THE IMPACT OF AN ELECTRONIC DISCHARGE INSTRUCTION APPLICATION ON THE QUALITY OF DISCHARGE INSTRUCTION DOCUMENTATION

A Thesis
Presented in Partial Fulfillment of the Requirements for
The Degree Master of Science in the
Graduate School of The Ohio State University

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THE OHIO STATE UNIVERSITY
1997

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ABSTRACT

In 1996 OSUMC implemented an in-house developed discharge instruction application termed Electronic Discharge Instructions or EDI. This system enabled physicians to complete patient discharge instructions from any OSUMC computer or terminal. Unlike most medical records that typically remain part of the confidential medical record, discharge instruction documents are reviewed by a number of individuals for a variety of purposes. Although computer systems may be used in a variety of aspects of the health care industry, could such technology improve the quality of the instructions a patient receives at discharge?

A total of 210 medical records were reviewed. These were divided into two groups of 105, hand written instructions and instructions created with EDI. The results indicated that a significant difference existed between the quality of hand written discharge instructions and instructions created with EDI. The electronic instructions received an overall higher mean score of 18.82 and sd = 1.06 (n = 105). The score was higher than the manually written instruction which received a score of 14.41 and sd = 3.70 (n = 105; F = 137.611; p < .0001). In addition to overall difference the data was examined considering document type and division a statistically significant main effect for document type was observed (F = 135.66; df = 1, 204; p < .0001). The overall mean scores of discharge documentation improved by the following margins for each of the divisions; Medicine 4.17 (from 14.92 to 18.46), Surgery 4.57 (from 14.49 to 19.06) and Rehabilitation 4.41 (from 14.41 to 18.82).
DEDICATION

The paper is dedicated to my wife Traci. Without her love and support throughout my graduate school, completion would have been impossible. She has given me the desire and purpose to pursue higher goals in my life. Without her presence I would not have had the motivation to attempt such a project. I thank you Traci for your unconditional understanding; for all those nights and weekends when I could not be home because I was working on what seemed like a never ending list of midterms, papers, and projects. Thank you Traci for every thing that you are. You are very special.

I would also like to dedicate this paper to my parents who also have been very supportive of me throughout graduate school. The two of you have always been an active positive force in my life. Whether it is was never missing an inning of a baseball game or asking how a midterm went, you always cared. I thank you for teaching me to realize that anything can be accomplished. You taught me that any dream is possible, no goal is unreachable. You enabled me to believe in myself.
ACKNOWLEDGMENTS

I would like to express my sincere appreciation to the many individuals who have provided me with support and encouragement throughout this research process. A sincere thank you is extended to my examination committee: Dr. Melanie Brodnik, Dr. Carol Osborn, and Dr. Carol Bininge for their valuable input and support. A special thank you is extended to my advisor, Dr. Melanie Erodnik, who without her guidance and encouragement none of this would have been possible. Her expertise and knowledge has truly been an invaluable asset to me throughout this process. In addition, I would like to also thank Dr. Larry Sachs for his technical assistance.

I would also like to acknowledge many of the individuals that I worked with at The Ohio State University Medical Center. Everyone has been understanding and supportive of my academic efforts and I am very grateful. Specifically, I would like to thank the three different supervisors I have had during my endeavors - Phyllis Teater, Sandy Scott, and Vicki Morrison.
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CHAPTER I

INTRODUCTION

Background and Setting

Few clinicians would argue the importance of high quality discharge instructions as increasingly higher acuity patients are discharged from inpatient medical institutions. A member of the Discharge Instruction Task Force for Automation at The Ohio State University Medical Center stated that ".the discharge instructions are one of our last chances to have a positive impact on our patients" (minutes from the Discharge Instruction Task Force for Automation meeting, 4/7/1993). Although computer systems may be used in a variety of aspects of the health care industry, could such technology improve the quality of the instructions a patient receives at discharge?

The idea of improving quality with the help of automation has been studied at various stages of the health care delivery process. For example, Nauert, Lower, and Cox. (1993) described improvement in 23 different types of documented categories as a result of the implementation of a computerized bedside documentation system. As an emphasis on information technologies continues to increase, many health care institutions are using various methods of automation to improve the discharge process. Kjerulff (1994) described the importance of studying such improvement by stating that in the competitive market of health care it is important to know that money spent on information technology is making the organization function more effectively and efficiently. The effect of a computerized discharge instruction system on the quality of documentation is addressed in this study.
In 1996 OSUMC implemented an in-house developed discharge instruction application termed Electronic Discharge Instructions or EDI. The Ohio State University Medical Center (OSUMC) is an academic medical institution located in Columbus, Ohio. The Medical Center consists of a partnership between The Ohio State University Hospitals (400 beds), the Arthur G. James Cancer and Research Institute (100 beds) and The Ohio State University College of Medicine. This system enabled physicians to complete patient discharge instructions as well as review instructions from previous admissions from any OSUMC computer or terminal. Prior to this implementation, discharge documentation was manually transcribed. A multipart document called the Discharge Instruction Form was completed at the time of discharge (see Appendix B for an example of this form). One of the main forces driving the decision to develop this application was based on the fact that the written Discharge Instruction Form did “not meet the needs of the institution, the patient, or the referring and follow-up physicians” (minutes from the Discharge Instruction Task Force for Automation meeting, 4/7/1993).

Although to a much smaller degree, as of March 1997 this form was still used by physician services that had not completely transitioned to EDI.

At OSUMC a standard was adopted that defined a set of categories and data, termed critical elements, that should be present on all discharge instruction form (see Table 1). The adoption of this standard occurred before and contributed to the design of the carbonized multipart Discharge Instruction Form. Therefore, all discharge instructions should contain the same categories and data elements regardless of patient condition, physician service, or how the discharge documentation was created. Both the multipart Discharge Instruction Form and EDI were designed to facilitate the completion of each of the critical elements.
Table 1: OSUMC's Critical Discharge Instruction Data Elements

At OSUMC the process of creating discharge instructions was a physician responsibility. Although other health care professionals may have been actively involved in discharge planning or teaching, the creation and approval of the Discharge Instruction Document was performed by the physician service. Therefore, the primary users of the application were attending physicians, residents, interns, medical students, and patient care resource managers (see the PCRM definition for more information on PCRM). Staff nurses and other unit personnel had minimal involvement in the creation of the discharge instruction document. Therefore, EDI was considered a physician-focused application. At other institutions such as Johns Hopkins Hospital and New England Deaconess Hospital, nurses were the primary users of their discharge instruction applications (Nickols et. al., 1987) and (Sider and Peterson, 1992).
Purpose of Study

The purpose of this evaluative study was to determine if computerization had an impact on the completeness, readability, and legibility of patient discharge instructions. Additionally, this project would determine if and/or which of the individual critical data elements of patient discharge instruction were affected. For the purpose of this research project, these characteristics were evaluated as an indicator of quality of the discharge instruction documentation. Although quality can contain other characteristics such as appropriateness, this project evaluated quality only considering completeness, readability, and legibility. Lastly, the study measured any such differences between the OSUMC divisions of Medicine, Surgery, and Rehabilitation.

Significance of Study

The Discharge Instruction Document serves a variety of purposes at OSUMC. Unlike most medical records that typically remain part of the confidential medical record, discharge instruction documents are reviewed by a number of individuals for a variety of purposes. For example, it is not uncommon for various copies of this document to be reviewed by the patient, patient's family, post discharge care facility, referring physician, family physician, and any OSUMC clinician that cared for the patient post discharge. Therefore this document must to be useful, meaningful, and inclusive to a wide range of both laypersons and clinicians.

This study provides valuable data on the effect of EDI on the quality of discharge documentation. Since this information has not previously been evaluated, the results provided OSUMC with data that helped evaluate the impacts of EDI.
Research Questions

This project focused on the impact a clinical information system had on the Discharge processes.

Specifically the quality of the Discharge Instruction Document was examined. The research questions for this project were:

- Is there a difference in the quality of the manual discharge instruction documents versus automated discharge instructions?
- Is there a difference, among the Divisions of Medicine, Surgery, and Rehabilitation, in the quality of the manual discharge instruction documents versus automated discharge instructions?
- Is there a difference, by discharge instruction critical element, in the quality of the manual discharge instruction documents versus automated discharge instructions?

Definition of Terms

The following definitions were used for the purpose and scope of this project.

- **CIS** – In the field of Health Informatics CIS stands for Clinical Information System. At OSUMC, the computer system that is used to review clinical results as well as input discharge instruction information is also referred to by the employees as "CIS". See Appendix F for example screen prints from OSUMC's CIS.

- **Critical Elements or Discharge Instruction Critical Element** – In conjunction with JCAHO's requirements and an attempt to increase quality and consistency, the Medical Center has defined a number of critical data elements that should be addressed on the discharge instruction document. These individual pieces of information have been adopted by OSUMC as relevant and should be addressed on all discharge instruction documents. See Appendix B and Error! Not a valid link. for the listing of OSUMC's discharge instruction critical elements.
- **Discharge Instruction Document (also referred to as the Discharge Summary)** – A document generated by a clinician for the purpose of providing instructions to the patient as well as information about the patient's stay. The document served a dual role of information for the patient as well discharge summary information that is a permanent part of the medical record. It was standard practice at OSUMC that this document was written at a patient level, not using medical terminology or abbreviations. This document existed in either an electronic form, being generated via EDI, or a hand written Discharge Instruction Document. See Appendix A for an example of the hand written form and Appendix K for an example EDI.

- **Division** – A grouping of physician services that shared a commonality in relation to services performed. Although other divisions existed at OSUMC, such as Women and Infant, Medicine, Surgery, and Rehabilitation were the three divisions used in this project. See Appendix C for a detailed description of the services that make up the Divisions.

- **Document Type** – A term used to describe the media on which to patient's discharge instructions have been recorded. The document type was either hand written or electronic (EDI).

- **EDI or Electronic Discharge Instructions** – The name of OSUMC's clinical information system that clinicians used to create discharge documentation via a computer. It was also use used to refer to the actual instructions a patient received if they were created EDI. For example, a nurse might say when preparing a patient to leave their room at discharge, "has the patient gotten their EDI yet?"

- **HIS** – Health Information System
- **PCRM or Patient Care Resource Manager** – Many of the physician services at OSUMC had a non-physician team member call a Patient Care Resource Manager, or PCRM. This individual was a permanent and consistent member of the service. Unlike residents and medical students, PCRMs did not rotate to a new service every month. They typically rounded with the service and functioned as a team member in most capacities. Most of these individuals were RNs, although some had other backgrounds such as social work. The PCRMs focused on quality and continuity issues from both the patient and OSUMC perspective. Although it varied from service to service, the PCRM was typically involved in the discharge instruction process, automated and manual.

- **Quality or Discharge Instruction Quality** – A term used to describe the completeness, readability, and legibility of the Discharge Instruction Document. Completeness is based on each of the critical elements and how they are addressed. The more complete the critical elements, the higher the quality of the discharge instruction document. The readability was based on the ease by which a typical patient would be able to understand the instructions. Specifically, were medical abbreviation and/or medical terminology used? Legibility described how easy or difficult it was for a patient to ready the instructions. Legibility was primarily an issue for hand written instructions. See the Instrumentation section on page 26 in Chapter 3 for specifics on how each of the critical elements were evaluated.

- **Service or Physician Service** - The clinician team responsible for the care of the patient. Services were categorized by the specialty of the attending physician. Examples of services were Cardiology, Thoracic Surgery, and Family Medicine. A typical service consisted of an attending physician, resident(s), intern(s), medical student(s), and sometimes a patient care resource manager.
Limitations of the Study

The first limitation of this study was recent emphasis on the quality of discharge instructions, a Hawthorne Effect. The quality of the instructions a patient received at the time of discharge was an area that was targeted for improvement at OSUMC (Minutes from the Task Force for Automation of Discharge Instructions, 4/1993). The fact that this issue received attention may have heightened clinician awareness to quality and completeness issues. This alone may have had an impact on the quality of the Discharge Instruction Document.

Another limitation of this study was the fact that a PCRM's presence on a service was not taken into account when measuring pre and post Discharge Instruction Document quality. PCRMs were being added to services throughout OSUMC over the last several years. Their impact on the quality of the Discharge Instruction Documents may have been significant. The scope is this study did not include this variable when measuring pre and post discharge instruction quality.

A third limitation that should be identified was the fact that this project did not examine the data elements in relation to the rest of the person's medical condition or medical record. This study only examined data present on the Discharge Instruction Document. For example, if a patient's discharge instruction documentation contained three properly documented medications and the patient actually was discharged on five medications, a perfect score of "2" would have been recorded. No attempt was made to validate the information for correctness or completeness by comparing it to other documents in the patient's medical record.
Assumptions

As described in the limitations of this study, no attempt was made to consider what should have been documented when evaluating the discharge instruction critical elements. For the purpose of this study it was assumed that omissions in relevant clinical information occurred at the same rate for hand written and electronically generated instructions.

In addition, no attempt was made to validate the correctness of the information contained on the discharge documentation. It was assumed that all information contained on the patients' instructions was accurate.
CHAPTER 2

REVIEW OF LITERATURE

Overview

The literature revealed that a number of institutions are using computers during the discharge process. The idea of using computers to facilitate various aspects of a patient discharge is not a recent one. Recognized as a powerful assistive device over 21 years ago, the Full Term Nursery at Duke University Medical Center used computers to assist with the creation of nursery discharges (Jelovsek, Smith, Blackmon and Hammond, 1977). In 1976 this system interfaced with Duke’s computerized obstetric medical record that was instituted in 1971. This in-house developed system imported information from the previously automated obstetric record and combined it into the printed nursery discharge summary.

Ornstein, Oates and Fox (1992) described the evolution of medical documentation from information primarily stored in physician memories in the 1900s to the computerized patient records of current times. The authors went on to summarize some of the inadequacies associated with a paper record such as, "insufficient in content, format, accuracy, and accessibility to allow determination of health care effectiveness and outcomes." It was suggested that as technology improved and medical records converted into an electronic format many of shortcomings associated with the paper medical record could be minimized.
Aghababian, Williams, Holbrook and Lew (1992) also described the limitation of the handwritten medical record in an emergency department environment by stating that physicians don't have an adequate amount of time to complete manual documentation. Both Aghababian, et al (1992) and Ornstein, et al (1992) concluded that many of the problems with handwritten documentation could be eliminated with automation.

The concept of evaluating computer systems from a variety of perspectives such as technical, economic, and social impacts is also noted in the literature. In 1987 an anonymous author (Journal - Health Technology) described the importance of a technology assessment and how it should be integrated with an institution's quality assurance program. Kjerulff (1994) also described the importance of evaluating computer systems based on intended objectives by stating "a computer system that is technically sound but is not used effectively will not achieve its intended benefits." In response to recent trends in the health care industry of evaluating broad organizational concerns and impacts, Kaplan (1997) described an increasing interest in evaluating computer information systems.

A variety of methods have been used to evaluate health care related computer applications. Anderson and Aydin (1994) describe nine categories that are involved when researching and evaluating an information system (see Table 2). The authors described the effects of automation, or impacts, as "direct or indirect, and intended or unintended." Kaplan (1997) took an even more broad approach when describing "newer evaluation approaches." A "social interactionist perspective" was described which considered the characteristics of the system, the individual, the organization, and the effects among them. When examining the benefits of an HIS, Wong and Abendroth (1996) considered three perspectives: efficiency, patient care, and clinical research.
• External Environment of the Organization
• Internal Environment of the Organization
• Information System Users
• Systems Development Environment and Staff
• Management and Operational Environment of the System
• The Nature of the System Including the Information Processed
• Patterns of Utilization
• Organizational Impacts
• Social Impacts

Table 2: Categories of HIS research and evaluation (Anderson & Aydin, 1994)

Scope of Literature Search

A variety of methods were used to review the literature for this study (see Table 3). Electronic search engines, Internet search engines and news groups were used. The following table describes the details of each search resource. Although revisited several times throughout this project, none of the Internet resources produced any usable sources.
Search Resources

MEDLINE<1966 - Oct 1996> Electronic Search Engine,
   Key Work Combinations: automated, discharge, instructions, electronic, computer, computers, computerized, quality, documentation

CINAHL<1982 - September 1996> Electronic Search Engine,
   Key Work Combinations: automated, discharge, instructions, electronic, computer, computers, computerized, quality, documentation

   Key Work Combinations: automated, discharge, instructions, electronic, computer, computers, computerized, quality, documentation

Sci.Med.Informatics, Medical Informatics Internet News Group
   A request for information was posted several times throughout the study.

HIMS Listserv
   A message was posted on the HIMS listserv asking for information on any institutions that have had experiences with computerized discharge instructions.

Yahoo and AltaVista Internet Search Engines
   An Internet search was also done in an attempt to location information on hospitals that are currently using computerized discharge instructions but have not published their work. Searches were conducted multiple times throughout this project because of the inconsistencies and rapid growth of the Internet.

Table 3: Search resources utilized for the review of the literature

Although the literature base for clinical information systems was growing, very few articles could be located that examined the quality of discharge documentation in relation to the implementation of a clinical information system. The topic has, however, been studied in other aspects of the health care delivery process, specifically nursing care. From a similar quality of documentation perspective, this issue has been examined in the area of nursing documentation and how it is affected by an information system.
Literature Findings

At the time of this research project no specific national standard or guideline existed for the content of patient discharge instructions. The standards defined by the Joint Commission on Accreditation for Health Organizations (JCAHO) stated that there needs to be evidence in the patient's record of discharge instructions to the patient and family (IM.7.2). JCAHO does not define a specific set of data elements that should be contained in the instructions. Required or suggested content are therefore left for the individual institution to define. JCAHO also required that the medical record include a clinical resume, which contains the reason for hospitalization, significant findings, procedures performed, treatment rendered, the patient's condition at discharge and instructions to the patient and family.

Considering this, each institution must define what should be the standard information that appears on discharge instruction documentation. Therefore, this process would be the first step in defining quality for an institution's discharge instructions. Aghababian, et al (1992) described quality in a health care setting as an ever-changing entity that must be continually redefined. The authors go on to describe a variety of perspectives of quality and how quality evolves as new knowledge and technology becomes available. It was also stated, from an emergency department perspective, that technology can assist physicians as they gather and process data and consequently improve the quality of patient care (Aghababian, et al 1992). Wong and Abendroth (1996) had similar points of view but, from a more global perspective. The authors discussed several areas where automation improved the quality of care and minimized resource utilization. Wong and Abendroth (1996) cited a variety of examples that improved the overall quality and efficiency of care. Areas such as physician order entry, monitoring / reminder systems, and results reporting systems were the main examples cited. The potential for future physician focused systems and their benefits were common themes of both of these articles (Aghababian, et al 1992) and (Wong and Abendroth, 1996).
Vukmir, et al (1993) described how computerized discharge instructions improved patient compliance with emergency department referrals by 10%. These instructions were entered into a computer system by an emergency department physician and printed at the time of discharge. Although it is not known exactly what specific aspects of the instructions were enhanced with automation, the results imply an improvement in the quality of the discharge instruction documentation and directly impacted follow-up care. An even more noticeable improvement in compliance referrals of 28.6% was observed when using computerized discharge instructions with patients over the age of 40.

The Emergency Department at UCLA experienced similar results utilizing computers to improve the quality of care was the UCLA Emergency Department. Specifically, the ED utilized an expert charting system called EDECS (Schriger, et al 1994). This physician-focused system facilitated patient care by integrating clinical guidelines into everyday practice and generated patient discharge instructions. This system utilized decision rules that were designed to address specific chief complaints such as acute low back pain or fever in children (Schriger, et al 1994).

Beyond the scope of an emergency department, a variety of institutions realized positive impacts as a result the implementation of information systems. For example, at New England Deaconess Hospital an information system was implemented in an attempt to improve the interagency referral document and patient home instruction documents (Siders and Peterson, 1992). Prior to automation, problems of poor quality, inconsistent information, and incomplete data were identified. In addition, the handwritten documents were difficult to decipher. The authors reported that the implementation of an automated nursing discharge summary improved quality, efficiency, and encouraged interdisciplinary discharge planning. However, it is not known how these improvements were measured or to what degree they occurred.
Johns Hopkins Hospital developed a discharge instruction application in order to "provide its patients with concise, easy-to-read discharge instruction" (Nichols, et al 1987). This system prompted the nurse for discharge instruction information such as patient activity level, follow-up appointments, and discharge medications. This system interfaced with other systems and some data were collected automatically.

The article was written in the early stages of development so outcomes and/or results are unknown. The authors did project certain benefits such as a standard level of quality discharge information that is easy for the patient to read. Other potential benefits identified were a decrease in time the nurse spent writing discharge instructions, error-checking abilities, and convenient retrieval of discharge instructions for research purposes (Nichols, et al 1987).

The University Hospitals and Clinics in Columbia, Missouri improved the quality of their nursing documentation as a result of an HIS implementation. Implementation of an HIS improved the quality of 23 nursing documentation elements following the implementation of a bedside documentation system (Nauert, et al 1993). The authors indicated that the system’s usage of pre-set defaults or prompts and automatic prompting may have had an impact on the improvement. Nauert, et al., (1993) stated, with respect to the improvements, that the “introduction of an automated system will not improve the quality of documentation unless the information is prompted or is inserted automatically via default.” (Nauert, et al p. 114, 1993).

A point-of-care bedside nursing documentation was implemented at New York University Medical Center. Marr, et al (1993) examined the effects of bedside terminals on the quality of nursing.

Traditional benefits of automation such as accuracy and speed had already been realized. The focus of this article was to determine if the addition of bedside terminals would help to increase timeliness and completeness of nursing documentation. Specifically, documentation dealing with medication administration charting, daily charting, physical assessments, and admission nursing notes, were areas of interest. The authors examined nursing documentation from two medical nursing units. No positive
correlation between the presence of bedside terminals and improvement in completeness and timeliness of medication administration charting, daily charting, physician assessment, and nursing admission notes was supported (Marr et al, 1993). The authors were unable to identify any specific reasons for this fact.

Newton (1995) studied the effects of the implementation of a computerized nursing care planning system on the quality of documentation as well as nursing satisfaction with the computer system. The assessment of the quality of documentation focused on the areas of assessment, planning, and evaluation of nursing care plans. Handwritten documentation (pre-system implementation) and computer-generated records were taken from two wards at Royal Hampshire County Hospital, Winchester. Data from 16 different wards were analyzed using the document section of a quality assessment tool. Nursing attitudes toward computerized care plans changed from 41% negative attitudes prior to implementation to 72% negative three months after implementation. Newton summarized the staff's feelings toward the computer system by stating "70% responded that they would not miss the computer if it was taken away." Although the staff did not appear to be satisfied with the documentation system, improvements in the quality of documentation were observed. The number of assessments demonstrated a non-significant increase from 61% to 68%. However, care plans demonstrated a statistically significant increase from 32% to 70% after the system had been used for three months. The care plans improvement was significant for planning and evaluation for each of the documentation components. Based on Newton's conclusions, the quality of documentation was improved with the implementation of a computerized bedside documentation system despite the nurses' negative attitudes toward the system.

Another example of a nursing information system being utilized to create individualized care plans was the system at the University of Iowa Hospitals and Clinics (Prophet, 1993). The care plans generated with this system encompassed patient critical data, nursing orders, and a problem list. In addition, the
system (termed INFORMM) had the capability to generate a patient discharge referral form that involved clinician inputs from social services, medical records, and nursing. The author reported that this system improved the quality of discharge instructions, specifically in the following areas: continuity of care, interdisciplinary care planning, documentation efficiency, content standardization, and quality improvement and research. However, it was not reported how or to what degree these objectives were measured or evaluated (Prophet, 1993).

In summary, a number of studies documented the impacts and improvements of computerization for a variety of healthcare settings under varying conditions. Specifically, the areas nursing documentation, emergency department instructions and referrals, and patient discharge documentation were examined. In general, although to varying degrees, these impacts resulted in improvement. However, it should be noted that no study specifically examined the effects of automation on the individual elements or categories of patient discharge documentation of an in-patient physician based clinical information system.
CHAPTER 3

METHODS

Introduction

The purpose of this chapter is to present how this study was conducted. The chapter is divided into six sections. The first section describes OSUMC's computer environment, design, and output. The second section describes the research design of the study. Section three describes the sample selection procedures that were used. The fourth and fifth sections specify the data collection procedures and the instrumentation methodology. The final section describes the data analysis techniques.

OSUMC's Program Design

Hardware Environment

The CIS system operated on a VAX-cluster based system. VT terminals and PCs running terminal emulation software were the primary means of connecting to the system. Such access was provided on the nursing units as well as a variety of other locations throughout OSUMC. Several external OSUMC facilities such as walk-in clinics remote and departmental practices also were connected to OSUMC's network. In addition, the network, including CIS, could be accessed from remote locations through the use of a secure modem connection.
CIS Environment

CIS was a results-reporting system that allowed clinicians access to a variety of clinical data (see Appendix F for example screen prints). Information on almost any patient could be accessed from any terminal, although some security restrictions did apply. Examples of information that could be accessed were labs, visit history, dictated reports, cardiology reports, radiology reports, and completed discharge instruction documents.

EDI Environment

EDI was a significant enhancement to the CIS system (see Appendix G for sample EDI screen prints). For the first time clinicians were able to input information as opposed to simply displaying it. During the input of discharge instruction information the physician would navigate through a variety of menus that would prompt him/her for the appropriate information. A variety of symbols helped to guide them through the data entry process, indicating which categories contained information, which ones were not yet completed, and which ones were intentionally blank (such as if the patient were not on any medications). It should also be noted that the only required or mandatory fields were the Condition upon discharge, Diagnosis, and Discharge to Where fields. All of the other categories could be left blank by simply striking a function key.

Although EDI was modeled after the hand written discharge instruction form, some differences did exist. Specifically, some optional categories were added to EDI. These categories were not part of OSUMC's critical discharge elements and were not evaluated during this project. The additional categories were Secondary Diagnosis, Allergies, Miscellaneous Instructions, and Addenda (see appendix G for example screen prints).
System Output

Upon completion of the discharge instructions three copies were printed on a laser printer located on the nursing unit. Copies were designated for the patient, permanent medical record, and physician. At any time additional copies of this document could be printed. See Appendix K for an example of a printed EDI.

Research Design

An evaluative research design using a retrospective chart audit, specifically of the Discharge Instruction Form, was used to collect information regarding the quality of discharge documentation at OSUMC.

Sample Selection

The Information Systems Department estimated that by September 1996, 75%-85% of hospital inpatient services were using EDI on a regular basis. Therefore, the date of September 1, 1996 was chosen as the reference date for selecting pre and post EDI implementation medical records. Hand written discharge instruction forms were selected from medical records that had discharge dates ranging from September 1, 1995 to August 31, 1996. Electronically created discharge instructions that were selected had discharge dates ranging from September 1, 1996 to March 1, 1997. The reason that the pre EDI implementation date range is 12-months as opposed to the 6-month post implementation was related to the rate EDI in which EDI was implemented on the units. Because EDI implementation was gradual, a number of services had been using the computer application for a significant period of time prior to September 1996. Due to this fact, the extended pre-implementation time frame was necessary to insure an adequate number of pre EDI discharge instruction forms.

A stratified random sampling strategy was used to select medical records for both the pre and post
implementation categories. Two lists that contained all OSUMC discharges for the specified date ranges were generated. These lists were then randomized and used to generate a population from which the samples were drawn. All discharges described in the above date ranges had an equal chance of being selected.

One hundred five hand-written discharge instruction documents and 105 electronic documents were used. A total number of 210 discharge instructions were chosen as reasonable and practical in terms of review time. A table to suggest sample size was consulted and revealed a suggested sample size value that was greater than this level. The sampled discharge instructions were also separated into three categories based on the discharging division; Medical Services, Surgical Services, or Rehabilitation Services. The number of discharge instructions that were evaluated for each division is displayed in Table 4. See Appendix C for a more thorough description of the discharge rates for each division.
<table>
<thead>
<tr>
<th>Sample Source</th>
<th># Actual Discharges</th>
<th># Records Reviewed</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hand Written Discharges from 9/1/95 to 9/1/96 by Division</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surgical Services</td>
<td>8222</td>
<td>35</td>
<td>0.4%</td>
</tr>
<tr>
<td>Medical Services</td>
<td>12,532</td>
<td>35</td>
<td>0.3%</td>
</tr>
<tr>
<td>Rehab Services</td>
<td>1914</td>
<td>35</td>
<td>1.8%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>22,668</td>
<td>105</td>
<td>0.5%</td>
</tr>
<tr>
<td><strong>Electronic Discharges from 9/1/96 to 3/31/97 by Division</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surgical Services</td>
<td>3852</td>
<td>35</td>
<td>0.9%</td>
</tr>
<tr>
<td>Medical Services</td>
<td>5713</td>
<td>35</td>
<td>0.6%</td>
</tr>
<tr>
<td>Rehab Services</td>
<td>843</td>
<td>35</td>
<td>4.2%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>10,408</td>
<td>105</td>
<td>1.0%</td>
</tr>
</tbody>
</table>

Table 4: Actual discharges and records reviewed by OSUMC division

**Data Collection Procedures**

Permission was obtained from the Medical Information Management Department to review discharge instruction documents (see Appendix H for the request for access form). According to the guidelines set forth by The Ohio State University and The Ohio State University Medical Center, human subject approval was not required because patient identification information was never recorded (see Appendix J).

**Review of Hand Written Discharge Documentation**

The manual discharge instruction documents were obtained from OSUMC's Medical Information Management Department. Upon approval to review the records, the desired date ranges, possible
services, and sampling method was submitted to Medical Information Management. Per standard OSUMC policy, charts were reviewed in the Medical Information Management Department in batches of 25. The discharge instruction document's critical element information was recorded on a data collection sheet (see Appendix E). If a record did not contain a manually written discharge instruction document, it was discarded and no information was recorded.

Review of Electronic Discharge Documentation

Permission was obtained to review the electronic versions of the discharge instruction documents from any OSUMC networked terminal. With the help of Medical Information Management and the Information Systems Department a randomized list of medical record numbers was created using the previously stated subject selection criteria. The documents were then review by the researcher and the Discharge Instruction Document's critical element information was recorded on a data collection sheet.

Data collection was performed in batches of 25 of fewer charts in an attempt to maximize intra-rater reliability and provide some assurance of consistency in data collection over time. Additionally, a group of 10 charts were evaluated using the previously stated data collection sheet and criteria to ensure intra-rater reliability in relation to the interpretation of critical element criteria. The total scores were recorded and stored in a separate location. One week later the same 10 charts were reevaluated. The total scores were identical (see appendix D for pilot scores). Pearson r was calculated as a check on intra-rater reliability. The results indicated a strong positive relationship (r = 1.00, p = .000) between scores obtained during the two trial periods.
Instrumentation

Each of the discharge instruction categories were rated using either a 0-1 scale or a 0-2 scale. The following is a description of the criteria used to evaluate each category.

0-1 Scale Discharge Items

The 0-1 scale was used for items that had only one dimension (present or not). Elements were assigned a "1" if the item was present and a "0" if the item was absent. The following table presents the elements that were evaluated using this 0-1 scale.

<table>
<thead>
<tr>
<th>Critical Elements Evaluated with the 0-1 Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>An order for the patient’s discharge</td>
</tr>
<tr>
<td>Resident to dictate discharge summary (if stay &gt; 2 days)</td>
</tr>
<tr>
<td>Date of admission</td>
</tr>
<tr>
<td>Discharge diagnoses</td>
</tr>
<tr>
<td>Condition at discharge</td>
</tr>
<tr>
<td>Date of discharge</td>
</tr>
</tbody>
</table>

Table 5: Discharge instruction critical elements that were scored from 0-1

0-2 Scale Discharge Items

Categories that were more complex than the ones listed above were rated with a 0-2 scale. Table 6 describes the specific criteria that were used to rate each category. The lowest score of "0" was recorded if the critical element was unable to meet the criteria for score of "1". A value of "1" was scored if the category's criteria was only partially met as per the criteria described. A "2" was scored only if all the criteria described below was met for a given category and the information was legible.
Even though the criterion for each of the critical elements was specific to the nature of the category's content, legibility of the writing and readability was a consistent criterion across all of the critical elements.
<table>
<thead>
<tr>
<th>Critical Element</th>
<th>Requirements for a “1” Rating</th>
<th>Requirements for a “2” Rating</th>
</tr>
</thead>
</table>
| Operation(s) / Procedures | - Operation or procedure information was listed but a date was not specified  
- Pieces were illegible                           | - The following conditions were met.                                                      1. The operation or procedure and a date(s) were present.  
2. Reference to the fact that the patient did not have any operations or procedures.  
3. Was legible |
| Discharge medications   | - Medications were listed but two or more of the follow were not met.  
- Dose, Route, Frequency, or Reason not specified  
- Drug name, dose, route, or frequencies were specified but contained medical abbreviations.  
- Pieces were illegible                  | - Medications were listed and one or fewer of the follow were observed.  
- Dose, Route, Frequency, or Reason not specified  
- Drug name, dose, route, or frequencies were specified but contained medical abbreviations.  
- Reference to the fact that the patient was not on any medications  
- Reference to the patient to continue pre-admission medications |
| Physician               | - The physician’s name was listed but no phone number was given.  
- Pieces were illegible                     | - Both the physician’s name and phone number were specified and was legible  
- A central departmental number was given that the patient could call and was legible |
| Follow-up plans and appointments | - Follow-up appointment information was specified but did not include a date, time, or location OR did not include a phone number to schedule appointment.  
- Pieces were illegible                      | - Follow-up appointment information was specified and included: date, time, location OR phone number to schedule appointment.  
- It was stated that the patient did not have any follow up plans or appointments. |
| Activity limitations    | - Activity limitations were specified but pieces were illegible.                           | - Activity limitations were specified.  
- It was stated that the patient did not have any activity limitations. |
| Diet                   | - Diet information was specified but pieces were illegible.                               | - Diet information was specified.  
- It was stated that the patient did not have any dietary limitations. |
| Special care needs      | - Care instructions that would fall under any of the other categories were presented but either pieces were illegible or contained medical terminology/abbreviations. | - Care instructions that would fall under any of the other categories were presented in a legible format using lay person terminology. |

Table 6: Discharge instruction critical elements that were scored from 0-2
Data Analysis

Frequencies and percentages were used to summarize discharge instruction critical elements before and after EDI implementation. To address statistical significance across divisions (Medicine, Surgery, and Rehabilitation), a log linear analysis was conducted for each criterion. This log linear analysis was essentially a three dimensional chi-square (method by Division by rating) which allowed an overall assessment of before and after EDI implementation, as well as changes related division. A total score was generated by summing across the items. Document type and division differences on this total score were analyzed in a two-way analysis of variance. Inferential analysis was performed at the 0.05 level of significance.
CHAPTER 4

ANALYSIS OF DATA

The purpose of this evaluative study was to determine if computerization had an impact on the quality of the discharge documentation, if any of the individual critical data were affected, and measure any differences among the OSUMC divisions of Medicine, Surgery, and Rehabilitation relative to discharge documentation.

The evaluation method used to score discharge documents, as previously described, resulted in an overall document score ranged from a maximum of 20 to a minimum score of 0.

Profile of Sample

A total of 210 medical records were reviewed. These were divided into two groups: 105 hand written instructions from charts of patients discharged ranging from September 1, 1995 and August 31, 1996 and 105 instructions created using EDI from charts of patients discharged between September 1, 1996 to March 1, 1997. The pre and post EDI implementation instructions were further subdivided into one of three OSUMC discharging divisions. An equal number of records were randomly sampled from each division (35 for each division). The records were evaluated using specific criteria for each of the critical elements (see page 26 in Chapter 3). Items were then scored. A statistical analysis computer program, SPSS, was used for data input and analysis. The following sections present the analysis of data by research questions. See Table 7 for a breakdown of the sample population.
<table>
<thead>
<tr>
<th>Division</th>
<th>Hand Written</th>
<th>EDI</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medicine</td>
<td>35</td>
<td>35</td>
<td>70</td>
</tr>
<tr>
<td>Surgery</td>
<td>35</td>
<td>35</td>
<td>70</td>
</tr>
<tr>
<td>Rehabilitation</td>
<td>35</td>
<td>35</td>
<td>70</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>105</strong></td>
<td><strong>105</strong></td>
<td><strong>210</strong></td>
</tr>
</tbody>
</table>

Table 7: Sample breakdown by division and method of post-discharge instruction

Research Question 1.

Is there a difference in the quality of the manual (hand written) discharge instruction documents versus automated (computer generated) discharge instructions?

This question was related to the overall score of the discharge document, the summation of all the critical elements. Means and standard deviations representing the overall score of the discharge documents were calculated for both handwritten discharge instructions and instructions created with EDI (see Table 8). An ANOVA test also was performed using the scores of discharge documents for both document types (see Table 9).

The combined or overall mean score of the discharge instruction documents was 16.61 and a standard deviation of 3.50 (n = 210). Handwritten discharge instruction documents scored 14.41 and sd = 3.70 (n = 105). Discharge instructions created with EDI scored 18.82 and sd = 1.06 (n = 105). This difference was statistically significant (F = 137.611, p < .0001) difference.
<table>
<thead>
<tr>
<th>Document Type</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand Written</td>
<td>105</td>
<td>14.41</td>
<td>3.07</td>
</tr>
<tr>
<td>EDI</td>
<td>105</td>
<td>18.82</td>
<td>1.06</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>210</td>
<td>16.61</td>
<td>3.50</td>
</tr>
</tbody>
</table>

Table 8: Means and standard deviations for overall discharge document scores

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Document Type</td>
<td>1</td>
<td>1020.805</td>
<td>1020.805</td>
<td>137.611</td>
<td>.000</td>
</tr>
<tr>
<td>Within Document Types</td>
<td>208</td>
<td>1542.952</td>
<td>7.418</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>209</td>
<td>2563.757</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 9: ANOVA summary table for overall score by document type

Research Question 2.

Is there a difference, among the Divisions of Medicine, Surgery, and Rehabilitation, in the quality of the manual discharge instruction documents versus automated discharge instructions?

This question was related to the overall score of the discharge document, the summation of all the critical elements, by division. Means and standard deviations representing the overall score for each division are summarized in Table 10.
<table>
<thead>
<tr>
<th>Source</th>
<th>n</th>
<th>Mean</th>
<th>sd</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand Written</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medicine</td>
<td>35</td>
<td>14.29</td>
<td>3.61</td>
</tr>
<tr>
<td>Surgery</td>
<td>35</td>
<td>14.49</td>
<td>3.55</td>
</tr>
<tr>
<td>Rehabilitation</td>
<td>35</td>
<td>14.46</td>
<td>4.03</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>105</td>
<td>14.41</td>
<td>3.70</td>
</tr>
<tr>
<td>EDI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medicine</td>
<td>35</td>
<td>18.46</td>
<td>1.24</td>
</tr>
<tr>
<td>Surgery</td>
<td>35</td>
<td>19.06</td>
<td>0.84</td>
</tr>
<tr>
<td>Rehabilitation</td>
<td>35</td>
<td>18.94</td>
<td>1.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>105</td>
<td>18.82</td>
<td>1.06</td>
</tr>
<tr>
<td>Overall</td>
<td>210</td>
<td>16.61</td>
<td>3.50</td>
</tr>
</tbody>
</table>

Table 10: Means and standard deviations representing overall scores for each division

In addition, a two factor ANOVA test was performed using the scores of discharge documents for both document type and division (see Table 11). There was a statistically significant main effect for document type ($F = 135.66; df = 1.204; p < .0001$). The mean for the handwritten records was 14.41 (sd = 3.70) while the mean for the electronic records was 18.82 (SD=1.06).
<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Effects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Document Type</td>
<td>1</td>
<td>1020.805</td>
<td>1020.805</td>
<td>135.661</td>
<td>.009</td>
</tr>
<tr>
<td>Division</td>
<td>2</td>
<td>6.371</td>
<td>3.186</td>
<td>.423</td>
<td>.655</td>
</tr>
<tr>
<td>2-Way Interactions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Document Type &amp; Division</td>
<td>2</td>
<td>1.552</td>
<td>.776</td>
<td>.103</td>
<td>.902</td>
</tr>
<tr>
<td>Model</td>
<td>5</td>
<td>1028.729</td>
<td>205.746</td>
<td>27.343</td>
<td>.000</td>
</tr>
<tr>
<td>Residual</td>
<td>204</td>
<td>1535.629</td>
<td>7.525</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>209</td>
<td>2563.757</td>
<td>12.267</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 11: ANOVA summary table for overall document score by document type and division

Research Question 3.

Is there a difference, by discharge instruction critical element, in the quality of the manual discharge instruction documents versus automated discharge instructions?

A log linear analysis was performed on 12 of the 13 discharge instruction critical elements in order to address differences across divisions for each element. No analysis was performed on Patient Name because it was present on all 210 medical records that were reviewed. The log linear analysis allowed for an overall assessment of documentation type (hand written or EDI) as well as changes related to Division.

Summary of Overall Log Linear Results

Every discharge instruction critical element, with the exception of Admission Date, Dictating Resident, and Patient Name, demonstrated a statistically significant main effect for document type (see Table 12). In all of these cases the observed change was an improvement when EDI was used. Only two critical elements, Follow-up Appointments and Operations / Procedures, demonstrated statistically significant main
effects for division (p = .05 and p = .0003 respectively). In both cases the change resulted in an improvement when EDI was used (see Table 13). In all 13 critical elements no statistically significant interaction effects were observed.

<table>
<thead>
<tr>
<th>Critical Element</th>
<th>Document Type</th>
<th>Division</th>
<th>Interaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity</td>
<td>.0001</td>
<td>.61</td>
<td>.68</td>
</tr>
<tr>
<td>Condition</td>
<td>.002</td>
<td>.37</td>
<td>.87</td>
</tr>
<tr>
<td>Date Admitted</td>
<td>.27</td>
<td>.61</td>
<td>.93</td>
</tr>
<tr>
<td>Date Discharged</td>
<td>.02</td>
<td>.63</td>
<td>.91</td>
</tr>
<tr>
<td>Diagnosis</td>
<td>.002</td>
<td>.37</td>
<td>.87</td>
</tr>
<tr>
<td>Dictation Resident</td>
<td>1.00</td>
<td>.06</td>
<td>.22</td>
</tr>
<tr>
<td>Diet</td>
<td>.0001</td>
<td>.24</td>
<td>.68</td>
</tr>
<tr>
<td>Drugs / Medications</td>
<td>.0001</td>
<td>.57</td>
<td>.95</td>
</tr>
<tr>
<td>Follow-Up Appointments</td>
<td>.0001</td>
<td>.05</td>
<td>.14</td>
</tr>
<tr>
<td>Patient Name</td>
<td><em>Not Analyzed</em></td>
<td><em>Not Analyzed</em></td>
<td><em>Not Analyzed</em></td>
</tr>
<tr>
<td>Physician Information</td>
<td>.0002</td>
<td>.53</td>
<td>.33</td>
</tr>
<tr>
<td>Procedures</td>
<td>.0001</td>
<td>.0003</td>
<td>.26</td>
</tr>
<tr>
<td>Special Instructions</td>
<td>.0001</td>
<td>.32</td>
<td>.16</td>
</tr>
</tbody>
</table>

* p<=.05

Table 12: Summary of p-Values from critical element log linear analysis

Critical Element Detailed Breakdown

Table 13 contains a detailed breakdown of the number of instruction documents that were scored 0, 1 or 2 by service for each of the critical elements.
<table>
<thead>
<tr>
<th>Critical Element</th>
<th>Medicine</th>
<th>Surgery</th>
<th>Rehabilitation</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 1 2</td>
<td>0 1 2</td>
<td>0 1 2</td>
<td></td>
</tr>
<tr>
<td><strong>Activity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hand Written</td>
<td>3 10 22</td>
<td>3 10 22</td>
<td>5 4 26</td>
<td>105</td>
</tr>
<tr>
<td>EDI</td>
<td>0 0 35</td>
<td>0 0 35</td>
<td>0 1 34</td>
<td>105</td>
</tr>
<tr>
<td>Total</td>
<td>3 10 57</td>
<td>3 10 57</td>
<td>5 5 61</td>
<td>210</td>
</tr>
<tr>
<td><strong>Condition at Discharge</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hand Written</td>
<td>2 33 --</td>
<td>6 29 --</td>
<td>3 32 --</td>
<td>105</td>
</tr>
<tr>
<td>EDI</td>
<td>0 35 --</td>
<td>0 35 --</td>
<td>0 35 --</td>
<td>105</td>
</tr>
<tr>
<td>Total</td>
<td>2 68 --</td>
<td>6 64 --</td>
<td>3 67 --</td>
<td>210</td>
</tr>
<tr>
<td><strong>Date Admitted</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hand Written</td>
<td>2 33 --</td>
<td>1 34 --</td>
<td>1 34 --</td>
<td>105</td>
</tr>
<tr>
<td>EDI</td>
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<td>0 35 --</td>
<td>0 35 --</td>
<td>105</td>
</tr>
<tr>
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<td>3 67 --</td>
<td>1 69 --</td>
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<td></td>
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<tr>
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<td>3 32 --</td>
<td>1 34 --</td>
<td>105</td>
</tr>
<tr>
<td>EDI</td>
<td>0 35 --</td>
<td>0 35 --</td>
<td>0 35 --</td>
<td>105</td>
</tr>
<tr>
<td>Total</td>
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<td>3 67 --</td>
<td>1 69 --</td>
<td>210</td>
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<td></td>
<td></td>
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<tr>
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<td>6 29 --</td>
<td>3 32 --</td>
<td>105</td>
</tr>
<tr>
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<td>0 35 --</td>
<td>0 35 --</td>
<td>105</td>
</tr>
<tr>
<td>Total</td>
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<td>6 64 --</td>
<td>3 67 --</td>
<td>210</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>1 6 28</td>
<td>6 3 26</td>
<td>105</td>
</tr>
<tr>
<td>EDI</td>
<td>0 0 35</td>
<td>0 1 34</td>
<td>0 1 34</td>
<td>105</td>
</tr>
<tr>
<td>Total</td>
<td>1 8 61</td>
<td>1 7 62</td>
<td>6 4 60</td>
<td>210</td>
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<td><strong>Drugs / Meds</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>20 12 3</td>
<td>15 15 5</td>
<td>105</td>
</tr>
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<td>EDI</td>
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<td>0 2 33</td>
<td>0 3 32</td>
<td>105</td>
</tr>
<tr>
<td>Total</td>
<td>22 14 34</td>
<td>20 14 36</td>
<td>15 18 37</td>
<td>210</td>
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</tbody>
</table>

*Table 13: Critical element score breakdown*

*Continued on next page*
<table>
<thead>
<tr>
<th>Critical Element</th>
<th>Medicine</th>
<th>Surgery</th>
<th>Rehabilitation</th>
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<tr>
<td></td>
<td>0 1 2</td>
<td>0 1 2</td>
<td>0 1 2</td>
<td></td>
</tr>
<tr>
<td><strong>Follow-Up Appointments</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hand Written</td>
<td>4 18 13</td>
<td>2 16 17</td>
<td>2 20 13</td>
<td>105</td>
</tr>
<tr>
<td>EDI</td>
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<td>0 4 31</td>
<td>0 5 30</td>
<td>105</td>
</tr>
<tr>
<td>Total</td>
<td>4 35 31</td>
<td>2 20 48</td>
<td>2 25 43</td>
<td>210</td>
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<tr>
<td><strong>Physician</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>Hand Written</td>
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<td>7 7 21</td>
<td>3 6 26</td>
<td>105</td>
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<tr>
<td>EDI</td>
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<td>0 1 34</td>
<td>0 7 28</td>
<td>105</td>
</tr>
<tr>
<td>Total</td>
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<td>7 8 55</td>
<td>3 13 54</td>
<td>210</td>
</tr>
<tr>
<td><strong>Procedures</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>3 18 14</td>
<td>18 2 15</td>
<td>105</td>
</tr>
<tr>
<td>EDI</td>
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<td>0 16 19</td>
<td>0 13 22</td>
<td>105</td>
</tr>
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<td>18 15 37</td>
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<td></td>
<td></td>
<td></td>
</tr>
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<td>0 35 --</td>
<td>0 35 --</td>
<td>105</td>
</tr>
<tr>
<td>EDI</td>
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<td>0 70 --</td>
<td>0 70 --</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>10 25 --</td>
<td>2 33 --</td>
<td>105</td>
</tr>
<tr>
<td>EDI</td>
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<td>9 26 --</td>
<td>6 29 --</td>
<td>105</td>
</tr>
<tr>
<td>Total</td>
<td>11 59 --</td>
<td>19 51 --</td>
<td>8 62 --</td>
<td>210</td>
</tr>
<tr>
<td><strong>Special Instructions</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hand Written</td>
<td>11 10 14</td>
<td>9 10 16</td>
<td>15 4 16</td>
<td>105</td>
</tr>
<tr>
<td>EDI</td>
<td>4 3 31</td>
<td>0 0 35</td>
<td>0 1 34</td>
<td>105</td>
</tr>
<tr>
<td>Total</td>
<td>15 13 45</td>
<td>9 10 51</td>
<td>15 5 50</td>
<td>210</td>
</tr>
</tbody>
</table>
CHAPTER 5

DISCUSSION

This chapter presents a summary of findings, discussion, conclusions, and recommendations regarding this study. Provided in the first section is a summary of the findings. The second section contains the discussion. The third section contains conclusions and the final section focuses on recommendations as drawn from the earlier sections.

Summary of Findings

The results indicated that a significant difference existed between the quality of hand written discharge instructions and instructions created with EDI (n = 105; F = 137.611; p < .0001). The electronic instructions received an overall higher mean score of 18.82 and sd = 1.06 (n = 105) compared to the manually written instruction which received a score of 14.41 and sd = 3.70. In addition to overall differences the data were examined considering document type and division a statistically significant main effect for document type was observed (F = 135.66; df = 1, 204; p = .0001). The overall document mean scores improved by the following margins for each of the divisions; Medicine 4.17 (from 14.92 to 18.46), Surgery 4.57 (from 14.49 to 19.06) and Rehabilitation 4.41 (from 14.41 to 18.82). See Figure 1 for a graphics representation of the overall results by division.
Figure 1: Mean overall document scores by division and type

When document type and division were examined together the document type had a statistically significant effect with the exceptions of date admitted, dictation resident, and patient name. In all such cases the effect was an improvement in the quality of the electronic instructions. No interaction effects between document type and division were observed. In two cases, follow-up plans and procedures / operations, division had a statistically significant effect on quality. This effect also resulted in higher quality with EDI.

Based on both the overall scores and the individual critical element scores, division appeared to have little impact on quality. Both the hand written instructions and instructions created with EDI had scores that were similar across division. Instructions for surgical patients had the highest overall score for both types of instruction media. This may be related to the fact that instructions written for surgical
patients had the least variability. No significant main effect for division was observed for the overall documents scores. However, the critical elements follow-up appointments and procedures demonstrated a significant effect for division ($p = .05$ and $p = .0003$ respectively). It was not known why these differences were observed.

Discussion

Ornstein, et al (1992) suggested that computerization of the medical record would result in a decrease in many of the problems currently seen in the hand written record. Based on the overall results it appeared that the EDI system has helped to minimize some of the shortcomings, such as access issues and legibility, which existed on the hand written form.

It was difficult to compare the results of this study to studies that were cited in the review of the literature. As previously stated none of the studies reviewed specifically examined the documentation quality of an inpatient discharge instruction system that was used by physicians. With that factor considered however, other similarities and comparisons can be examined.

OSUMC, like New England Deaconess Hospital (Siders and Peterson, 1992) and Johns Hopkins Hospital (Nichols, et al 1987), developed and implemented an information system to eliminate many of the problems associated with hand written patient discharge instructions. Similar driving issues of increasing quality, readability, easier access to information and more complete information were common goals across all three institutions. Although both authors reported improvements on a general or global level, neither reported improvement on an individual category or element levels. The improvements in discharge document quality that resulted at OSUMC after the implementation of EDI indicate that these benefits have been achieved.
In addition to improvement in overall quality, the discharge critical elements also demonstrated considerable improvement when examined on an individual basis. All of the individual critical elements improved expect for dictating resident which remained unchanged. These results are similar to the results reported by Nauert, et al (1993) for the University Hospitals and Clinics in Columbia, Missouri after the implementation of a nursing bedside documentation system. The authors reported an improvement in the quality of 23 individual nursing documentation elements. Although similar in the respect of improving important components of documentation, these two systems were different in both purpose and user population. It would not be appropriate to compare the two in any more detail than general outcomes.

In addition to the quality improvements that were observed, the fact that the quality was consistently higher was also relevant. Nichols, et al (1987) projected one of benefits that Johns Hopkins would realize would be a standard and consistent level of quality discharge instructions. Based on an overall EDI SD=1.06 down from an SD=3.70 with hand written instruction, OSUMC has benefited from consistently higher quality discharge instructions.

The three categories that did not demonstrate a significant improvement as a result EDI were date admitted, dictating resident and patient name. Patient name was present on all of the 210 records that were examined, therefor no improvement was possible. On the hand written instruction is information appeared in the upper right hand corner of the document via a carbonized imprint of the patient's identification card. This was standard practice for all medical documents at OSUMC. The EDI system automatically populated the instructions with this information as well.

Date admitted did demonstrate improvement however, the margin of improvement was minimal and therefore not significant. Only four hand written records did not contain this information and 1 electronic admission date was absent. Due to this small improvement, it was not statistically
significant. Additionally, EDI automatically assigned an admission date. No explanation could be given to explain why an electronic document would not have this value other than system error or data collection error.

Although dictating resident did not show any improvement it is not an element that is intended for the patient or follow-up caregiver. This information appears on the instruction documents for OSUMC's internal purposes and processes. In fact, the dictating resident is intentionally omitted on the patient's copy of the electronic instructions. It only appears on the chart copy and the version that is accessed through the CIS system. The accuracy and consistency of this category may be an issue for the faculty but was irrelevant to the patient and follow-up care provider.

The fact that a clinician could work on a patient's instructions from any OSUMC terminal was described as a benefit or feature of EDI. However, it is not known if this flexibility had any negative impacts. For example, if a clinician entered the instructions from a remote location they would have only limited access to the patient's chart (via CIS) and limited access to the patient and nurses caring for the patient.

Quality Evolving with Technology

Aghababian, et al (1992) described quality as ever changing and evolving as new technologies are developed and implemented. This point was evident when analyzing the two different types of discharge instruction documents. For example, it was not uncommon for electronically created special instructions to contain 10-20 lines of detailed and thorough instructions. Such detail was rarely observed on the handwritten instructions, even those that scored a "2". It was rare to see more than two sentence fragments. Although OSUMC's formal standards had not changed, it appeared as though standards of quality had been raised as a result of the EDI implementation.
This improvement in quality appeared to extend beyond improvements within the critical elements. Although not evaluated in this study, additional categories that were not present on the handwritten form also appeared to improve the overall discharge documentation. Many of the electronic documents had a significant amount of information in categories such as *secondary diagnosis, additional contacts,* and *addenda* that had never been part of the handwritten instructions.

The *addenda* category appeared to significantly alter the content and length of the instructions. Addends were authored by the individual serves and varied in length ranging from one paragraph to four pages. The information contained in an addendum ranged in topic, examples included: *coumadin precautions, wound care procedures,* and *detailed exercise instructions.* Incorporating such information in the addenda category had several advantages. First, services were able to customize the content to fit a specific patient population. Second, all of the patient's instructions were centralized onto a single document. Finally, the level of accountability was increased. Both the title and content of the addenda(s) were stored along with the rest of the patient's discharge instructions as part of the permanent medical record.

The concept of quality evolving with the implementation of technology was also very apparent in the areas of clinician access, discharge planning and multidisciplinary input. Access was improved by the simple fact that a clinician or multiple clinicians could review and/or alter the instructions from any OSUMC computer simultaneously. For example, it was possible for a resident to make last minutes changes in a patient's instructions while on another nursing unit or clinic.

An improvement in discharge planning was also observed. Some clinicians would start working on a patient's instructions several days prior to discharge. If, for example, the medical student arranged a follow-up appointment for the patient he or she would often enter that information into EDI. Based on
conversations with residents and PCRM{s}, documenting discharge instructions several days in advance rarely happened prior to EDI.

Finally, EDI appeared to lend itself more to allowing documentation by multiple caregivers. Although this varied by physician service many of the services throughout the organization appeared to utilize this functionality. For example, the infectious disease service worked with pharmacy to develop patient focused educational statements, which are typically one or two paragraphs in length, for each discharge medication. This information, stored in the addenda category, automatically appeared as a choice list for all infectious disease patients. Other services utilized a real-time approach. For example, a social worker could enter information from any location without the need to track down the chart or the resident to inform them of new information.

Features of EDI

One advantage that EDI had over the handwritten method was that it provided users with a variety of prompts and shortcuts. These features should not be confused with system requirements or mandatory fields of which EDI had very few. The system did not require that any of the critical categories be completed by the clinician except diagnosis and condition upon discharge. Based on the results, it was assumed that one reason for improvement in quality was the added functionality and shortcuts found in EDI. A significant portion of the discussion for this research project focuses on the differences that the clinician faced when creating instructions manually and entering them into EDI. The following section summarizes many of EDIs' features that may have created a slightly different environment for the clinician, which may help explain some of the observed quality improvements.

Nauert, et al (1993) stated that the "introduction of an automated system will not improve the quality of documentation unless the information is prompted or is inserted automatically by default." Although,
EDI had a number of time saving features that will be summarized in subsequent paragraphs, not all of EDIs critical elements that demonstrated improvements have such features. For example, the critical element diagnosis demonstrated significant improvement (p < .002) and did not have any defaults or choices lists. It was a simple free text category. However, Nauert, et al's (1993) point of the importance of automated features is consistent with many of the categories that improved. Many of the categories in EDI did benefit from some degree of added functionality.

On a general level, EDI may have helped to address some of the confusion between a category that was blank intentionally or if it was simply forgotten. In order to leave a discharge element blank, assuming a non-required field, the clinician simply pressed a function key next to the category. The system then marked that category as complete without any information. This process of consciously indicating that a category should be left blank was different than the hand written environment where the category simply may have been skipped. This may be one reason that fewer categories were left incomplete under EDI.

In addition, to allowing the clinician to intentionally leave a category blank, the system would assign an appropriate phrase such as "No Discharge Medications Specified" or "No Activity Restrictions" if the clinician chose not to address a specific category. The implication is that, this feature was a factor that attributed to increased EDI scores for most of the elements. For example, it was not uncommon for hand written documents to have nothing filled in for activity (score of "0") where as EDI displayed "No Activity Restrictions" (score of "2"). The old medical phrase "if it wasn't documented... then it wasn't done" was truly applicable in relation to how items were scored.

Some of the discharge elements in EDI had unique features such as the drugs / medication category.

First, it allowed the clinician to enter the route in the form of a medical abbreviation such as PO, IM, or SQ. The abbreviation was then translated by the system into language that a layperson could easily
understand. For example, the route of a drug that should have been taken orally could be quickly entered into EDI using familiar clinician abbreviations (such as **PO**) but the actual instructions would read *by mouth*. This functionality was also true with the medication frequency. For example, the clinician would enter **TID** or **QHS** and the instructions would read *three times a day* or *at bedtime* respectively. These features helped ensure that the score was never docked because of the use of medical terminology or abbreviations, which commonly happened with the hand written instructions. It should also be noted that the system did not require routes and frequencies, simply a convenient way to enter them if desired.

Another element that had additional functionality in EDI was **physician**. Often information about a patient's attending, admitting, or referring, and/or outside referring physician(s) was already present in OSUMC's admitting system. If this was the case it could be easily imported into the discharge instructions. If such information were available, a message would appear at the bottom of the screen along with a quick-key to the left such as a "->" or a "@". The clinician simply had to type the symbol and the physician's name and phone number would automatically be imported. A typical example that was observed: the clinician would simply type "Follow-up with your referring physician in 10 days, call his office for an appointment" in the **follow-up plans** category and then type the appropriate symbol in the **physician** category to add the follow-up physicians' name and contact information. This meant that even if the user did not know who the follow-up physician was, complete and appropriate information was given to the patient.

Choice lists were offered in a variety of the categories that demonstrated an improvement in quality. **Condition**, **activity**, **diet**, and **special instructions** all utilized this functionality. The option of adding free text instead of selecting from the list was available. **Special instructions** displayed a choice list that was defined and customized by the individual physician services. For example, the Transplant service could have defined what **special instructions** appeared in their patients choice list. The discharging
clinician was automatically presented with the service's customized choice list. Services also had an option to view other services Special Instructions.

Conclusions

In conclusion, EDI had a positive effect on the quality of discharge documentation. These statistically significant improvements were observed both an overall document perspective and at a detailed level for each of the discharge instruction's critical elements. In addition, the EDI system did not appear to demonstrate any significant bias toward a certain patient populate. All three of OSUMC's divisions that were examined benefited from similar improvements.

Recommendations

Based on the above findings, the following should be considered for further research and information gathering.

1. Assessment of patients' and families' satisfaction with the electronic instructions.

2. Examination of the content of the instruction in more detail, using other aspects of the medical record to verify the content for correctness and completeness. An evaluation of what should have been documented in addition to what was documented.

3. Assessment of the satisfaction levels of the clinicians using EDI.
4. Examination of the time and cost differences involved with the two different document types. In addition to overall time, examination of whose time is being used for which aspects of the document. For example, does a medical student fill out 85% of the discharge instruction and the fourth year resident completes the remainder?

5. A survey of referring physicians, agencies, and other post discharge follow-up institutions on the adequacy of the content and access to the discharge instructions. Do these individuals or organizations receive the information in a timely manner? Should additional information be included on the instructions? Should it be arranged in a different format?
APPENDIX A

THE OHIO STATE UNIVERSITY MEDICAL CENTER’S
DISCHARGE INSTRUCTION DOCUMENT
Figure 2: OSUMC's hand written discharge instruction document
APPENDIX B

OSUMC'S CRITICAL DATA ELEMENTS
The following is a list of critical data elements specified by The Ohio State University Medical Center that must be addressed on all Discharge Instruction documents.

<table>
<thead>
<tr>
<th>Critical Data Element</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resident to dictate discharge summary (if stay &gt;2 days) *</td>
</tr>
<tr>
<td>Date of admission</td>
</tr>
<tr>
<td>Date of discharge</td>
</tr>
<tr>
<td>Condition at discharge</td>
</tr>
<tr>
<td>Discharge diagnoses</td>
</tr>
<tr>
<td>Operation(s)/Procedures and Date(s)</td>
</tr>
<tr>
<td>Discharge medications with dose, route, frequency, and purpose</td>
</tr>
<tr>
<td>Diet</td>
</tr>
<tr>
<td>Activity limitations</td>
</tr>
<tr>
<td>Special care needs</td>
</tr>
<tr>
<td>Follow-up plans and appointments (including planned readmission)</td>
</tr>
<tr>
<td>Physician names and phone numbers for further questions</td>
</tr>
<tr>
<td>Patient's name and medical record number</td>
</tr>
</tbody>
</table>

Table 14: OSUMC's critical data elements for discharge documentation

* This item did not appear on the patient's copy when the instructions were generated with EDI. It was only printed on the Chart Copy and Physician Copy.
APPENDIX C

DIVISION / SERVICE DISCHARGE RATES
Table 15 describes the discharge rates of the divisions of Medicine, Surgery and Rehabilitation.

Services within each division, with their respective discharge rates are presented below. The columns labeled Pre and Post are used to describe the date ranges for the manual (9/1/95 - 9/1/96) and electronic samples (9/1/96 - 3/31/97).

<table>
<thead>
<tr>
<th>Surgical Services</th>
<th>Pre</th>
<th>Post</th>
<th>Medical Services</th>
<th>Pre</th>
<th>Post</th>
<th>Rehab Services</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bone Marrow Transplant</td>
<td>311</td>
<td>62</td>
<td>Cardiology 1</td>
<td>539</td>
<td>151</td>
<td>General Rehab</td>
<td>330</td>
<td>81</td>
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<tr>
<td>Neuro Surgery</td>
<td>638</td>
<td>193</td>
<td>Cardiology 2</td>
<td>552</td>
<td>151</td>
<td>Head Injury Rehab</td>
<td>200</td>
<td>46</td>
</tr>
<tr>
<td>Orthopedic Surgery</td>
<td>822</td>
<td>205</td>
<td>Cardiology 3</td>
<td>553</td>
<td>173</td>
<td>Pain Mgmt Rehab</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Peripheral Vascular Surgery</td>
<td>605</td>
<td>161</td>
<td>Cardiology 4</td>
<td>529</td>
<td>1</td>
<td>Spinal Cord Rehab</td>
<td>82</td>
<td>19</td>
</tr>
<tr>
<td>SONC</td>
<td>789</td>
<td>248</td>
<td>Clinical Research</td>
<td>161</td>
<td>34</td>
<td>Adult Psych</td>
<td>635</td>
<td>165</td>
</tr>
<tr>
<td>Surgery 1</td>
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<td>220</td>
<td>Dermatology</td>
<td>5</td>
<td>2</td>
<td>Child Psych</td>
<td>184</td>
<td>32</td>
</tr>
<tr>
<td>Surgery 2</td>
<td>509</td>
<td>140</td>
<td>Diabetes</td>
<td>508</td>
<td>136</td>
<td>Adolescent Psych</td>
<td>191</td>
<td>48</td>
</tr>
<tr>
<td>Surgery 3</td>
<td>1</td>
<td>146</td>
<td>Ear Nose Throat</td>
<td>613</td>
<td>135</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surgery 6</td>
<td>428</td>
<td>226</td>
<td>Ophthalmology</td>
<td>319</td>
<td>37</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Thoracic Surgery</td>
<td>853</td>
<td>226</td>
<td>Family Medicine</td>
<td>540</td>
<td>191</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transplant - Other</td>
<td>300</td>
<td>89</td>
<td>Gastroenterology - 1</td>
<td>489</td>
<td>148</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transplant - Renal</td>
<td>408</td>
<td>142</td>
<td>Gastroenterology - 2</td>
<td>413</td>
<td>101</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transplant - Other</td>
<td>7</td>
<td>0</td>
<td>Hematology - 1</td>
<td>474</td>
<td>117</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dental Surgery</td>
<td>97</td>
<td>27</td>
<td>Hematology - 2</td>
<td>497</td>
<td>126</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plastic Surgery</td>
<td>237</td>
<td>58</td>
<td>Hematology - 3</td>
<td>676</td>
<td>99</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infectious Disease - 1</td>
<td>301</td>
<td>84</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infectious Disease - 2</td>
<td>297</td>
<td>76</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medicine - 1</td>
<td>359</td>
<td>110</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medicine - 2</td>
<td>385</td>
<td>98</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medicine - 4</td>
<td>448</td>
<td>163</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nephrology - 1</td>
<td>453</td>
<td>137</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nephrology - 2</td>
<td>482</td>
<td>144</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulmonary</td>
<td>22</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 15: Breakdown of the divisions by service and discharge rates pre and post EDI
APPENDIX D

PILOT CHART REVIEW RESULTS
<table>
<thead>
<tr>
<th>#</th>
<th>Score from Initial Evaluation</th>
<th>Scores from Second Evaluation (7 days later)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>2</td>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td>3</td>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td>4</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>5</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>6</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>7</td>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td>8</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>9</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>1</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Pearson $r = 1.00$, $p < .001$

Table 16: Results from the pilot chart review
APPENDIX E
DATA COLLECTION WORKSHEET
### Critical Data Elements:

<table>
<thead>
<tr>
<th>Critical Element</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resident to dictate discharge summary (if stay &gt;2 days)</td>
<td>0</td>
</tr>
<tr>
<td>Date of admission</td>
<td>0</td>
</tr>
<tr>
<td>Date of discharge</td>
<td>0</td>
</tr>
<tr>
<td>Condition at discharge</td>
<td>0</td>
</tr>
<tr>
<td>Discharge diagnoses</td>
<td>0</td>
</tr>
<tr>
<td>Operation(s)/Procedures and Date(s)</td>
<td>0</td>
</tr>
</tbody>
</table>

#### Partially Complete Criteria
- Operation or procedure information was listed but a date was not specified
- Pieces were illegible

#### Complete Criteria
- The following conditions were met.
  - The operation or procedure and a date(s) were present.
  - Reference to the fact that the patient did not have any operations or procedures.
  - Was legible

| Discharge medications with dose, route, frequency, and purpose                  | 0     |

#### Partially Complete Criteria
- Error! Not a valid link.

#### Complete Criteria
- Error! Not a valid link.

<table>
<thead>
<tr>
<th>Diet</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diet information was specified but pieces were illegible.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Activity limitations</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity limitations were specified but pieces were illegible.</td>
<td></td>
</tr>
</tbody>
</table>

#### Partially Complete Criteria
- Care instructions that would fall under any of the other categories were presented but either pieces were illegible or contained medical terminology/abbreviations.

#### Complete Criteria
- Care instructions that would fall under any of the other categories were presented in a legible format using lay person terminology.

<table>
<thead>
<tr>
<th>Special care needs</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Follow-up plans and appointments (including planned readmission</td>
<td>0</td>
</tr>
</tbody>
</table>

#### Partially Complete Criteria
- Follow-up appointment information was specified but did not include a date, time, or location OR did not include a phone number to schedule appointment.
- Pieces were illegible

#### Complete Criteria
- Follow-up appointment information was specified and included: date, time, location OR phone number to make schedule appointment.
- It was stated that the patient did not have any follow up plans or appointments.

<table>
<thead>
<tr>
<th>Physician names and phone numbers for further questions</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>The physician’s name was listed but no phone number was given.</td>
<td></td>
</tr>
<tr>
<td>Pieces were illegible</td>
<td></td>
</tr>
</tbody>
</table>

#### Complete Criteria
- Both the physician’s name and phone number were specified and was legible
- A central departmental number was given that the patient could call and was legible

| Patient’s name and medical record number                                        | 0     |

#### Total Score
- 0
APPENDIX F

CIS SAMPLE SCREENS
Figures 3-6 are screen captures from OSUMC’s CIS system.

```
[Image: CIS Main Menu]
```

Figure 4: CIS Main Menu
PATIENT RECORD

Medical Record #: [Blank]  SSN: [Blank]

Name: Patient Name and Other Data
Street:
City:

Birth Date: 14-Sep-1970  Age: 026  Expired:
Sex: M Male  Marital Status: M Married  Race: W Caucasian

CURRENT ADMISSION INFO

NOT currently admitted
Admit #: 00000  Admit Date: - -

Service:
Unit ID:
Location ID:
Attending Doctor:

Attending #: 
Hit RETURN to continue

Figure 5: CIS Patient Summary Information
<table>
<thead>
<tr>
<th>Visit Type</th>
<th>Admit/Visit Date</th>
<th>Disch Date</th>
<th>Attending</th>
<th>Service Visit#</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 0</td>
<td>09/23/96</td>
<td>MD Name Here</td>
<td>UNAL</td>
<td>00040</td>
</tr>
<tr>
<td>02 0</td>
<td>09/16/96</td>
<td>MD Name Here</td>
<td>GE1</td>
<td>00500</td>
</tr>
<tr>
<td>03 0</td>
<td>05/14/96</td>
<td>MD Name Here</td>
<td>GE1</td>
<td>00038</td>
</tr>
<tr>
<td>04 0</td>
<td>05/13/96</td>
<td>MD Name Here</td>
<td>GE1</td>
<td>00039</td>
</tr>
<tr>
<td>05 I</td>
<td>05/10/96</td>
<td>05/11/96</td>
<td>GE1</td>
<td>09232</td>
</tr>
<tr>
<td>06 0</td>
<td>05/10/96</td>
<td>MD Name Here</td>
<td>ED</td>
<td>00036</td>
</tr>
<tr>
<td>07 0</td>
<td>11/30/94</td>
<td>MD Name Here</td>
<td>PREV</td>
<td>00035</td>
</tr>
</tbody>
</table>

**Patient Name and Medical Record Number**

Enter (? - Help, # - to select, VR - View Results, MS - Menu Screen)

Figure 6: CIS Visit History
CHIEF COMPLAINT

Fever.

HISTORY OF PRESENT ILLNESS

The patient is a 22-year-old white male who notes sore throat, fever, chills for the past three days. The patient denies any history of cough, shortness of breath, chest pain, nausea, vomiting, diarrhea. The patient has no significant past medical history. He is not on any medications. He has no known allergies. He has had no previous surgery. The patient does note that one day before onset of symptoms he had his regular flu shot. The patient felt fine the next day but then began feeling ill. The patient does note a history of strep throat in the past. The patient notes he has not been taking any medication. The patient also complains of some mild headache. He

Right margin set to: 79

Figure 7: CIS Display of Results Example
APPENDIX G
EDI SAMPLE SCREENS
Figures 4-24 are screen captures from OSUMC's EDI system.

<table>
<thead>
<tr>
<th>Discharge Instruction Entry</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BENTLEY, TOM</strong> PHYSICIAN</td>
</tr>
<tr>
<td><strong>Terminal ID:</strong> [140.254.205.20] <strong>Printer ID:</strong> RH11ENS</td>
</tr>
<tr>
<td><strong>MRN:</strong> 100000000</td>
</tr>
<tr>
<td><strong>LAST NAME:</strong> PUBLIC</td>
</tr>
<tr>
<td><strong>FIRST NAME:</strong> JOHN Q.</td>
</tr>
<tr>
<td><strong>VISIT NUMBER, TYPE:</strong> 10000 Inpatient</td>
</tr>
<tr>
<td><strong>ADMIT/VISIT DATE:</strong> 01/15/1993</td>
</tr>
<tr>
<td><strong>DISCHARGE DATE:</strong> &lt;None&gt;</td>
</tr>
<tr>
<td><strong>SERVICE:</strong> DEMO</td>
</tr>
<tr>
<td><strong>ATTENDING PHYS:</strong> 00105 ASPARAGUS, RODNEY Z</td>
</tr>
<tr>
<td><strong>REFERRING PHYS:</strong> 00102 OKRA, JOSEPH D</td>
</tr>
<tr>
<td><strong>OUTSIDE REF PHYS:</strong> 00103 ONION, JACK B</td>
</tr>
<tr>
<td><strong>FAMILY PHYS:</strong> 00104 PARSLEY, ARTHUR</td>
</tr>
<tr>
<td><strong>DI FINALIZE STATUS:</strong> Preliminary</td>
</tr>
</tbody>
</table>

Choose a category, [Enter] to edit, [F8] to skip, [F10] to exit.

---

Figure 8: EDI Main Menu
Figure 9: EDI - Condition Upon Discharge
Figure 10: EDI - Diagnosis
Discharge Instruction Entry

BENTLEY, TOM
PHYSICIAN
March 26, 1997
08:52 PM
Terminal ID: [140.254.205.20]
Printer ID: RH1EANS

Secondary Diagnoses ( [Find] to search )
diabetes
Other Secondary [ could be entered here ]...

[F9] to save, [F10] to quit

HPN 100000000 Name PUBLIC JOHN 0, [F7] to enable cascade.

Figure 11: EDI - Secondary Discharge
Figure 12: EDI - Procedures and Treatments
**Discharge Instruction Entry**

BENTLEY, TOM  
PHYSICIAN  
March 26, 1997  
08:53 PM

Terminal ID: [140.254.205.20]  
Printer ID: RH11ENS

<table>
<thead>
<tr>
<th>Doc #</th>
<th>Doc Name</th>
<th>Phone Number</th>
<th>City, State</th>
</tr>
</thead>
<tbody>
<tr>
<td>L 10234</td>
<td>MATH, JOHN D</td>
<td>(419)342-2786</td>
<td>SHÉLY, OH</td>
</tr>
</tbody>
</table>

- [F9] to save, [F10] to quit

- VISIT NUMBER, TYPE: 10000 Inpatient
- ADMIT/VISIT DATE: 01/15/1993
- DISCHARGE DATE: <None>
- SERVICE: DEMO
- ATTENDING PHYS: 00105 ASPARAGUS, RODNEY Z
- REFERRING PHYS: 00102 OKRA, JOSEPH D
- OUTSIDE REF PHYS: 00103 ONION, JACK B
- FAMILY PHYS: 00104 PARSLEY, ARTHUR
- DI FINALIZE STATUS: Preliminary

Selection: DICTATING RESIDENT

You can perform a number search or a name search to choose a dictating resident.

**Figure 13: EDI - Dictating Resident**
Figure 14: EDI - Physician
Discharge Instruction Entry

BENTLEY, TOM  PHYSICIAN  March 26, 1987  08:56 PM
Terminal ID: [140.254.205.20]  Printer ID: RH1ENS

FOLLOWUP PLANNED APPOINTMENTS

Appointment dates, locations, occasions
Follow-up appointment information could be entered here...

[F9] to save, [F10] to quit

MHN 10000000  Home PUBLIC  , JOHN  0. [F7] to enable cascade.
Type in a freetext entry and hit [Insert] if you need more lines.

Figure 15: EDI - Additional Contacts
**Discharge Instruction Entry**

BENTLEY, TOM  
Terminal ID: [140.254.205.20]  
PHYSICIAN  
March 26, 1997  
08:54 PM  
Printer ID: RM1ENS

### Currently Selected Entries
- Regular
- 2 gm sodium
- No caffeine
- Low simple sugar
- no gummi bears

### Possible Entries
- **Other**
  - Low fat, low cholesterol
  - Regular
  - 4 gm sodium
  - 2 gm sodium
  - ADA diet (1200-2400 calories)
  - Low bacterial
  - Renal diet
  - No caffeine
  - Soft
  - Low simple sugar
  - High calorie, high protein
  - Enteral nutrition
  - Clear liquids
  - Full liquids

---

**Figure 16: EDI - Diet**
**Discharge Instruction Entry**

**BENTLEY, TOM**

**Terminal ID:** [140.254.205.20]

**Current Patient:** [CURRENT PATIENT]

**Possible Entries**

- **Advance as tolerated**
- No straining
- Minimize steps
- A free text entry could also be

---

**Figure 17: EDI - Activity**
Currently Selected Entries

• If you have questions or concerns, call (614) 293-800 oncology resident on call.
  - Fever and chills, temperature
  - Worsening pain not relieved
  - Shortness of breath
  - Any unusual events of nausea, abdominal bloating, change
• Other contact: Joanne Lester
• Other contact: Gail Davidson
• Keep incision clean, dry, and

Possible Entries for DEMO

• Other
• See another service's Special Care Instructions

[F9] to save, [F10] to quit.
Figure 19: EDI - Follow-up Plans and Appointments
Figure 20: EDI - Allergies
**Discharge Instruction Entry**

BENTLEY, TOM  
PHYSICIAN  
March 26, 1997  
08:57 PM  
Terminal ID: [140.254.205.20]  
Printer ID: RH11ENS

<table>
<thead>
<tr>
<th>Drug Name</th>
<th>Dosage</th>
<th>Route</th>
<th>Frequency</th>
<th>Specific Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRAMADOL</td>
<td>1-2</td>
<td>PO</td>
<td>PRN</td>
<td>every four h</td>
</tr>
<tr>
<td>BOSUSOL</td>
<td>300 units</td>
<td>SL</td>
<td>QMN</td>
<td></td>
</tr>
<tr>
<td>POWERDRIL</td>
<td>5 mg</td>
<td>PU</td>
<td>AC</td>
<td>two weeks</td>
</tr>
<tr>
<td>acetaminophen/hydrocodone</td>
<td>200 mg</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[F9] to save, [F10] to quit

MH1Q000000  Name: PUBLIC  JOHN  C. [F7] to view allergies.

**TYLENOL**

Figure 21: Drugs / Medications
Figure 22: EDI - Miscellaneous Instructions
Figure 23: EDI - Discharge to Where
**Discharge Instruction Entry**

**BENTLEY, TOM**

**PHYSICIAN**

**March 26, 1997**

**08:59 PM**

**Current Patient**

**Addenda**

**Cast Care:**

- Amphotericin B (Fungizone)
- Atovaquone suspension (Mepron)
- Azithromycin (Zithromax)
- Ciprofloxacin (Cipro)
- Clarithromycin (Bluxin)
- Clofazimine (Lamprone)
- Clofazimine (Mycex)
- Dapsone (Avlosulfon)
- Dronabinol (Marinol)
- Ethambutol (Myambutol)
- Filgrastim (Neupogen)
- Fluconazole (Diflucan)
- Foscarnet (Foscavir)
- Ganciclovir (Cytovene)

> See another service's Addenda

**[F8] to save, [F10] to quit**

**HPN: 1000000000 Name: PUBLIC, JOHN 0. [F7] to view addendum.**

**Amphotericin B (Fungizone)**

**rev 1/96**

---

Figure 24: EDI - Addenda
DIAGNOSIS:
  Breast cancer, noninvasive: ductal carcinoma in situ (DCIS)
  Breast cancer, noninvasive: lobular carcinoma in situ (LCIS)
  Other Diagnoses Could Be Typed Here....

SECONDARY DIAGNOSES:
  diabetes
  Other Secondary Dx Could Be Entered Here....

PROCEDURES/TREATMENTS:
  10/09/96 Lumpectomy, axillary node dissection
  Lumpectomy, axillary node dissection
  Lumpectomy
  Axillary node dissection
  Bilateral modified radical mastectomy
  Modified radical mastectomy

Figure 25: EDI - View Before Finalizing the Instructions
APPENDIX H

REQUEST FOR ACCESS TO MEDICAL INFORMATION
REQUEST FOR RESEARCH ACCESS TO MEDICAL INFORMATION

Theresa G. Boekley

Medical information for the purpose of:

Review of hard-copy medical records:
Submit Signed Confidentiality Statement for all individuals reviewing information
Submit list or category of patients to be reviewed

Review of medical information via OSUMC's Clinical Information System:
Submit Signed Confidentiality Statement for all individuals reviewing information
Submit list or category of patients to be reviewed

Review of medical information via downlload to workstation:
Submit Signed Confidentiality Statement for all individuals reviewing information
Submit list or category of patients to be reviewed
Submit completed Request for Download form

* THIS CAN ONLY BE DONE WITH REVIEW AND APPROVAL FROM INFORMATION SYSTEMS

Review of information from Cancer Data and Research Services database

Do the patients being researched fall within your normal scope of review (e.g. discharged from your service)?

YES ☑ NO

If the patients do not fall within your normal scope of review, have you notified the appropriate physician or medical department chair of this research project?

YES ☑ NO

Signature of Clinical/Departmental Chairman needed below

I agree to abide by The Medical Center's Medical Information Access and Release of Information Policy. I understand that patients may not be contacted without the express written approval of the Human Subjects Review Committee.

REQUESTOR IDENTIFICATION

Theresa G. Boekley
Name of Principal Researcher

293-2341
Paper 730-2451
Telephone/Pager Number

Melanie Brodnik, Ph.D., RRA
Director, HMS, School of Allied Medical Professions - OOS

Name/Title & Address

Signature of Clinical/Department Chairman
This is required for all research applications

Approval Signature (Director of Medical Information Management or Chairman of Clinical Information Access Committee)

Rev: 8/94

Figure 26: Request for access to medical information
APPENDIX I

SIGNED STATEMENT OF CONFIDENTIALITY
STATEMENT OF CONFIDENTIALITY

I, Thomas O. Bentley, understand that the information collected and maintained on patients of The Ohio State University Medical Center is confidential. I agree that all information made available to me will be held confidential and that I will not divulge any information of a patient-identifiable nature. Information abstracted from medical records, indexes, data bases, etc., will not identify the patient in any reports, documents, case studies, or publications resulting from my review of this information will not identify either patients or The Ohio State University Medical Center.

Further, I understand that any original hard copy information, disks or tapes that I have been given access to may not, under any circumstances, be removed from The Ohio State University Medical Center. I agree to properly dispose of all printouts and or electronic media, generated from this review by either returning them to the Medical Information Management Department or by shredding them.

I have read and agree to abide by the Guidelines for Research and Educational Access to Medical Information.

[Signature] 3/2/97

Date

Thomas O. Bentley

Name (please print)

Masters of Science - Health Informatics Track

Program/Department

The Ohio State University College of Allied Medicine

Institution or School

Figure 27: Statement of Confidentiality
APPENDIX J

HUMAN SUBJECTS EXEMPTION FORM
APPLICATION FOR EXEMPTION FROM HUMAN SUBJECTS COMMITTEE REVIEW

Principal Researcher: Thomas C. Bentley
(Must be OSU Faculty) (Typed Name) (Signature)
Department: Information Systems
Telephone/Pager # 293-2244

Exemption Category

YES NO (Please respond to each item - A through G)

- ✓ A. Patients will be contacted during research activity
- ✓ B. Patients will be individually identified in the published results.

✓ C. The ONLY involvement of human subjects in the proposed research activity will be in one or more of the exemption categories as described in the appendix of "Human Subjects Program Guidelines."

- ✓ D. The proposed research activity will involve minors (under the age of 18).
- ✓ E. The proposed research activity will involve pregnant women, mentally retarded, mentally disabled, and/or prisoners.

- ✓ F. The proposed research activity will involve human in vitro fertilization.
- ✓ G. The proposed research activity will involve an element of deception.

- ✓ H. The proposed research activity will expose subjects to discomfort or harassment beyond levels encountered in daily life.

CHECKING YES TO ANY OF THE ABOVE STATEMENTS (EXCEPT FOR C) WILL REQUIRE THE APPROVAL OF THE HUMAN SUBJECTS COMMITTEE

Figure 28: Human subjects exemption form
APPENDIX K

AN EXAMPLE EDI
Contained on the following pages is the text from a randomly selected example of an EDI from OSUMC's test database. This output was a direct screen dump of the instructions as they appeared on an OSUMC connected computer terminal. The paper hard copy of the instructions would have had a very similar look. This is only an example to demonstrate what the format of the final EDI product looks like. The content is no way is reflective of all discharge instructions.
MRN: 100000000 Name: Patient Name

C-----------------RESULT#2---------------------------------

☐

MRN: 100000000 Name: DOE , John. DISCHARGE INST.

☐

I 04/23/96 04/30/96 ATTENDING NAME HERE 02417 Final

---------------------------------------------------------

CONDITION UPON DISCHARGE:
Good-fair

DIAGNOSIS:
coronary artery disease
angina

SECONDARY DIAGNOSES:
peripheral vascular disease -- bilateral bypass surgeries
COPD
severe fatty liver changes

PROCEDURES/TREATMENTS:
4/26/96 coronary artery bypass graft -- 3 vessel

DICTATING RESIDENT:
None

PHYSICIAN NAMES AND PHONE NUMBERS FOR FURTHER QUESTIONS:

Dr. (Name I) (614)293-0000 Attending Physician

Dr. (Name II) (614)645-0000 Outside Referring Physician

Dr. (Name III) (614)676-0000 Family Physician

Figure 29: Example EDI output
ADDITIONAL CONTACTS:

Contact (PCRM's name was here), RN PCRM, through (attending physician's name was here) office with any questions or problems.

DIET:

Heart Healthy Diet

Low fat, low cholesterol

4 gm sodium

no alcohol

ACTIVITY:

As tolerated

Advance as tolerated

Normal weight bearing

Elevate leg at least as high as waist level FREQUENTLY during the day and above level of heart in bed at night

SPECIAL INSTRUCTIONS:

Keep the incision clean and dry

You may shower, but no soaking or scrubbing over incision(s)

Use soap and water to cleanse incision area

Chest tube site care:

* Cleanse with soap and water

* If draining, cover with band-aid or sterile gauze dressing

* If not draining, leave open to air

* No soaking in tub or swimming until chest tube sites healed

* No ointments or salves on sites unless ordered by physician

For evening and weekend hours if you have questions or concerns call
Figure 28 (continued)

614-000-0000 (phone number altered for privacy purposes) and ask the operator to page the thoracic surgery resident on call.

Call your doctor's office if any of the following occur:

* Fever and chills
* Worsening cough
* Worsening shortness of breath
* Coughing up blood
* Any problems with wound healing
* Any signs of wound infection (redness, increased tenderness, increased drainage)
* Pain not relieved adequately by pain medication

No driving for 6 weeks
No lifting anything over 10 lbs for 6 weeks
No contact sports or other listed activities for 6 weeks

FOLLOWUP PLANS/APPOINTMENTS:

call your family doctor within 1-2 days of discharge to schedule a 1 week follow-up appointment

call Dr Brown's office this week to schedule 6 week follow-up appointment

Your leg staples may be removed by your family doctor on May 9.

ALLERGIES:

no known drug allergies

MEDICATION(S):

*lopressor 25 mg

    Twice a day by mouth

*BABY ASPIRIN 80 mg
Once a day By mouth

*COLACE 100 mg

Twice a day By mouth

-SPECIAL INSTRUCTIONS:

as needed to avoid constipation while taking tylenol #3

*TYLENOL #3 1-2 tab po

Every 4 hours, as needed By mouth

-SPECIAL INSTRUCTIONS:

as needed for pain

*BUMEX 2 mg

Twice a day By mouth

-SPECIAL INSTRUCTIONS:

take for 1 week

*potassium 20 mEq

Twice a day By mouth

-SPECIAL INSTRUCTIONS:

take for 1 week

MISCELLANEOUS INSTRUCTIONS:

obtain a chem 7 on Fri 5/3 and have results called or faxed to

Lorie Rhine, 293-8420, fax # 293-4726/

DISCHARGED TO WHERE:

Home

DISCHARGED TO WHOM:

Family member/Friend
Figure 28 (continued)

DISCHARGE MODE:
  Wheelchair

ADDENDA:
  None

Discharge Instruction Finalized by: Discharging Clinician name would appear here...

THE
OHIO
STATE
UNIVERSITY
REFERENCES


Schriger DL, Da (Finish reference)


