4 Amount of cheque

53. Ability to provide input edits such as:
   53.1 Duplicate batch number
   53.2 Valid catalogue (stock) numbers
   53.3 Valid vendor number
   53.4 Valid purchase order number
   53.5 Other (specify)

54. Ability for the system to use average costing.
COMMENTS RE ABOVE SECTION:
GENERAL LEDGER

1. Ability to include the printing of revenue and management accounts on a monthly basis.

2. Ability to include those provided by the current "BCHA Interdata" version.

CHART OF ACCOUNTS

1. Ability to provide for a flexible coding structure to enable specification of the maximum number of digits to the G/L code and the level that can be coded.

2. Ability to designate the following attributes to each account:
   2.1 Expense/revenue/asset/liability
   2.2 Fund
   2.3 Division/department/cost centre
   2.4 Dollars or statistics
   2.5 Various groupings of accounts to handle other reporting requirements
   2.6 Various groupings of cost centres to allow different "rollups" according to reporting needs
   2.7 An account code independent from reporting structure
   2.8 Split a G/L account for reporting purposes (e.g. allocate overhead to cost centres based on user defined formulas)

JOURNAL ENTRY

1. Ability to provide for manual journal entries for all postings not coming from a sub-system.

2. Ability to provide for entry and retention in the G/L, for audit purposes, the following data:
   2.1 Journal entry number
   2.2 Journal entry date - may be prior year if adjusting prior year, or else must be current year and current of future accounting period (effective date - date of entry)
   2.3 Description (20-30 characters)
   2.4 Dr accounts (maximum number)
   2.5 CR account(s) (maximum number)
CASH RECEIPTS

1. Ability to record the following:
   1.1 Date of receipt
   1.2 Receipt number
   1.3 Received from and on behalf of
   1.4 Purpose
   1.5 G/L account number
   1.6 Amount

2. Ability to allow for reversals.

3. Ability to list by date.

SUB SYSTEM INTERFACE

1. Ability to provide for automatic interfaces with the following sub-systems:
   1.1 Accounts Receivable
   1.2 Cash receipts
   1.3 Payroll
   1.4 Materiel Management (including setting up an estimated payable)
   1.5 Accounts Payable
   1.6 Admission/discharge/transfer and registration

2. Ability to validate data from sub-system and exception reporting.

3. Ability for postings to be summarized by:
   3.1 Account number
   3.2 Source
   3.3 Period (using posting date)
PROCESSING PROCEDURES

1. Ability to generate on demand trial balance and/or G/L summary and/or statement of expense and revenue preliminary to month-end close off.

2. Ability to produce trial balance and G/L summary at month end.

3. Ability to retain historical details on alternate computer readable media if disk storage insufficient to retain on the current file.

4. Ability for G/L system to be updated and balanced on a daily basis.

5. Ability to maintain a detailed suspense account for invalid or out-of-balance entries.

6. Ability to provide a daily record of transactions including volume, source and amount.

YEAR END PROCEDURES

1. Ability to close off year end and post forward to next year before all adjustments are through and after sub-systems start to post new year.

2. Ability for year end adjustments to be posted to both last and current year.

3. Ability to run final year end close several months after year end.

4. Ability at the first year end close, to post forward asset and liability balances, profit/loss figures and zero revenue and expense accounts.

MANAGEMENT REPORTS

1. Ability to prepare reports for comparison of budget to actual expenditure for the following:

   1.1 Hospital
   1.2 Division
   1.3 Department
   1.4 Cost centre
1.5 Statistics and dollars on same report (where applicable)

1.6 Both revenue and expense accounts

2. Ability to produce balance sheets.

3. Ability to prepare a profit and loss statement.

4. Ability for year to date and/or monthly figures to appear for actual and budget as designated by user.

5. Ability to produce exception reports where tolerances are exceeded, either by expense type or by cost centre.

6. Ability for the non inventory usage report to include journal entries and current charges and credits.

7. Ability for above reports to be available on demand basis.

8. Ability to design own reports and report groupings.

9. Ability to print reports in user specified order.

ACCOUNT ANALYSIS FUNCTIONS

1. Ability to explore any summary figure on any management report.

2. Ability to select an account or a range of accounts, date(s) and source code(s) for detail printing of postings satisfying the selected parameters and sorted as specified by user.

3. Ability to generate statement of changes in financial position work sheets for work capital and for cash.

4. Ability to generate projected year and financial statements during the year based on year to date actual results plus remaining periods budget data.

BUDGET

1. Ability to enter budgets for both statistics and dollars.

2. Ability to provide for flexible budgeting (using user specified formulas and parameters and global change capabilities).

3. Ability to assign monthly amounts by G/L number upon data entry.

4. Ability to automatically calculate from last year's volumes and dollars using percent assigned upon data entry for all or selected G/L accounts.
5. Ability to assign annual amount by account number to be spread evenly throughout year.

6. Ability to change amount (above) as required, throughout year.

7. Ability to have budget, volumes and dollars, to appear on management reports as designated by user, with automatic variance calculation.

8. Ability to store and use more than one budget for a given year or years.

9. Ability to provide online entry, enquiry and edits.

10. Ability to input/modify next year's budget before end of current year.

CAPITAL AND OTHER FUNDS

1. Ability to handle multiple funds which include:

   1.1 Cash receipts posting to separate bank account
   1.2 Accounts payable to separate G/L
   1.3 Cheques generated are posted to separate bank account
   1.4 Accounts receivable has user designed invoices
   1.5 Equipment and depreciation listing to include:

      1.5.1 Description of asset
      1.5.2 Purchase (receiving) date
      1.5.3 Serial number and user assigned control number
      1.5.4 Quantity and cost
      1.5.5 Who uses equipment
      1.5.6 Asset life expectancy
      1.5.7 Current month and year to date depreciation (type of calculation determined by user)
      1.5.8 Disposal date
      1.5.9 Interface to G/L - purchase and depreciation (capital fund ledger)
FILES AND TABLES

1. Ability for control G/L chart of accounts by user.

2. Ability to alter management report groupings during fiscal year.

3. Ability for user design and modify report formats.

4. Ability for the G/L protect against an out-of-balance condition with sub-systems and with annual entries.

5. Ability to handle 12-14 month period fiscal year.

6. Ability to handle multiple hospitals.
COMMENTS RE ABOVE SECTION:
LABORATORY

1. Ability to interface with:
   1.1 Admission/discharge/transfer
   1.2 Indirect interface from an automated instrument (e.g. Astra 8, RA 1000, Corning 178, Coulter Counter) through an intermediate buffer
   1.3 Central Patient Index
   1.4 Outpatient Registration

2. Ability to support the entry of results by terminal.

3. Ability to receive ward generated lab requests and be able to record the time and date of request.

4. Ability to monitor duplicate tests ordered within a user specified period of time.

5. Ability to process ward generated enquiries and return status of ordered tests (to eliminate phone calls).

6. Ability to print out lab tests on wards and store the results.

7. Ability to prepare walking list (specimen collection list) for accessioning staff together with appropriate labels.

8. Ability to prepare worklists for various work areas and instruments.

9. Ability to add to generated worklists.

10. Ability to reprint worklists with test results.

11. Ability to report results in conventional and/or S.I. units with appropriate reference ranges.

12. Ability to add various interpretative comments to reports (code phrase comments and free form formatting).

13. Ability to search files for previous work done on patients (archiving).

14. Ability to sort patient results out by patient name, ordering doctor or ward.

15. Ability to periodically review status of ordered tests.
16. Ability to maintain active patient records: inpatients - 60 days, outpatients - 6 months.

17. Ability to charge all laboratory tests upon completion (interface with Accounts Receivable).

18. Ability to pre-access all tests for morning collection.

19. Ability to have immediate access to patient information to an extent determined by hospital policy.

20. Ability to register and retain lab data on selected patients for longer periods.

21. Ability to classify laboratory orders (e.g. STAT, ASAP, Pre-Op, Routine).

22. Ability to produce laboratory utilization reports by test, and/or physician and/or diagnosis.

23. Ability to date and time a completed laboratory report.

24. Ability to provide a hard copy of all laboratory results within the laboratory (completed report).

25. Ability to allow verification of all results before they are released.

26. Ability to transmit STAT results immediately after verification.

27. Ability to provide cumulative results reporting for a complete patient’s stay in intelligent format.

28. Ability to compare test results with previous results of the same procedure (e.g. reasonable limits check).

29. Ability to provide a quality control package (Shewhart, Levey-Jennings).

30. Ability to provide for workload recording by shift, day, month, year, year to date and previous year and year to date (DBS units, number of tests, number of patients).

31. Ability to provide for instrument maintenance schedules.

32. Ability to perform staff scheduling.

33. Ability to record staff time (time book). Interface with personnel/payroll.
34. Ability to generate printed Lab results at least for major pieces of automated equipment (Astra 8, RA 1000, Corning 178, Coulter Counter) and produce cumulative reports.

35. Ability to provide for word processing for maintenance of:
   35.1 Methods manuals
   35.2 Doctor's lists
   35.3 Patient instruction, etc.
   35.4 Autopsy and surgical reports

36. Ability to provide for computer assisted instruction.
COMMENTS RE ABOVE SECTION:
MICROBIOLOGY

1. Ability to enter and print results on wards and to allow for interpretive comments (free text).

2. Ability to enter and store microbiologic reports by patient name and hospital number, ward location(s), organism(s) isolated and susceptibility pattern when required, for user defined period.

3. Ability to generate infection control information with reference to culture reports (site and organism(s) isolated), hospital demographic information and hospital procedure, e.g. surgery by type, catheterization, intravenous administration, inhalation therapy.

4. Ability to generate antibiotic susceptibility profiles at any time for the past 12 month period.

5. Ability to inventory and track long-term, in-house cultures, e.g. blood cultures.

6. Ability to inventory and track long-term referred out cultures, e.g. tuberculosis cultures.
COMMENTS RE ABOVE SECTION:
TISSUE PATHOLOGY

1. Ability to log specimens with sequential yearly accessioning numbers including departmental prefix.

2. Ability to provide, upon patient return visit, instant retrieval of patient identification information, previous accession number(s) and diagnosis.

3. Ability to retain on-line patient identification information, e.g. name, date of birth, sex, date of biopsy and diagnosis for user specified time period.

4. Ability to accept patient clinical history, surgical procedure at specimen log-in.

5. Ability to enter previous biopsy diagnostic reports filed manually.

6. Ability to provide for free-text and pre-defined comments for gross and microscopic description, comments, English diagnosis and coded diagnosis.

7. Ability to accept SNOP, SNOMED or user-defined coding systems.

8. Ability to search for user selected items, e.g. diagnosis, biopsy site, sex, age range, doctors, and to provide data content and comparative studies.

9. Ability to provide above for autopsy reports and to allow for multiple diagnoses.

10. Ability to calculate work load statistics.
COMMENTS RE ABOVE SECTION:
RADIOLOGY

1. Ability to maintain a basic patient scheduling system.

2. Ability to provide accurate patient location information on an immediate basis.

3. Ability to provide notification to "need-to-know" areas (e.g. Food Services) that a patient is scheduled for Radiology services.

4. Ability to provide status and/or results reporting to various "need-to-know" areas from the request through to final report.

5. Ability to identify and locate previous Radiology procedures performed on a patient and give bag #, signed out, and by whom, date.

6. Ability to produce a monthly notice for overdue file loans by Doctors.

7. Ability to print a log alphabetically three times per day of patients seen through-out the day including:
   7.1 Patient name
   7.2 Physician
   7.3 Diagnosis
   7.4 Medical Record number
   7.5 Procedure(s) performed

8. Ability to notify and identify STAT orders that must be performed on an immediate basis.

9. Ability to provide STAT results reporting to critical care areas.

10. Ability to generate radiology reports including procedures schedules, statistical/utilization reports, demand and supply report.

11. Ability to produce a patient file including basic demographic information, film file status, types of exams, radiology reports, reason for examination, etc.

13. Ability to input list of existing patients names/number and get associated bag #.

14. Ability to prepare labels for films and files.

15. Ability to print outstanding test lists.

16. Ability to provide for film file/chart location using.

17. Ability to provide listing of films signed out with individual and location detail.

18. Ability to control and monitor Radiology stock.

19. Ability to provide link with Accounts Receivable for billing procedures.

20. Ability to provide link with stores inventory.

21. Ability to produce bag # of deceased patients and inactive files for removal.

22. Ability to provide standard reports and standard results statements to allow each Radiologist to have unique set of standards.

23. Ability to develop schedules for procedures and print daily schedules.

24. Ability to schedule order for future days and generate requisition on the appropriate day.

25. Ability to produce month end reports on:

   25.1 Total activities by subdepartment (e.g. Nuclear, Echo, CT, Heart Cath, Angio, Radiology, Ultrasound) and by exam and by units (standards)
   25.2 Financial reports (fee for service) for Radiologists
   25.3 MSP billing for hospital

26. Ability to interface with Clinical Laboratory and Pathology to correlate surgical, pathological and radiological results.

27. FUTURE CAPABILITY to run Quality Control procedures.
COMMENTS RE ABOVE SECTION:
PHARMACY

LABELS - ACUTE

1. Ability to put the following information on label:
   1.1 Bed
   1.2 Patient name
   1.3 Prescribing physician
   1.4 Drug name (generic, brand)
   1.5 Drug form (capsule, etc.)
   1.6 Strength
   1.7 Directions (sig) (User defined table and free form)
   1.8 Issue date
   1.9 Unique prescription or unit # (consecutive; 5 characters; multiple prescription per #, sort by date)
   1.10 Pharmacist's initials
   1.11 Alert instructions
   1.12 Stop date - programmed to automatically put in a certain # of days which can be overridden

2. Ability to specify the number of labels at the time of prescription.

3. Ability to specify up to 99 labels, the default determined at the time of installation.

4. Ability to have multiple sizes and multiple formats.

LABELS - EXTENDED CARE

5. Same as Acute but with card number (x of y) for blister pack.

6. Ability to produce labels with 2 formats for each order.
7. Ability to set up Cancer/T.P.N./I.V. Admixture labels with the following information provided from the patient profile (or data base):

7.1 Same as Acute PLUS
7.2 Up to 20 drugs per label
7.3 Bag number instead of card number
7.4 Expiry date

8. Ability to calculate based on user-defined formula, and print conversions on labels (e.g. on a TPN label, where \( x \text{ mg} = y \text{ ml} \) where \( y \text{ ml} \) is calculated from \( x \text{ mg} \) according to user-defined formula).

9. Ability to generate user-defined custom labels.

10. Ability to integrate with Accounts Receivable, Accounts Payable, inventory control for:

10.1 Pharmacare billing for Acute and Extended Care patients and community patients
10.2 Billing WCB/DVA/IA/Cancer Control Agency of B.C.
10.3 Inventory control and reorder points entered by Pharmacy.

11. Ability to generate the following drug interaction data:

11.1 Two levels of alert desired; contact Doctor before releasing; release then investigate
11.2 Standard interactions
11.3 Source of interaction information
11.4 Integration with Laboratory, Radiology, Dietary orders
11.5 Remote update and/or user update of drug interaction data through third party agencies (e.g. DPIC, Drug and Poison Information Centre, St. Paul's Hospital, Vancouver)
12. Ability to have a system for internal inventory control for up to 2,000 different items with the following information on each item (master file):

12.1 DIN
12.2 Primary vendor (name, address, contact, phone)
12.3 Secondary vendor
12.4 Key
12.5 Description/package size
12.6 Unit cost
12.7 Quantity on hand
12.8 Reorder level
12.9 Reorder quantity

13. Ability to print out a list of inventory items due for reorder.

14. Ability to keep a transaction file with the following information:

14.1 Lot number
14.2 Expiry date
14.3 Who or where issued (patient Rx or ward stock)
14.4 PLUS relevant information from master file list

15. Ability to generate a patient profile with the following information:

From ADT:

15.1 Name
15.2 Patient #
15.3 Room & bed
15.4 Institution name
15.5 Birthdate
15.6 Sex
15.7 Surface area
15.8 Height
15.9 Weight
15.10 Admitting diagnosis
15.11 Allergies
15.12 Date of Admission
15.13 Physician responsible
15.14 Pharmacare plan and #
15.15 C.C.A.B.C.
15.16 W.C.B.
15.17 Other conditions, diagnosis, allergies
15.18 Present medications
15.19 Comments (2 lines) prescriptions

16. Ability to read bar code and produce bar coded label where needed.

17. Ability to generate order information (entered at Pharmacy) with the following characteristics:

17.1 Ability to create a new order using a previous prescription

17.2 Ability to refill an prescription

17.3 Ability to generate orders from ward stock (inpatient profile) which will not reduce inventory or generate labels

17.4 Ability to generate prescriptions in the usual way which is to reduce inventory, and print labels
18. Ability to generate the following reports:

18.1 Drug utilization report
18.2 Narcotic and controlled drug report
18.3 Billings CCABC, Pharmacare
18.4 Statistics (month-end) - (financial drug usage and by cost centre)
18.5 Purchase orders
18.6 Extended Care resident medication profile
18.7 Medication administration record (Acute Care different from E.C.)
18.8 Drug profile available to ward by order entry/reporting module
18.9 Custom reports (e.g. workload statistics)
18.10 Table lists - drug formulary, inventory

19. Ability to perform data entry with the following features:

19.1 Automatic generation of prescription number (with overwrite capability)
19.2 To find a patient profile and history:
   19.2.1 Inpatient/outpatient/community patient
   19.2.1 Patient #
   19.2.2 Rx #
   19.2.3 Name
19.3 Build profile or obtain from ADT
19.4 Enter orders - single, refills
19.5 Batch refills for Extended Care
19.6 Use DIN number, keyword or first 2 to 3 letters or drug name list
19.7 Use number or name to identify physician
19.8 Enter label information (e.g. type of label format, number of labels required)

19.9 Date (system generated)

19.10 Password security

20. Ability to perform pharmacokinetic calculations.

21. Ability to place orders to pharmacy from nursing stations and Extended Care.

22. Ability to continue use of our existing modified unit dose (controlled dosage system) using blister cards.
COMMENTS RE ABOVE SECTION:
FOOD SERVICES

1. Ability to prepare and print individual menus for patients.
2. Ability to record and edit standard menus.
3. Ability to interface to a document reader for the purpose of entering and subsequent processing of completed patient menus.
4. Ability to prepare from patient menus, tray preparation cards detailing all items on each patient tray to assist in checking trays for completeness.
5. Ability to tally menu selections for preparation of quantities for cook's work sheets.
6. Ability to receive notices through order entry/communications of meals to be held and of any changes in diet requisitions.
7. Ability to prepare labels for special nourishments to attach to items on dietary trays sent to nursing wards at non-meal times.
8. Ability to input and store recipes.
9. Ability to adjust recipes for varying number of clients.
10. Ability to prepare purchase orders from non-stock food items.
11. Ability to cost recipes and menus.
12. Ability to flag patient for whom diet review is required.
13. Ability to provide for nutrient analysis.
14. Ability to prepare and print patient and dietary service evaluation and provide a summary of statistics of the responses.
15. Ability to list patients on each nursing unit by patient name, room number, diet, etc.
16. Ability to produce financial budgets for patients and non-patient food costs.
17. Ability to interface with "smart" cash registers for on-line costs and inventory control.
18. Ability to monitor perpetual inventory, control costing and forecast product requirements.
19. **FUTURE CAPABILITY** to reconcile invoices with goods received and prices charged.

20. **FUTURE CAPABILITY** to flag items for which there is a user defined discrepancy between invoice price and P.O. price.
COMMENTS RE ABOVE SECTION:
ORDER ENTRY/REPORTING/COMMUNICATION

1. Ability to enter and verify orders on-line and generate or modify standing orders from nursing stations or Admitting.

2. Ability to highlight (flag) duplicate procedures/orders requested for a patient based upon pre-defined criteria.

3. Ability to notify ancillary departments of requested procedures that would affect those departments and/or services, namely:
   3.1 Radiology
   3.2 Pharmacy
   3.3 Food Services
   3.4 Materiel Management
   3.5 Laboratory
   3.6 Physical Medicine/Occupational Therapy
   3.7 Enterostomal Therapy
   3.8 Respiratory Technology
   3.9 General/Emergency
   3.10 Switchboard

4. Ability to print outstanding orders reflecting current status.

5. Ability to review previously ordered tests/procedures, displayed by time, date.

6. Ability to interface with stand-alone automated system on a real-time basis.

7. Ability to enter messages for a specific location or general broadcast indicating time frames for display.

8. Ability to automatically change patient classifications from emergency to inpatient when assigned room/bed.

9. Ability to automatically change patient classification when moved within Extended Care Unit or to acute hospital and back.
10. Ability to access patient information on the system using:

10.1 Patient name
10.2 Patient location
10.3 Patient unit number

11. Ability to enter test results on-line and update order status.

12. Ability to print test results immediately for standard orders or for orders generated in specific locations.

13. Ability to update or modify test results and immediately print at patient location.

14. Ability to review status of tests/procedures ordered for individual patients:

14.1 Procedure requested
14.2 Specimen obtained
14.3 Procedure/test performed - result pending
14.4 Result/report generated

15. Ability to cancel or change patient orders.

16. Ability to provide a detailed audit trail of all transactions generated throughout the network.

17. Ability to provide security and user password techniques to restrict unauthorized access to the system.

18. Ability to interface all pertinent data elements to the financial system.

19. Ability to store and display all orders placed for a patient during a length of stay. Orders should be retained for a minimum period of time after discharge based upon user defined procedure retention criteria.

20 Ability to generate statistics.

21. **FUTURE CAPABILITY** for small "banking" application for Extended Care Unit, to include:

21.1 Ability to link to Business Office Resident Trust Accounts in order to have current balance and give residents funds for outings, etc.
21.2 Ability to flag and update resident valuables.

21.3 Ability to actualize expenditure from Resident Activity Fund (Social Diversional)

22. **FUTURE CAPABILITY** to run nursing care plan
COMMENTS RE ABOVE SECTION:
NURSING ADMINISTRATION

1. Ability to generate statistical information and run on existing IBM-AT microcomputer.

2. Ability to run nurse care plan application for each nursing unit.

3. **FUTURE CAPABILITY** to access total Patient Care Units (PCUs) for each nursing unit in order to assess workload in relation to bed allocation.

4. **FUTURE CAPABILITY** to run staff scheduling for each nursing unit and interface with existing IBM Displaywriter.
COMMENTS RE ABOVE SECTION:
1. Ability to interface to the present HMRI abstracting computer and software or the provision of a separate abstracting program which retrieves patient data from the data base. This should provide the abstracter with patient data selected from the ADT system without having to rekey it.

2. Ability to construct and keep current an incomplete chart list for Doctors. The list will document which charts are yet to be completed for each doctor and will be circulated to physicians on a periodic basis.

3. Ability to track a patient's medical record location inside and outside Health Records.

4. Ability to interface the ADT system with the IBM Displaywriter word processors in the steno pool to provide the stenos with patient data selected from the ADT system without having to rekey it.
COMMENTS RE ABOVE SECTION:
PASTORAL CARE

1. Ability to interface with CR/ADT.
COMMENTS RE ABOVE SECTION:
SOCIAL WORK SERVICES

1. Ability to interface with CR/ADT, order entry/reporting/communication, AR/AP/GL, Medical Records.

2. Ability to identify demographic and diagnostic indicators for profiling high risk Social Work clients on admission.

3. Ability to identify high risk children upon admission (Emergency, Outpatient or Inpatient) and generate a high risk Child Abuse Registry.

4. Ability to generate departmental statistical information.

5. **FUTURE CAPABILITY** to perform the following:
   
   5.1 Problem classification profile
   
   5.2 Referral dispositions
   
   5.3 Workload measurement system
   
   5.4 Medical/clinical history profile
COMMENTS RE ABOVE SECTION:
1. Ability to interface with CR/ADT, order entry/reporting/communication, AR/AP/GL, Medical Records.

2. Ability to generate departmental statistical information.
COMMENTS RE ABOVE SECTION:
ADMINISTRATION

1. Ability to download statistics and budget information to a stand-alone microcomputer and in a format compatible with Lotus 1-2-3, Symphony or similar electronic spreadsheet analysis.

2. Ability to interface with existing IBM-AT microcomputer.

3. FUTURE CAPABILITY to provide communications module to include the following:

   3.1 Report writing

   3.2 Messaging

   3.3 Interface with existing IBM Displaywriters word processing for management information and medical staff administration information such as credentials, privileges, etc.
COMMENTS RE ABOVE SECTION:
MEDICAL STAFF

1. Ability to list and print patients at any video display terminal and retrieve the following information:
   1.1 Medical orders for today
   1.2 Medical orders since admission
   1.3 Current medication orders
   1.4 Orders for specific date
   1.5 Orders by type (laboratory, radiology, etc.)
   1.6 Patient diagnoses
   1.7 Patient admitting data

2. Ability to enter medical orders at any video display terminal.

3. Ability to list attending/consulting physician census at any video display terminal.

4. Ability to access toxicology reference at any video display terminal.

5. Ability to access drug information at any video display terminal.

6. Ability to access poison control index at any video display terminal.

7. Ability to access medical data banks for current journal information.

8. **FUTURE CAPABILITY** of listing meeting schedules by physician.
COMMENTS RE ABOVE SECTION:
1. Ability to interface with CR/ADT.
COMMENTS RE ABOVE SECTION:
PAYROLL/PERSONNEL

1. **FUTURE CAPABILITY** to interface with existing BCHA payroll/personnel system and/or ability to provide stand-alone system.
COMMENTS RE ABOVE SECTION:
PARKHOLM LODGE INTERMEDIATE CARE FACILITY

Parkholm Lodge provides intermediate care services to ninety (90) residents and provides an Adult Day Care Program for twenty (20) people per day. The facility employs approximately forty (40) full-time equivalent staff and has an annual operating budget of approximately $2 million. The budgetting and accounting activities are entirely separate to the activities of the Chilliwack General Hospital; however, services such as Administration and Food Services are purchased from the Chilliwack General Hospital.

1. FUTURE CAPABILITY to interface AR, AP, GL, Food Services and Pharmacy applications of the Chilliwack General Hospital with Parkholm Lodge.
COMMENTS RE ABOVE SECTION:
INTERFACEABILITY WITH FUTURE MODULES

1. **FUTURE CAPABILITY** to interface with preventative maintenance/environmental monitoring and control modules.

2. **FUTURE CAPABILITY** to interface with materiel management module(s).

3. **FUTURE CAPABILITY** to interface with strategic management/decision support modules.

4. **FUTURE CAPABILITY** to interface with OR and other scheduling module(s).
COMMENTS RE ABOVE SECTION:
**PUBLICATIONS - ADDENDUM**


