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Meta-Analysis on Costing Out Nursing Services

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ABSTRACT

This descriptive meta-analytic study investigated 73 primary studies on costing out nursing services. A critical review of the literature revealed that findings from the various published and unpublished studies were inconsistent and inconclusive. This meta-analysis integrated the literature to identify the relationships between nursing costs and a second variable.

The most frequently reported variables among the primary studies were compared using Pearson r correlations and percentages. The variables of total and direct nursing costs were correlated to the variables of length of stay, direct nursing care hours, hospital costs, and diagnostic related grouping (DRG) reimbursements. Analysis was conducted two ways. First the studies were treated as a single value for each variable reported. In addition, relationships were examined between the variables for frequently reported DRGs.

Treating each study as a single finding, the research revealed statistically significant correlations between several variables. Total nursing costs were found to correlate .85 to direct nursing care hours, .99 to hospital costs, and .65 to length of stay. Direct nursing costs revealed .94 correlations to direct hours, .95 to hospital

costs, and .83 to length of stay. Nursing costs did not correlate, with any statistical significance, to DRG reimbursements. When frequently studied DRGs were examined, only eight yielded statistically significant results, although no consistency between the variables was noted. When percentages were calculated, total nursing costs were reported to be 22.15% of hospital costs and direct nursing costs were found to be 15.68%.

The major benefit nursing derives from costing out services is the increased ability to justify, monitor, and control costs within the cost-conscious health care environment. The use of meta-analysis, with descriptive primary studies, is validated as a tool for summarizing nursing knowledge and advancing nursing practice. A major limitation of this study was the different definitions of direct nursing care and direct nursing costs found among the primary studies. For future nursing research, specific definitions for total and direct nursing costs and direct nursing care are recommended.

DEDICATION

This dissertation is dedicated to my father

Paul T. Grier

October 26, 1929 to May 31, 1991

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I wish to personally thank my husband, Andrew James Eckhart, for his support, both emotional and financial. He has always believed in my ability and has encouraged me to continue to expand my mind.

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TABLE OF CONTENTS

Page

Page

LIST OF TABLES

Page

CHAPTER 1

INTRODUCTION

Beginning in the early 1980s a new concept known as costing out nursing services was introduced in nursing literature. This concept addressed the idea of identifying specific costs for the nursing services provided to each patient. The patient could then be billed for nursing care according to the amount of services required and received.

Traditionally hospital nursing care costs have been included in the patient's bill under the category of daily room rate. Other services incorporated in the room rate ranged from housekeeping to dietary ("Costing out nursing," 1987). Within the room rate charge, nursing care expenses have been reimbursed on a flat fee for service basis known as the per diem rate (Walker, 1983).

During the 1980s many studies were conducted in various American hospitals to determine if identifying specific nursing costs was financially advantageous for nursing departments. However, the results of the studies were inconsistent.

Some studies found that the amount of nursing care required for patients with the same diagnosis fluctuated extensively (Grohar, Meyers, & McSweeny, 1986; Lagona & Stritzel, 1984; Mowry & Korpman, 1985; Sanders, 1985; Wolf &

Lesic, 1986). The investigators concluded that it may not be in nursing's best interest to accept a predetermined monetary reimbursement. They recommended that more testing on the cost of nursing services be conducted.

Other studies found that a patient's length of stay adequately predicted nursing care costs (Caterinicchio, 1984; McKibbin, Brimmer, Galliher, Hartley, & Clinton, 1985). Grimaldi and Micheletti (1983) found that the per diem, or per day, method of cost allocation allowed for sufficient allotment of nursing costs. Differentiating the specific costs for nursing care by patient in a manner other than by diagnosis was not identified as being financially necessary for nursing departments.

For the concept, costing out nursing services, independent studies were found to be inconsistent and inconclusive concerning how to identify the cost of nursing care and whether it created a benefit for nursing. To identify any contribution from a group of research studies, the studies must be examined with the same standards. Meta-analysis provides a method by which numerous study findings can be evaluated as a coherent whole (Hunter & Schmidt, 1990).

The purpose of this research was to conduct a meta-analysis of the studies that address the cost of nursing services. A critical examination of the costing studies was used to describe the concept as found in nursing literature.

The contribution that costing out nursing provides to nursing practice and the requirements identified for its future were explored.

The statistical focus utilized in the meta-analytic methodology was required since narrative reviews alone do not provide rigorous definition and standardization of techniques (Glass, McGaw, & Smith, 1981). It was hoped that a thorough examination of these studies would identify if costing out nursing services should be treated as a passing fad or if it should be the beginning of a new tradition for nursing.

Background of the Problem

In the twenty year period prior to 1984 health care costs in America rose between two and three times the rate of the consumer price index (Kotelchuck, 1984). Before 1983 hospital health care reimbursement was based upon reasonable cost compensation identified after the patient was discharged. The payment unit was the patient day and rates reflected costs incurred by the hospital (Shaffer, 1983). This retrospective payment system did not encourage hospitals to contain costs.

In response to increasing health care costs, the federal government altered the hospital reimbursement system for Medicare patients. Together the 1982 Tax Equity and Fiscal Responsibility Act (P.L. 97-248) and the 1983 Social Security Amendment (P.L. 98-21) required the development of

a prospective payment system (Kotelchuck, 1984; Levine & Abdellah, 1984). This introduced a reimbursement system based upon a patient's diagnosis and was identified as diagnostic related groupings (DRGs).

DRGs were first developed in 1975 at Yale University by Fetter and colleagues (Kotelchuk, 1984). The original purpose of the DRG system was to aid in peer review for medical practices (Irurita, 1987). At that time the number of DRGs consisted of 383 patient categories that attempted to be homogeneous with regards to the intensity of required hospital services (Kotelchuk, 1984).

In 1979 a grant from the Health Care Financing Administration was awarded to the Yale researchers to revise the DRG system and correct any identified problems (Willian, 1983). The revisions were based upon information from the International Classification of Diseases-9th Revision-Clinical Modifications. The changes resulted in 23 major diagnostic categories (MDCs) organized by body systems. The MDCs were then broken down into 467 DRGs (Block & Press, 1986). Since that revision additional DRGs have been added to cover procedures and diagnoses not previously recognized (Grimaldi, 1990). As of October 1, 1991 a total of 492 DRGs were available ("St. Anthony's," 1991).

In 1980 New Jersey became the first state to test the DRG system as a method of hospital reimbursement (Kotelchuk, 1984). In 1983, when P.L. 98-21 and P.L. 97-248 required

the development of a system to control medical costs for Medicare patients, the DRG system was adopted for national implementation. DRGs were gradually incorporated into the national health care system over four years starting October 1, 1983 (Shaffer, 1983).

DRGs specified a predetermined reimbursement rate for hospital services defined in terms of at least one of the following variables: a patient's principal diagnosis, comorbidities and complications (secondary diagnoses), age, operating room procedures, and, at times, discharge status (Fetter, 1984). DRGs attempted to group patients into categories of individuals requiring similar health care services. A patient's length of stay (LOS) was used to measure the amount of hospital services provided and to reflect hospital costs (Fetter, 1984; Plomann & Shaffer, 1984).

As a result of the prospective payment system, hospitals were encouraged to reduce patient's LOS. When a patient left quickly the hospital spent less and was able to make a profit from the DRG reimbursement. When a patient had a lengthy or delayed hospital stay, the institution had the potential to spend more than the allotted reimbursement. Then the hospital lost money (McKibbin, Brimmer, Clinton, Galliher, & Hartley, 1985).

In general, DRGs varied from the retrospective payment method utilized prior to 1983 in two major aspects. First,

the medical diagnosis was used as a more accurate measurement of hospital output than the individual services provided. Second, the payment scale was prospectively fixed (McCarthy & Thorpe, 1986).

DRGs were basically determined from a medical orientation, that is, the services prescribed by physicians (Levine & Abdellah, 1984). The required amount of nursing care, determined by the severity of a patient's illness, was not a factor influencing the DRG reimbursement rate (Piper, 1983). Yet a review of nursing literature revealed that nursing care requirements can vary tremendously within a medical diagnostic category (Overfelt, 1988; Schaefers, 1985; Wike, 1988).

The DRG system has dramatically affected the financial status of hospitals. Reimbursements are no longer based upon incurred expenses. Since the national acceptance of DRGs in 1983, other insurance companies have established contracts with hospitals based upon DRG reimbursement policies. As of 1989, 70% of hospitalized patients were being reimbursed with some form of DRG payment plan (Munoz et al., 1989).

With the implementation of DRGs, hospitals had less control over financial reimbursements for the medical services provided. If the health care industry of today wishes to continue setting standards for the delivery of health care, it must control costs within the new framework.

Medical administrators must have accurate cost information from each hospital department and deal realistically with financial losers (Block & Press, 1986). Health care providers are actively examining how and when expenses are being generated. Once the incurred expenses are identified, steps can be taken to monitor and decrease the costs of providing health care.

As hospital administrators attempt to control expenses and increase cost effectiveness, cutbacks in services that are ill defined, such as nursing, can be expected (Sanders, 1985). Since the need for nursing care is one major reason patients are admitted to the hospital (Grandbouche, 1982; Mowry & Korpman, 1985; Van Slyck, 1985), identification of specific nursing care is necessary to identify and control the cost of nursing service. If nursing cannot clearly identify the services it provides, it stands to loose the financial support needed to deliver quality patient care.

The DRG system does not define a specific method to allot funding for nursing. There is, therefore, no well defined straightforward relationship between the cost of providing nursing care and the method of allocating funds to the nursing department. Studies reflecting the relationship of nursing costs to nursing reimbursement under the DRG program have been inconsistent. A thorough examination of the studies involved with costing out nursing services is needed. It is hoped that this will identify problems in the

present system and provide nursing with direction for its financial future.

Significance of the Study

Kyle and Kinder (1990) noted that although nursing care was only one portion of DRG costs, it was the most unpredictable. Independent studies have been inconsistent and inconclusive with respect to the amount of the DRG reimbursement utilized to deliver nursing care. The percentage of nursing expenses within a DRG category has been found to vary greatly.

Domask (1986) found the percent of nursing costs to the DRG reimbursement as ranging from 3.7% to 19.5%. Reschak, Biordi, Holm, and Santucci (1988) noted that nursing costs account for between 7.3% and 17.4% of the hospital's DRG allotment. In 1985 Replogle reported nursing costs per DRG to average between 13.0% and 24.0% of the reimbursement rate. With costs for nursing services reflecting such a wide range within the DRG framework it is very difficult to identify what percent of the hospital's budget nursing costs comprise.

These inconclusive findings result in two major problems. The first problem addresses the hospital's budget. Stanley and Luciano (1984) noted that nursing comprises between 35-50% of any hospital's operating expense budget. Other reports depict nursing care as between 14-20% of the total budget (Bargagliotti & Smith, 1985). Before

any institution can decide how to control costs, it must be able to identify the costs (McCormick, 1986). For any business to treat a major portion of its budget as "overhead," "room rate," or other undefinable expense is not a sound financial or business practice. To allow a large portion of the budget to fluctuate without being able to trace it leads to unstable information about the financial status of the organization. The success of any institution depends upon its financial stability.

The second problem strongly affects nursing practice. When nursing is included in the room rate, it is seen as an expense. A major reason patients are admitted to a hospital is for continuous nursing care. Therefore nursing is more than a negative cost center. It generates income and it should be recognized for its contribution (Grandbouche, 1982; Payson, 1987). Once nursing can be viewed as a profit center it becomes a source of revenue, not a drain on resources (Sandrick, 1985).

Insurance companies and patients within the health care system today demand and expect a clear description of the medical dollars spent. Other hospital services are clearly delineated on medical bills; examples include radiation, laboratory, and physical therapy. For these departments, consumers can identify how much they paid for services rendered. If nursing wishes to be recognized and accepted

for the professional nursing services provided, it must identify the cost of its services (Joel, 1984).

The research studies to date have unfortunately not presented a clear concise description of nursing care costs. It is hoped that a structured meta-analysis of costing out nursing services will result in some clarification of the concept.

Meta-Analytic Techniques

Historically, narrative reviews that are not statistically developed have been used to summarize a given body of knowledge. Although these summaries may assist in providing a basis for nursing practice and theory, such reviews have been criticized. Without a specific quantitative approach to the literature the results tend to provide contradictory findings, to be too subjective, and are not able to be reproduced (Curlette & Cannella, 1985).

Glass (1976) defined meta-analysis as "the statistical analysis of a large collection of analysis results from individual studies for the purpose of integrating the findings" (p. 3). He referred to meta-analysis as an integrative review as well as an analysis of analyses (Glass, 1976).

Glass, McGaw, and Smith (1981) specified several characteristics of meta-analytic technique. The essential attribute was the quantitative framework used for the statistical analysis. To execute statistical testing, all

study findings must be converted into a common metric. Glass et al. noted that specific quantitative identification also was necessary in order for others to know how to replicate the research.

The second characteristic they identified was that meta-analysis does not prejudge the studies in terms of research quality. The integrative analysis must recognize the methodological weaknesses found in the studies such as problems with reliability or internal and external validity. But Glass et al. felt that the influence of the study quality on the findings must be regarded as a posteriori question, not an a priori judgement. A priori decisions could exclude several relevant studies from being considered.

The final characteristic for meta-analysis that Glass et al. recognized was that the technique aims at generalization and seeks a general conclusion. The studies included in a meta-analytic format are expected to reflect differences in design and technique. This characteristic was referred to as a comparison of apples and oranges. They noted that if the studies examined the same variables in the same manner the results would be equivalent. Therefore there would be no need for an integrative review.

Another characteristic of meta-analysis was identified by Mullen (1989). He stated that the statistical unit of analysis should be the findings of each independent study

instead of the specific responses within each study. Mullen agreed with Glass et al. (1981) that meta-analysis must be precise, objective, and replicable.

When conducting meta-analytic research, a specific sequence must be followed (Cooper, 1982; Jackson, 1980). The research question or hypothesis must first be selected. Next the database of primary studies must be collected. The importance of conducting a comprehensive search for studies was stressed. Thirdly the studies must be described, classified and coded. Then the study findings could be converted into a common statistic and the meta-analysis could be done. The final step was the reporting and interpretation of the results.

Rothstein and McDaniel (1989) elaborated on Cooper's (1982) and Jackson's (1980) third guideline. They agreed that the problem must be identified and studies that address the issue must be selected and coded. They noted that while each study was being described and coded it must be carefully critiqued. The critique of the study's methodology, however, should not exclude a study from inclusion in the research unless it was fatally flawed.

A fatally flawed study could be defined in several ways. It could be one in which the reader suspects the primary research was improperly conducted or possibly fabricated. For meta-analytic studies, a fatally flawed

primary study also would be one that does not include the necessary variables or information being analyzed.

Integration of research findings with meta-analytic techniques could have different results based upon the identified purpose for the study (Strube & Hartmann, 1983). One major purpose for meta-analysis can be a predictive function. With this objective the results of several studies can be used to decide if a specific treatment was effective. The research studies used for this predictive function usually have an experimental methodology.

Another objective for a meta-analytic review can be a descriptive function. Here the researcher describes a body of literature and identifies gaps in the knowledge base. This can help in identifying areas for further research as well as building a framework for theory development.

In this research study, descriptive techniques were used to describe the literature on costing out nursing services. It is hoped that an in-depth meta-analytic review of these studies may provide some clear answers that can help hospital and nurse administrators as they make financial decisions affecting the future.

Research Questions

This research focused on two objectives. The first was to determine any relationships between the variables of nursing costs, nursing care hours, LOS, hospital costs, and hospital DRG reimbursements. The second was to identify any

benefit in costing out nursing services. For all the research questions, nursing costs and hours of nursing care were included only on a per stay basis.

The research questions fell into three categories. The first group of questions treated each study's findings as a single result. That is, for each variable in a study, the individual DRGs were averaged together to obtain one value per variable per study. The questions in this group were:

1. What is the linear relationship between total nursing costs and LOS?

2. What is the linear relationship between direct nursing costs and LOS?

3. What is the linear relationship between total nursing costs and hours of direct nursing care?

4. What is the linear relationship between direct nursing costs and hours of direct nursing care?

5. What is the linear relationship between total nursing costs and hospital costs?

6. What is the linear relationship between direct nursing costs and hospital costs?

7. What is the linear relationship between total nursing costs and the hospital DRG reimbursement?

8. What is the linear relationship between direct nursing costs and the hospital DRG reimbursement?

The second group of questions addressed the same items but focused on individual DRGs. Any DRG addressed at least

three times in the database of primary studies was examined. The questions for this group were:

9. What is the linear relationship between total nursing costs and LOS for specific DRGs?

10. What is the linear relationship between direct nursing costs and LOS for specific DRGs?

11. What is the linear relationship between total nursing costs and hours of direct nursing care for specific DRGs?

12. What is the linear relationship between direct nursing costs and hours of direct nursing care for specific DRGs?

13. What is the linear relationship between total nursing costs and hospital costs for specific DRGs?

14. What is the linear relationship between direct nursing costs and hospital costs for specific DRGs?

15. What is the linear relationship between total nursing costs and the hospital DRG reimbursement for specific DRGs?

16. What is the linear relationship between direct nursing costs and the hospital DRG reimbursement for specific DRGs?

Some studies provided percentages of nursing costs to hospital costs and DRG reimbursements instead of values for the variables. The third group of questions examined these

percentages for specific DRGs. DRGs reported at least twice were investigated. The questions for this group were:

17. What is the percent of total nursing costs to hospital costs for specific DRGs?

18. What is the percent of direct nursing costs to hospital costs for specific DRGs?

19. What is the percent of total nursing costs to the hospital DRG reimbursement for specific DRGs?

20. What is the percent of direct nursing costs to the hospital DRG reimbursement for specific DRGs?

The research questions examined LOS, nursing costs, nursing care hours, hospital costs, and DRG reimbursements using each study as a single finding and by specific DRGs. When individual DRGs were studied, most of the primary studies involved contributed more than one piece of information.

Definition of Terms

The following definitions provide an explanation of the technical terminology used in this study.

1. Diagnostic related groupings (DRGs) are 492 categories of diagnoses, medically related with respect to diagnosis and treatment.

2. Patient classification systems (PCS) are tools used to categorize or group patients according to their nursing care needs. They are also known as acuity systems.

3. Length of stay (LOS) is the number of days a patient is hospitalized.

4. The cost of nursing care is a term that has three components, total costs, direct costs, and indirect costs. Total nursing costs combine direct and indirect care costs. Direct costs are variable expenses associated with providing patients with direct nursing care. Indirect costs are fixed costs related to non-direct nursing care services, or supportive services. These include nursing administration and nursing education. Only costs per stay, not per day, were used for the analysis.

5. Nursing care hours are the amount of time required per patient per hospital stay to administer direct nursing care services.

6. Meta-analysis is the statistical integration of the results of independent studies (Mullen, 1989). It is also defined as the analysis of analyses (Glass, 1976).

Assumptions

The following assumptions were used in this meta-analytic study.

1. The cost of nursing care can be quantified.

2. The various acuity systems used in the independent studies were tested for reliability and validity.

3. The data compiled by the researchers in each individual study was reliable.

4. Meta-analysis is a method by which test results from independent studies can be integrated and compared. It allows for comparisons between studies that utilize different PCSs.

5. Total charges per patient were treated as being equal to hospital costs unless otherwise specified by a study.

Limitations

This study had the following limitations.

1. Study findings were limited as this researcher did not have access to the primary data. Many studies stated several variables were examined, however, the published reports did not provide values for all the variables.

2. Since most of the studies were descriptive studies, the most common statistic provided was the mean value for the variables. Additional statistical tests and findings were rarely reported.

3. Since no systematic classification instrument had been developed, the studies did not consistently use the same PCS. No one PCS method was found often enough in the studies to be examined by itself.

4. Each primary study provided different definitions for the variables of direct nursing care hours, direct nursing care costs, and total nursing care costs.

5. Since the studies were not all conducted during the same year, the total cost of nursing care services and the

DRG reimbursements to the hospital reflected an increase over time.

Summary

This study identified the relationships between nursing costs, LOS, hours of nursing care, hospital costs, and DRG reimbursements. Direct and total nursing care costs were examined. In addition, the study indicated what benefits nursing derives when services are costed out. These objectives were accomplished using meta-analytic techniques to evaluate primary research studies focusing on costing out nursing services.

The following chapter provides an extensive literature review of studies that address the cost of providing nursing care. A critical analysis of these studies focuses on the contributions they have made and the problems they present.

CHAPTER 2

LITERATURE REVIEW

This study utilizes meta-analytic research techniques appropriate for reviewing a given body of literature and summarizing the results (Rothstein & McDaniel, 1989). In this chapter a description of all located studies addressing the costing out of nursing services is presented. The chapter concludes with the identification of variables used in this meta-analysis.

Before deciding which specific studies should be selected for the statistical analysis, all available studies that addressed costing out nursing services were examined. Many studies were found that addressed costing out nursing services but did not use a diagnostic related grouping (DRG) framework. Other studies did not include the variables that were later identified as necessary for inclusion in this meta-analysis. To obtain a complete picture of the research, all located studies addressing costing out nursing services are presented in this review of the literature.

The studies are presented chronologically by the year during which the research occurred rather than by the date of publication. If the date was not clearly identified, the researcher placed it into the year that was implied by the study.

After completing the literature review, the variables to be utilized in this research are defined. For the statistical analysis, only the studies that addressed the required variables were included.

Guidelines for Study Critique

Glass, McGaw, and Smith (1981) referred to two types of study characteristics that should be considered when critiquing a study for meta-analysis, substantive and methodological factors. Substantive characteristics are specific to the problem being studied. For this research it included the type of hospital, the type of unit selected for the study, and the type of acuity tool used to identify the cost of nursing services.

Methodological characteristics are more general and are similar for all types of meta-analytic studies. The sample size, randomization of subjects, degree of subject loss, and test reliability were methodological elements. In addition to substantive and methodological attributes, the literature review reported study findings, limitations, and conclusions.

While examining the literature consideration must be given as to which studies can be used for analysis. A study may be qualitatively sound but not useful for the statistical analysis. The meta-analysis should only include studies that address the variables identified for the research. These are considered the relevant studies.

Studies Done Prior to 1982

Before 1983 DRGs were not nationally used. The federal government began pilot testing the DRG format in some hospitals during the late 1970s. Whether a hospital makes or loses money on a DRG reimbursement depends to some extent upon a patient's length of stay (LOS). Some studies were conducted to decide if nursing care requirements were related to LOS.

One such study, done by Caterinicchio (1984), examined data for 11 months between 1979 and 1981. Patient charts (N = 2,660) were reviewed to determine if age and/or LOS would affect nursing costs. Medical, surgical, obstetric, gynecologic, psychiatric, and intensive and coronary care units from eight acute care hospitals were included. The acuity tool measured the number of minutes of nursing care required per patient.

The researcher correlated the variables of age and LOS to the classification scores to determine the amount of predictability they had on the variable of nursing costs. LOS was found to explain up to 94% of the variance in nursing care costs. Although the patient's age was found to provide some measure of nursing cost it was found not to influence costs when LOS was controlled.

Grimaldi and Micheletti (1983) used the same population as Caternicchio (1984) to calculate reimbursement rates for nursing. Patient acuity was determined utilizing the

Relative Intensity Measures (RIM) tool. Instead of identifying the patients in terms of DRGs, the information was presented in terms of nursing resource clusters. Each of the thirteen identified clusters incorporated several DRGs. Some problems surfaced when attempting to define nursing costs in terms of RIMs.

First there were concerns about the accuracy of the information collected. One-fifth of the subjects in the original sample had been discarded due to reporting problems, leaving a total sample size of 2,660. In addition many staff nurses did not record the minutes of direct care promptly after providing patient services. Grimaldi and Micheletti found the longer the interval between action and reporting, the higher the chance of inaccurate data information. The study concluded that although the RIM system may allocate costs more accurately than the per diem method, on a cost-per-case basis both costing methods yield very similar results.

Another early study by Kreitzer, Loebner, and Roveti (1984) disagreed with Caterinicchio that LOS was an adequate predictor of nursing costs. Data were collected on 2,420 subjects in 73 DRGs for three months in 1979. The usable sample size was 1,504 patients from medical, surgical and gynecology units. The classification method used to assess severity was tested for reliability and validity. It was known as AS-SCORE, an acronym for age, systems involved,

stage of disease, complications, and response to therapy (Horn, 1981). The study used AS-SCORE to compare the patient's severity of illness, or acuity, to LOS and to patient charges.

Kreitzer et al. attempted to identify inconsistencies within the DRG system noting that billing based upon LOS assumed homogeneity within DRGs. The investigators found that 40% of the selected DRGs were heterogeneous subgroups based upon LOS and severity of illness. Considering the variables of patient charges and acuity, 43% of the DRGs were heterogeneous. The findings revealed that looking at LOS and patient charges, 35% of the selected DRGs were heterogeneous, not homogeneous. It would therefore be risky, the study noted, to use LOS as a valid determination of charges.

In 1980 Halloran (1985) studied a convenience sample ($\underline{N}$ = 2,560) of 31 DRGs at an acute care community hospital. By using the Rush-Medicus classification system he tested which method of diagnosing, medical diagnosis or nursing diagnosis, accounted for more variation in the nursing workload.

Nursing diagnoses were found to explain 53.2% of the difference in nursing workload. Medical diagnoses accounted for only 26.3% of the variation. Halloran concluded that the amount of time spent on nursing care services was best predicted by a patient's nursing condition rather than by

the medical diagnosis. The same study and findings were reported in an article by Halloran and Halloran (1985).

Studies Conducted in 1982

While DRGs were being tested in New Jersey, some early studies were conducted throughout the country. Riley and Schaefers (1983) did research at a tertiary care teaching hospital. All patients admitted with four specific DRGs over a one year period were identified. Data on a proportionate random sample of 98 subjects were then collected. The article mentioned that patients were classified according to the amount of direct nursing care required but the specific PCS used was not defined. Findings were reported for each DRG on LOS, nursing acuity, nursing care hours per day and per stay, direct and total nursing costs, total hospital costs and the percent of nursing to hospital costs.

Riley and Schaefers found that the amount of nursing care required varied extensively between their four specified DRGs. The average range of nursing care hours needed per DRG per day varied from 6.4 to 4.8 hours. The proportion of total nursing costs to hospital costs was relatively small, only 17%. They concluded that it was possible to measure nursing costs based on acuity and conceivable to compare nursing costs and DRGs.

Atwood, Hinshaw, and Chance (1986) used data collected in 1982-1983 on medical-surgical units and intensive care

units (ICUs). The study examined 48 DRGs and about 6,000 patient hospital stays. The purpose of the research was to decide whether patients' nursing care needs accurately identified the nursing resources required. Patients were classified using a PCS developed at the University Medical Center, Tucson, Arizona and tested for reliability and validity.

Atwood et al. reported LOS and acuity ratings. No strong relationship was found between a patient's DRG rating, which is based upon LOS, and their nursing care requirements. Within an ICU, however, DRGs were noted to predict nursing care needs better than on general medical-surgical units. All 48 DRGs were collapsed into one group to identify the hours and costs of nursing care. Nursing costs were identified as room rate, but the study noted that nutrition was also included in that figure.

A research study by Sovie, Tarcinale, Van Putte, and Stunden (1986) supplied information on nursing care costs for a portion of a larger sample. The top 22 DRGs on a medical unit were identified by LOS, nursing care hours, room costs, direct nursing costs, and the percent of direct costs to room costs. Data on a variety of other DRGs were presented on nursing care hours, LOS, age, and the percentage of days in different classification categories. No correlation was found between increasing age and prolonged LOS. Sovie et al. concluded that even though DRGs

were not homogeneous, they did have validity for describing the nursing workload when used in conjunction with a nursing PCS.

A study by Van Putte, Sovie, Tarcinale, and Stunden (1985), conducted between 1982 and 1984, utilized some of the same population used by Sovie et al. (1986). The hours of care were identified by nursing unit instead of by DRG. The required nursing care hours per patient day were identified using the hospital's PCS which had been tested for reliability and validity. Using a convenience sample of 13,829 patients the research found a positive correlation between the patient's acuity rating and the number of nursing hours required.

Studies Conducted in 1983

The RIM method employed by Grimaldi and Micheletti (1983) was also used by Joel (1984) to study a sample of 3,521 patients at eight hospitals. Fourteen adult and pediatric DRGs were examined concerning differences in nursing costs using the patient day, or per diem method, versus the RIM method. Information about the reliability of RIM was included. The LOS and sample size for each DRG were identified. Joel concluded that RIMs are a more equitable method for identifying the distribution of nursing costs than the patient day allocation.

A study conducted by Lagona and Stritzel (1984) measured the amount of nursing care used by patients in

select DRGs. Nursing care costs were identified from a classification tool identified as MAPS. A description of the tool was not provided. The study took place at a community teaching hospital. Over a three month period 35 patients with two specific DRGs were studied in terms of LOS, hours of nursing care, and direct costs. The average hours of nursing care per day were reported to vary extensively between the two DRGs. The cost of nursing care was noted to fluctuate depending upon the hours of care provided.

Mitchell, Miller, Welches, and Walker (1984) conducted a six month study of nursing costs by DRG. The hours and cost of direct nursing care for specific DRGs were examined to determine the relationship between total hospital costs and direct nursing care costs. A convenience sample of 89 patients with four specific DRGs on four nursing units was studied. The PCS used to identify nursing costs was a time-based system developed and utilized at the hospital for eight years. The investigators found that nursing resource usage varied considerably within the DRG framework.

Mitchell et al. reported that data on six DRGs were collected; however, only enough information to report on three was obtained. Yet the article provided results on four DRGs. It was noted that a second classification instrument, known as the Severity of Illness Index, was completed on each patient. This methodology was reported to

reflect a more "accurate like" resource usage, but unfortunately, no information to support this claim was included.

Rieder and Kay (1985) did a study that indirectly addressed the cost of nursing care. Patients were classified using the Workload Management System for Nursing which was tested for reliability and validity. The 447 patients with seven specific DRGs were obtained from five naval hospitals. Data concerning these patients' LOS were collected during four months in 1983 and then compared to the LOS for patients from 1980 and 1982. Specific values for the LOS in 1983 were not provided although values for 1980 and 1982 were given.

Requirements for nursing care based upon the PCS were found to be higher during the first few days of any hospitalization. After that time patients that stayed in the hospital required less nursing care. Rieder and Kay concluded that knowledge about a patient's acuity level can aid in determining the patient's LOS. From a cost perspective the study noted that an increased LOS resulted in greater hospital and nursing costs. The researchers felt, however, that the small sample size may have created a bias in the results.

A small sample size was found in an unpublished study by Williams (1984). Thirty medical-surgical patients were utilized to examine acuity levels, LOS and nursing costs in

an attempt to describe nursing costs using the hospital's own PCS. The acuity system was noted to be a reliable method upon which to identify the cost of nursing services. The research, however, was not able to identify the portion of nursing costs included in the room rate.

Studies Conducted in 1984

As DRGs continued to be established in hospitals across the nation, the number of studies that examined the cost of nursing care services increased. By 1984, a year after DRGs were nationally implemented, many research studies were conducted but results were not published until later.

Harrell (1984) focused her doctoral dissertation on nursing care costs. The variables examined were nursing care hours, patient acuity levels, age, direct nursing costs, and nursing productivity ratios. Medical, surgical, neurological and cardiac ICUs were used to study patients (N = 655) with 1 of 15 specified DRGs from an acute care nonprofit nonteaching private hospital. Data were collected for a six week period. The PCS was developed by the hospital and had been tested for reliability. The study was based upon a theoretical framework involving Open Systems Theory. This was one of only a few studies that utilized a theoretical framework.

The study findings noted that direct nursing care costs ranged from 6.5% to 13.9% of the hospital costs. LOS was found to be a major predictor of nursing care costs.

Nursing care hours, patient acuity and nursing productivity were found to be useful in defining nursing costs per DRG. Study findings were also reported in Harrell (1986).

Using the same methodology as Riley and Schaefers (1983) to calculate nursing costs, Schaefers (1985) compared the cost of nursing services from 1982 to 1984. The study was conducted at a tertiary public teaching hospital. Using the discharge diagnosis from 1982, a proportionate random sample of the top 25 DRGs was identified. This provided the diagnoses that were used for data collection on 613 patients in 1984. The PCS method used to define nursing care services was developed by the hospital.

LOS and total nursing costs for both years were given. The findings revealed that nursing costs were 40% higher in 1984 than they had been in 1982. The cost of direct nursing care had increased from $12 an hour to $14, and the average hours of care a day increased from five to six. Information was also presented comparing this hospital's LOS and nursing care hours to another hospital's findings. Schaefers noted that problems were inherent when comparing cost information between facilities. Specifically, some inconsistencies existed concerning which staff members were included in direct hours of nursing care and the use of different PCSs at the hospitals.

Another 1984 study, done by Arndt and Skydell (1985), compared nursing cost information between hospitals. The

GRASP (Grace-Reynolds Application and Study of PETO [Poland, English, Thorton and Owens]) classification method was used although no information was provided about its reliability or validity testing. Data on 30,000 patients at five community hospitals over a nine month period were collected. The variability of nursing care requirements to age, DRG, day of hospitalization, and between hospitals was studied.

The researchers found that when age was examined independently, patients over age 65 usually required more nursing care than individuals under age 65. Controlling for LOS significantly reduced differences between age groups. Results revealed a wide variation in nursing care requirements by DRG among the hospitals. Arndt and Skydell provided only scattered results of their findings. Total nursing hours and total nursing costs at the five hospitals were reported for two DRGs. The sample size of each DRG was not furnished.

Information from this same study was provided in a slightly different format in an article by Skydell and Arndt (1988). Data on the total cost of nursing care and total hours of care per stay were compared between the five facilities for two different DRGs.

Sherman (1986) also compared information between different facilities. The study presented data on patients with the same DRG located in 13 hospitals. A convenience sample was obtained from university affiliated teaching

hospitals within a specific district. The patients were classified with a process known as Disease Staging Methodology. The study findings were reported for hospital costs, LOS, number of days in ICU, and hours of nursing care required.

Three sample sizes were referred to in the article. In the narrative 122 and 99 patients were identified. The table presenting the findings reflected a sample size of 120. Sherman reported that the Disease Staging Methodology was very sensitive to coding errors, thereby making comparisons between hospitals very difficult.

A study done in 1984 by McKibbin, Brimmer, Clinton, Galliher, and Hartley (1985) used the same PCS method, Medicus, utilized by Halloran. The research focused on the relationship between nursing costs and DRG reimbursements at two hospitals. A convenience sample size of 1,594 patients was used to examine nursing costs in 21 DRGs. Some of the variables reported were nursing costs, nursing care hours, LOS, DRG reimbursements, and hospital costs.

The conclusions from this research differed from many of the studies already discussed. McKibbin et al. found a positive relationship between nursing care hours and DRG reimbursements. The DRGs receiving less money required less nursing time while the ones with larger reimbursements required more nursing care hours. On the average, total nursing costs were found to account for 20% to 28% of the

hospital costs. The investigators concluded that for most DRGs, nursing care services were adequately reflected in the reimbursement. A summary of this study appeared in a 1985 article by McKibbin, Brimmer, Galliher, Hartley, and Clinton.

A wide variation of nursing care requirements within specific DRGs was found by Wolf and Lesic (1986). Their six month study was done at an acute care community teaching hospital. Direct and total nursing costs were examined for 1,737 patients in 37 DRGs. The total hospital cost for each DRG was reported. The nursing workload for each patient was identified using a computerized nursing information system. The recorded workload was then converted into a weighted relative index to identify the cost of nursing care services.

Wolf and Lesic found that for 37 DRGs, total nursing care costs accounted for between 9.28% and 70.59% of hospital costs. With such a large variation, Wolf and Lesic, reaching a different conclusion than McKibbin et al., felt that to better control costs nursing resources needed to be determined by DRG.

In 1984 Dahlen and Gregor (1985) examined the cost of nursing care using an all registered nurse (RN) staff. At an acute care facility a convenience sample of 93 patients was studied. For 10 DRGs the hospital costs and direct, indirect, and total nursing care costs were identified.

Patient costs were defined based upon a PCS developed by Lawrence Donnelly and revised by the hospital.

With an all RN staff the study revealed total nursing costs varied from 9.5% to 23% of hospital costs. The average nursing care costs were 14% of the total bill. This study was the only one located where the hospital used an all RN staff.

A study by Reitz (1985) focused indirectly on the cost of nursing care services. The study dealt with the development of a PCS tool that could identify patient acuity and thereby reflect required nursing care services. The PCS known as the Nursing Intensity Index was found to serve as a valid and reliable instrument in determining patient acuity. This tool was later used in other studies.

Bailie (1986) applied the Nursing Intensity Index to investigate nursing care costs for three DRGs. At a regional medical center, a randomized proportional sample of 20 patients per DRG were examined. The variables studied were nursing intensity, LOS, and hospital charges. The specific cost for nursing care was reflected in the room rate. Findings revealed that nursing needs varied within and between DRGs. Bailie concluded that the Nursing Intensity Index reflected the cost of providing nursing care services more equitably than did the per diem method.

McClain and Selhat (1984) examined direct and indirect nursing costs at an acute care hospital. A sample size of

only 20 patients was collected with three specified DRGs. The PCS was developed by O'Leary and Associates. LOS, nursing hours, and total nursing costs were identified. The LOS for the DRGs was found to be larger than the national average. The study was able to translate nursing care hours and costs into a format that made them comparable to LOS.

When DRGs were established at one acute care hospital, Bargagliotti and Smith (1985) studied the cost of nursing care services. LOS, age, nursing care hours, the percent of nursing to room rate, and the percent of nursing to hospital costs were identified for 109 patients in four DRGs. The hours of nursing care were determined with a PCS, developed by Quantitative Health Systems, Inc., which was routinely audited for reliability and validity.

Bargagliotti and Smith found that the cost of nursing services averaged between 33% and 40% of the room rate and 16% to 20% of total hospital costs. Although average nursing costs were reported to be less than 25% of hospital costs, the research found a wide range of nursing costs within each DRG category. Like many of the costing out studies, only one hospital was used to collect data.

The amount of variation in patient acuity levels within DRGs was examined in two 1984 research studies, Ethridge (1985) and Mowry and Korpman (1985). Ethridge utilized a classification system developed by the hospital, however, no mention of reliability or validity testing was made. Over a

six month period, information on 53,272 medical and surgical patients and on 5,000 critical care patients was collected. The study identified the portion of hospital revenue attributable to nursing and noted that hospital revenue was basically unchanged when nursing costs were identified.

This study was unclear as to why a change in hospital revenue should be expected when nursing was costed out. Since DRGs preset the reimbursement rate, costing out nursing services would not be expected to increase the hospital's allotment. Costing out, however, might alter nursing's portion of the remuneration. The study did not address costs as a function of DRGs.

Mowry and Korpman (1985) also reported the cost of nursing care according to acuity levels. The study was conducted at a short term acute care facility using patients in five DRGs (N = 240). The variables of LOS, acuity level, direct nursing costs, and total DRG reimbursements were identified. The hospital's acuity system used to delineate nursing care hours was developed by St. Luke's Medical Center in Phoenix, Arizona and had been tested for reliability and validity. The investigators noted that this PCS was being used by 16 hospitals nationally but no additional studies using this acuity system were located.

Mowry and Korpman found that in some DRGs the differences in nursing costs per day varied up to 500%. Such a large variation supported the idea of hospitals

tracking actual nursing costs to prevent unexpected financial overruns in some patients' care. No mention was made concerning what portion of the sample consisted of outliers. Outliers are patients who stay in the hospital substantially longer than the recommended DRG time allotment and can increase nursing care and hospital costs.

Reschak, Biordi, Holm, and Santucci (1988) collected data on direct and indirect nursing costs at a nonprofit teaching hospital for six weeks in 1984. The 50 subject sample included patients admitted under two DRGs and used a PCS developed and tested at the hospital. Direct nursing care hours, LOS, age, nursing costs, and DRG reimbursements were recorded on each patient after discharge.

Results showed that the percent of DRG reimbursement used by nursing varied from 7.3% to 17.4%. Although Reschak et al. found wide ranges of nursing care costs with the two DRGs, they concluded that the average amount of nursing resource required per patient was accounted for within the DRG system. In the study 20% of the patients in DRG 210 fell into outlier status. The study acknowledged that the number of outlier patients involved would increase the cost of nursing care services.

The Severity of Illness Index used by Mitchell et al. (1984) was also utilized by Grohar, Myers, and McSweeney (1986). The investigators conducted a retrospective chart review on a random sample of 35 patients in four DRGs.

Unfortunately specific DRG codes were not provided and the labels given were not complete enough for DRG numbers to be assigned. The variables examined were LOS, hours of direct care, cost of direct care and nursing resource usage per acuity level.

Grohar et al. found large fluctuations for required nursing care within each DRG. They concluded that neither DRGs nor acuity levels were homogeneous enough to predict direct nursing resources. The article did not report on validity or reliability testing of the Severity of Illness Index. Although the hospital had a mix of staff, only the care provided by and the costs for the RNs were retrieved. No cost allocation was calculated for time spent by other caregivers or for indirect nursing costs as these were reported to be unobtainable.

The AS-SCORE classification method used by Kreitzer et al. (1984) and the RIM Methodology (Grimaldi & Micheletti, 1983; Joel, 1984) were also utilized in a 1984 study conducted by Wilson, Prescott, and Aleksandrowicz (1988). Wilson et al. compared the nursing costs and nursing intensity on a group of patients using four classification techniques. The PCS methods were identified as AS-SCORE, RIM, MacLeod and the per diem systems. A convenience sample (N = 155) with three specific DRGS was obtained from a community teaching hospital.

Wilson et al. reported the findings for each DRG on LOS. Values on the nursing intensity were provided using AS-SCORE, RIM, and MacLeod methods. The cost of direct nursing care and the percent of nursing costs to hospital charges was given for RIM, MacLeod, and per diem systems. Wide variations in nursing costs among the PCSs were found. The researchers concluded that more consistent definitions should be used in defining nursing costs between facilities to obtain reliable cost comparisons between hospitals. Some general information reported while this study was in progress was found in Prescott (1986).

Trofino (1986) reported on the results of four studies done at four hospitals. The studies attempted to decide if the Reality Based System for Pricing Nursing Service could serve as an alternative to the RIM methodology for nursing reimbursement. The article stated that the variables of LOS, direct and total nursing costs, and nursing care hours were identified at each hospital.

Correlations between the hospitals were done on nursing care hours and LOS for various DRGs. Sample sizes varied depending upon which two hospitals were being compared but ranged from 895 to 3,277. The correlations of nursing care hours between the hospitals ranged from .76 to .88, but the PCSs used to identify the hours were different between facilities. No specific information was provided concerning the costs of nursing care for the individual DRGs. Although

Trofino felt that this pricing method may be an alternative to the RIM system, more extensive testing was required.

Many studies were conducted in 1984 utilizing a variety of PCSs and reporting diverse findings about the cost of nursing services. Sample sizes fluctuated from 20 individual records (McClain & Selhat, 1984) to 58,272 patient days (Ethridge, 1985). These inconsistent trends were also noted in later research studies.

Studies Conducted in 1985

Besides the 1984 dissertation by Harrell several other doctoral dissertations and master's theses addressed the concept of nursing care costs. Sanders' doctoral dissertation (1985) examined the costs of nursing care services in several DRG categories. A stratified random sample (N = 232) addressed the cost of care in five DRG categories. The sample consisted of 40% of the cases discharged from the hospital over a three month period with one of five DRGs. General Systems Theory was utilized as the theoretical framework. Patient classification was done with the Medicus system that was tested for reliability and validity. The study variables examined included LOS, direct nursing care hours, and direct, indirect and total nursing costs and acuity scores.

Sanders' findings recognized that the type and amount of nursing resources required both within and among DRGs were too heterogeneous to be based upon LOS. The study

concluded that the per diem method of allocating nursing costs did not accurately reflect the amount of resources required for DRGs. Sanders noted that a PCS used in conjunction with DRGs could provide a better method of determine nursing resource usage.

Replogle (1985) and Domask (1986) studied the cost of nursing care by DRG in 1985 for their master's theses. Replogle examined patients in five DRGs to assess the costs of nursing care. Using an acuity method tested for reliability and validity, a sample of 111 patients on six ICU and telemetry units was studied. The setting was a private nonprofit teaching hospital owned and operated by a religious order.

The variables Replogle monitored were LOS, nursing care hours, patient acuity levels, cost of direct nursing care, and DRG reimbursements. The study findings reflected that the cost of providing nursing care services ranged from 13.0% to 24.0% of the DRG reimbursement rate. A wide variation in nursing costs based upon the patient's LOS was also found. The study's theoretical framework was a model developed by Curtin (1983).

Even though a study of nursing costs was not conducted by Curtin (1983), her article was important to include in this literature review. Curtin proposed a model for costing out nursing care services that was used in several studies (Domask, 1986; Replogle, 1985). A system structured in a

similar fashion to the DRG format was proposed but would reflect the amount of nursing time required in each category. Each Major Diagnostic Category would have a corresponding Nursing Care Category and each DRG a similar Nursing Care Strategy. The average minutes of direct and indirect nursing care for each diagnosis would be identified within the Nursing Care Strategies. The cost of nursing care services could then be determined based upon time requirements.

This theoretical framework was used by Domask (1986). Domask studied a convenience sample of 234 patients in three specified DRGs at a tertiary acute care nonprofit teaching facility. The purpose of the research was to relate the cost of nursing care and nursing workload to the DRG reimbursement. The PCS, tested for reliability, was the Medicus system also used by Sanders (1985) and McKibbin, Brimmer, Clinton, Galliher, & Hartley (1985).

Domask studied acuity levels, hours of nursing care, LOS, nursing costs, and DRG reimbursements. A large variation was reported within each DRG on the percentage of the reimbursement rate used to provide nursing care. One DRG required between .72% and 38.47% of the reimbursement for nursing care costs while another ranged from 1.47% to 73.95%. The study supported incorporating patient acuity within the DRG framework. The research also expressed the

need for more uniform acuity systems to be able to compare cost information between facilities.

A study by Fosbinder (1986) examined nursing costs for 13 DRGs at an acute care hospital. The type of PCS that was used was not identified but had been tested for reliability and validity. A sample of 740 patients was studied in terms of LOS, percentage of outliers, costs of nursing services, and DRG reimbursements. The research found that DRG reimbursements do not make allowances for individual differences in nursing care requirements. The percent of DRG allotments needed to cover nursing care costs ranged from 6.1% to 19%. The findings were identified in two ways, once for all patients and again with outliers excluded.

The San Joaquin classification system was used by Rosenbaum, Willert, Kelly, Grey, and McDonald (1988). For two weeks a convenience sample of 249 patients with two specified DRGs was studied. The study had several purposes. First it investigated the correlation between patient acuity, occupancy and nurse staffing. Then it examined a method for determining direct care costs as a portion of DRG reimbursement. Finally the study identified the variation in nursing hours and costs based upon acuity for selected DRGs. The PCS was tested for reliability and validity.

Rosenbaum et al. found that staffing did not correspond to the acuity ratings but did reflect census patterns. The hours of nursing care actually worked were lower than the

organization's expected values, thereby saving the hospital considerable expense. For one DRG the average direct nursing costs consumed 7.4% of the reimbursement and for another it was 8.13%. The study provided range and standard deviation values on the two DRGs for the variables of LOS, nursing care hours, and nursing costs. Unfortunately no average or mean values were given that could be used for the meta-analytic study.

The cost of nursing care was indirectly addressed in terms of patient acuity and unit staffing by Donovan and Lewis (1987). Data from 1969 that used the Commission for Administrative Services to Hospitals (CASH) methodology were compared to data from 1985 that used the Rush-Medicus PCS. The Rush-Medicus system had been tested for reliability. For a two week period in 1969 patients on eight medical units served as the convenience sample. In 1985, however, the yearly average was used to calculate the sample size because of continuing census and acuity fluctuations and the specific sample size was not given.

Marked increases in patient acuity levels were noted between the two time-periods although a slight decrease in nursing personnel was found. The hours of nursing care per day decreased from an average of 5.46 in 1969 to 5.21 in 1985. The examination of nursing costs was done comparing 1972 with 1985. In 1972 nursing comprised 17.8% of the corporate budget and dropped to 14.7% in 1985. Donovan and

Lewis noted that the increased productivity levels in nursing did not support any ideas of nursing costs as a major contributor to escalating hospital expenses.

The preliminary results of a study in progress were provided by Thomas and Vaughan (1986). The PCS was developed by MacLeod Associates and also used by Wilson et al. (1988). The acuity tool recorded the amount of nursing care required per patient in terms of Relative Value Units and was tested for reliability. The variables examined were the amount of time required to do nursing care and LOS. The patients were identified by type of unit instead of by DRG. The researchers noted that once the amount of time required had been identified the costs of nursing care could easily be defined.

A 1985 pilot study reported by Richards, Hexum, and Anderson (1987) indirectly addressed nursing costs. The study examined which patient care requirements were most frequently found in three DRGs. Examples of these requirements included nursing interventions such as assessments, treatments, and teaching. A total of 244 patients were rated in terms of their nursing needs at time of admission and discharge. The study noted that close evaluation of routine nursing tasks could lead to an improved database for financial analysis.

Wolf, Lesic and Leak (1986) studied the difference in direct nursing costs for primary and team nursing units over

a six month period. An acute care community hospital with a 28 bed team and a 28 bed primary care unit was used. Both units served medical-surgical patients. The patients were classified with the Relative Index of Workload scale. Acuity levels, LOS, and direct nursing costs were examined and compared between the units. All DRGs were combined.

The investigation revealed that on the primary care unit acuity was 28% higher, patient's LOS was 24% longer, and average reimbursement rates were larger. Nursing costs were also higher but only by 22%. Though the values for each variable were higher on the primary care unit, the study reported that the primary unit provided a cost savings for the hospital. The unit was $1.30 less per patient per day than the unit providing team nursing. Wolf et al. noted that with prospective payment plans, like DRGs, providing the most cost effective nursing model was important.

A correlational study was conducted by Lucke and Lucke (1986) for one month at a public teaching hospital. The sample, comprised of 135 ICU patients, was used to define to what extent severity of illness, nursing intensity and LOS predicted the cost of nursing care. The APACHE-II (Acute Physiology and Chronic Health Evaluation) system was used to define the severity of illness. Nursing intensity was identified using a PCS that was developed at the hospital and tested for reliability and validity. Due to a small sample size for specific DRGs, all DRGs were consolidated.

The inclusion of nursing intensity was found to markedly improve the prediction of LOS and hospital costs. A high correlation was reported between the APACHE-II system and the nursing PCS. Lucke and Lucke recommended that more extensive testing be done with larger sample sizes and separating out specific DRGs.

Cheatwood and Martin (1986) based a cost analysis study on the results of three studies that had occurred at the same institution. Patients in three DRGS, for a total sample size of 104, were examined on age, LOS, and nursing care hours. The article stated that the nursing care hours were broken down by the level of the care giver, but the study only reported the total values. The PCS used was specifically developed for the facility.

The researchers were interested in determining whether nursing diagnoses were consistent within DRGs. No definite relationship between nursing diagnoses and nursing care hours was found. Like Arndt and Skydell (1985), when Cheatwood and Martin examined the age variable, younger patients required fewer nursing care hours than older ones. This study noted that before the real cost of nursing services could be identified, a realistic workable methodology must be developed.

One of the three studies mentioned by Cheatwood and Martin (1986) was located. It was done by Martin and Kelly (1986) and examined nursing care costs for general

categories of orthopedic patients not specific DRGs. A convenience sample size of 44 patients over a three week period in 1985 was used. Nursing care hours by level of caregiver, LOS, and direct, indirect, and total nursing costs per orthopedic category were recorded.

The research found that the percent of nursing costs to hospital costs ranged from 8.35% to 17.9% in the specified categories. Martin and Kelly noted that though the cost of nursing care at the facility was identifiable the results were not generalizable. The need for each hospital to develop and validate its own acuity system prevented cost information from being exchanged.

Trace (1988) studied four forms of AIDS (acquired immune deficiency syndrome) over a nine month period. After this study was completed, a DRG rating for AIDS was recognized but at the time of this study no DRG category had been assigned. A convenience sample of 41 patients was examined from a large tertiary-care hospital. The acuity tool was computerized but no mention was made about where it was developed or if it had been tested for reliability and validity. The reported variables were age, LOS, nursing care hours, nursing costs, and the percent of total nursing costs to both room charges and hospital charges.

Trace found that nursing costs were directly related to LOS. Total nursing costs accounted for 34.1% of the room charge and 11.8% of the hospital costs. One limitation of

the study, noted by the researcher, was that several patients could be considered under more than one of the four AIDS categories identified. It was recommended that the study be repeated in another hospital to obtain more generalizable results.

The studies conducted in 1985 continued to reflect a variety of acuity methods. The reliability and validity testing done on many PCSs was often not reported. Many did not itemize specific DRGs but, instead, grouped them together or did not provide a DRG number. The sample sizes reflected a wide range. Although some researchers used the same PCS, few studies built upon prior research. The idea of costing out nursing services was also researched indirectly in several studies. During 1986 many additional studies were done, but the problems and inconsistencies found in 1985 remained.

Studies Conducted in 1986

In 1986 several research studies were conducted as part of doctoral dissertations and masters theses. One dissertation was performed by Trofino (1988). She monitored 29,696 patients at six hospitals for a year to determine if a relationship existed between nursing care hours and LOS for 48 specific DRGs. A variety of PCSs were used that had been tested for reliability and validity. The hospitals ranged in size from 201 to 706 beds.

Mean nursing care hours per DRG were similar across hospitals for 64% of the sample. LOS was also found to be highly similar across hospitals. Correlations between hours and LOS found that nursing care hours were determined by LOS. One of Trofino's recommendations was that attention be given to DRGs reflecting wide variations in nursing care hours. In addition, the study recommended developing a PCS that used nursing diagnosis instead of nursing tasks. Trofino felt that a PCS based upon nursing diagnoses might eventually lead to the development of a nursing-DRG system.

Although Trofino monitored the mean LOS and nursing hours, the findings were provided in terms of Analysis of Variance, Pearson Product Moment Correlations, and Chi-Squared tests. For meta-analysis, the data must be in the same format for all studies. The common statistical information provided from the majority of other studies was mean values, therefore, the data from this study were not usable for the meta-analysis. Data from this project were also reported in Trofino (1989a, 1989b).

Sochalski (1988), in her doctoral work, examined nursing costs for patients (N = 437) over a three month period with a stay in an ICU. The variables of age, LOS, severity of illness, operative status, and nursing costs were monitored using two tools. They were APACHE-II, used to monitor severity of illness, and Medicus, for recording acuity levels. Both systems, tested for reliability and

validity, had previously been found in other research studies (Halloran, 1985; Lucke & Lucke, 1986).

Although costs were not identified according to specific DRGs, large variations in nursing expenses were reported between patients. Five percent of the patients were noted to acquire 33% of the total nursing costs. Severity of illness was found to account for a considerable amount of the variation in nursing costs for ICU patients. In addition LOS was found to reflect factors other than patient severity, such as chronic illness or patient dependency.

A masters thesis involving nursing costs and DRGs was conducted by Clippard (1987). Nursing costs for 10 DRGs on 232 patients at a rural, nonprofit hospital during a six month period were identified. General Systems Theory was identified as the conceptual framework. The monitored variables were LOS, nursing costs, DRG reimbursement rates, hours of care, and hospital costs.

For 8 of the 10 DRGs in the study, findings on LOS were within one day of the national average LOS. The percent of nursing costs to hospital costs was found to be between 15% and 22%. Even though Clippard did not feel the results could be generalized to other facilities, she noted that a positive relationship occurred between DRG reimbursement rates, LOS, and nursing costs.

A master's thesis done in 1986 by Johnson (1986) examined the cost of nursing services for four DRGs. Nursing care hours, nursing costs, and reimbursements were monitored on a proportional sample of 124 subjects reflecting four DRGs. The PCS used at the community hospital was developed by Robert Hansen and was tested for reliability and validity. Open Systems Theory served as the theoretical framework.

The research found the percent of total nursing costs to DRG reimbursements ranged from 8.8% to 18.4%. Johnson's conclusions agreed with other studies that claimed there was too much variation within the DRG structure to adequately represent the amount and cost of nursing care services.

An unpublished master's project by Williams (1987) was located. Nursing costs, LOS, hospital costs, and nursing care hours were reported for 645 patients in ten specific DRGs. The PCS utilized was identified as Janna Plus, but no mention was made about reliability or validity testing.

A wide range of nursing hours and costs for all DRGs was reported. On the average the ratio of nursing costs to hospital costs was 12% with a range of 7% to 18%. Williams noted that nursing expenses were higher for medical than for surgical DRGs. Nursing costs were higher still for patients with a stay in ICU or telemetry.

The impact staffing levels have on nursing costs was examined by Flood and Diers (1988). Two general medical

units at a university affiliated community hospital using the San Joaquin PCS, also used by Rosenbaum et al. (1988), were followed. Over a three month period one unit was consistently short staffed while the other was staffed more closely to the required level. Census on the two units was very similar.

The patients on the unit that was short staffed had a higher incidence of complications resulting in longer hospital stays. The acuity levels were also higher on this unit although the number of outliers was very similar between the two units. Once the costs per unit were calculated, the research found that the short staffed unit had cost the hospital $116,286. Flood and Diers' findings strongly supported adequate staffing levels as one way to control costs. Some information about LOS was provided for a few DRGs but in general specific DRGs were not identified.

Several DRGs were delineated in terms of LOS and nursing care hours in a study by Marks (1987). The 719 bed teaching research and tertiary care facility had patterned its own PCS on Horn's Severity of Illness Index. A sample of 11,005 patients was classified according to the PCS which was tested for reliability and validity. Ten DRGs, for a total of 3,371 patients, were identified on LOS and nursing care hours per day and per stay.

Marks discovered a weak positive correlation between Horn's Severity of Illness Index and the average nursing

hours per day. This study found that 80% of the patients fell into 20% of the DRGs. The researcher advocated that by focusing on the common DRGs, hospitals could develop a statistically sound database on nursing care hours per DRG. She also noted that DRGs did not sort patients into nursing cost categories, but that was a task for which they were never intended.

Two 1986 studies dealt with nursing costs by developing models to predict consumption resources, D'Arco (1988) and Scherubel and Swartz (1988). A model for predicting nursing costs on a medical ICU was used by D'Arco. A sample size of 120 patients on a 14 bed unit was examined for 28 days. The study attempted to identify how much nursing care was required for each level of patient acuity. The amount of time spent in each category was described by four types of activities: patient, unit, non-nursing, and personal. Once the time was determined, the cost for each level of acuity could be specified and the patient billed accordingly.

Scherubel and Swartz (1988) studied the use of hospital resources by addressing the following variables: age, sex, race, DRG, medical and surgical procedures implemented, attending physician, the stage of disease, nursing hours consumed, ancillary services used, therapies provided, and the type of payor. A convenience sample of 31,681 patient records was examined.

The study found that the model developed by Scherubel and Swartz accounted for 66% of the variation in hospital costs for cardiovascular patients, 54% for orthopedic patients, and only 22% for gastrointestinal patients. No explanation was given on why these values were so different. The investigators recommended that additional testing be conducted. The specific hours of nursing consumption were not reported.

For six months between 1985 and 1986, the Medicus Systems Corporation conducted a study at 22 hospitals all using the Medicus PCS (Petit, Kavois, & Glandon, 1988). They created a multiple hospital database of nursing costs and other variables that could affect costs. The results from this study were reported by several authors revealing different types of information (Marquess & Petit, 1987; McCormick, 1986; Petit, Kavois, & Glandon, 1988).

Petit et al. provided some general information about the Medicus study for patients with surgical DRGs, medical DRGs, and other DRGs. In these areas data were provided on nursing costs, LOS, percent of RN hours, percent of days in ICU, and acuity ratings for a sample of 33,015 patients. A higher variation in costs among medical DRGs over surgical DRGs was reported. This meant that patients with medical DRGs were less consistent in terms of nursing care and costs.

Some hospitals in the study reported that a higher percentage of RN staff created higher costs. A difference within DRGs was found in the amount of time patients spent in ICU. Petit et al. noted that these factors may account for some cost variation across hospitals. The researchers reported that the Medicus study led the way for developing more comprehensive databases to compare nursing care costs.

The second article that provided information about the Medicus study was by McCormick (1986). Results from the study were reported on the cost of direct nursing care, the percent of RN costs, and LOS for 20 DRGs. The study found direct nursing costs to represent 17.8% of the Medicare reimbursement.

Marquess and Petit (1987) compared the information from the Medicus study to five DRGs at their hospital. Direct labor costs were divided into variable and total labor expenses. Data on the variable and total labor costs, LOS, percent of direct care by RNs, and percent of days in ICU were identified. The results of 1,486 patients at the facility were compared to 24,277 patients with the same DRGs from the multiple hospital survey conducted by the Medicus corporation. The number of patients in each DRG group was not identified.

Marquess and Petit searched for but were unable to locate any simple correlation between the percentage of RN staff utilized and the cost of nursing care. The study

noted that with the ability to compare cost information between the hospital and national averages, a nursing department can closely ascertain where and why variations occur.

Some inconsistencies were found between the three articles in terms of the Medicus study sample size. Petit et al. stated the total sample size was 70,000 patients, although the study reported on only 33,015 for the combined total of medical, surgical and other DRGs. Marquess and Petit agreed with the 70,000 total size and identified 24,277 of them as surgical and medical DRGs. Both Petit et al. and Marquess and Petit cited 7,142 surgical cases, yet, Petit et al. noted 15,806 medical DRGs while Marquess and Petit accounted for 17,135. McCormick, on the other hand, reported a total size of "more than 80,000" (p. 50). McCormick did not record the sample size for the 20 DRGs he examined. These inconsistencies reflect a major problem when attempting to compare study findings.

Another 1986 study was conducted by Green, McClure, Wintfeld, Birdsall, and Rieder (1988). Patients were classified according to two PCS methods that were tested for reliability and validity. The first was the Workload Management System for Nursing also used by Rieder and Kay (1985). The second was the GRASP method noted by Arndt and Skydell (1985). At the time of discharge the patient records were also classified as to the level of illness.

The Severity of Illness Index, also found in Marks (1987), was used for this purpose.

Patients in the 25 most frequently noted DRGs were followed creating a sample size of 1,064. For each DRG data were provided on LOS and nursing care hours. By level of severity within each DRG information was given on LOS, nursing costs, and ancillary costs. Ancillary costs were those expenses incurred from other hospital departments. Green et al. found a strong positive correlation between the acuity tool and the patient's severity of illness. The investigators noted that inclusion of the PCS created more homogeneous patient groups within DRGs. As patient groups become more homogeneous, the study noted that comparisons between hospitals might be possible.

The GRASP acuity tool was also used by Shafer, Frauenthal, and Tower (1987). Six DRGs were examined in terms of LOS, hours of care, and total hospital costs. The study revealed that for patients with average acuity levels, costing according to the per diem method was adequate. But when patients had either extremely high or low acuity levels, costing out nursing services according to the PCS was more accurate.

As in 1985, several research studies conducted in 1986 used the same PCS. Medicus Systems Corporation developed a multiple hospital database for institutions using the Medicus PCS. This provided some guidelines that could be

used for comparing cost information. In general the studies continued to be very independent and did not build upon previous research.

Studies Conducted in 1987

By 1987 the number of reported studies on costing out nursing services had markedly decreased. One doctoral dissertation, Sherman (1987), was located. It compared nursing costs, nursing care hours, LOS, hospital costs, and acuity levels. The sample consisted of 352 medical-surgical patients at four hospitals. The Iowa work-sampling methodology and the San Joaquin PCS were utilized. A theoretical framework for the study was presented.

Sherman found the Iowa work-sampling method and the San Joaquin method were highly correlated for identifying nursing care hours. Total nursing costs ranged from 1% to 19% of hospital costs. Costs were defined by either medical or surgical unit at each of the four hospitals, not by DRG.

A master's thesis done by Runner (1989) was based upon the study done by Riley and Schaefers (1983). Runner studied the relationships between total nursing costs and the variables of nursing intensity, DRG classification reflected by LOS, and total hospital costs. General Systems Theory, also utilized by Sanders (1985) and Clippard (1987), was described as the conceptual model. A proportionate random sample of 100 patients from four DRGs at a tertiary care teaching hospital was examined.

The type of PCS was not identified, but was used to calculate direct and total nursing costs. Data for each DRG were reported on age, LOS, nursing care hours, hospital costs, total nursing costs, and the percent of nursing costs to hospital costs. Total nursing costs were found to be an average of 12.96% of hospital costs. Since the study was based upon Riley and Schaefers, Runner compared her results to their findings. LOS, nursing care hours, total nursing costs, and the percent of nursing costs to hospital costs were all lower than in Riley and Schaefers' study.

Runner explained the differences in study findings by commenting that according to nursing literature LOS and nursing care hours have decreased over time. The drop in total nursing costs was attributed to the size of the facilities and inflation. Yet as inflation occurs, prices and costs are expected to increase. It is possible that the decrease in nursing care hours resulted in a reduction in nursing costs. This aspect of the study was not clear.

Nursing costs were indirectly discussed in a study by Bost and Lawler (1989). A method to measure nursing resource consumption to better identify the cost of nursing care services was examined. A randomly selected sample ($\underline{N}$ = 107) from the hospital's 10 most frequently reported DRGs, was monitored. The PCS utilized at the rural community hospital was the Nursing Intensity Index described by Reitz (1985).

Although specific DRGs were not identified the study reported the DRGs were not homogeneous with respect to nursing intensity. The actual test results were also not provided but general information was given. The research found that the LOS and total hospital costs increased with intensity. Bost and Lawler stated that the ability to identify the use of nursing resources with a valid and reliable PCS was necessary for budgeting and allocating costs.

Barhyte and Glandon (1988), in a 1987 research project, stated that nursing must consider separating nursing costs from the traditional room and board charges. The cost allocation for nursing within the DRG allotment must be adequate to cover expenses. Therefore Barhyte and Glandon studied the difference between nursing costs as allocated from a PCS versus the conventional per day method. Patients on a 46 bed surgical unit were examined for an 84 day period. The PCS was the Rush-Medicus system, tested for reliability and validity, and used by Halloran (1985) and Sochalski (1988).

The 3,058 patient days were divided into six two-week periods. Each period was defined in terms of average acuity, census, direct, indirect, and total nursing costs. Barhyte and Glandon discovered that the PCS methodology was more accurate for allocating nursing costs than was the per day method.

Age, hospital costs, and resource utilization for patients in ICU were studied by Munoz et al. (1989). A convenience sample of 6,331 ICU admissions at the 805 bed teaching hospital was examined. Findings were presented by age group and by general hospital service. Nursing costs were included in the room rate. The study found that the average patient would generate $5,005 more in expenses, hospital wide, than would be reimbursed by DRGs. In addition patients over age 65 with an ICU stay were found to have a longer LOS and greater severity of illness than younger patients.

The Medicus system was utilized by two studies in 1987, Sullivan, Carey, and Saunders (1988) and Van Hoesen and Eriksen (1990). Sullivan et al. researched nursing costs for 116 coronary ICU patients. Acuity levels, LOS, nursing hours, and nursing costs by acuity level were reported. The research revealed that when acuity levels and surgical procedures were considered, the use of the Medicus PCS to develop a variable billing rate for nursing was supported.

Van Hoesen and Eriksen (1990) studied 57 cardiovascular surgery patients with 1 of 11 DRGs. Differences in LOS, acuity levels, and quality of nursing care were examined for one year before and after the implementation of DRGs. Quality nursing care was defined based upon the formulation of the nursing care plan, attendance to the patient's

physical and nonphysical needs, and accomplishment of the nursing care objectives.

The study revealed some expected and some unexpected findings. A drop in LOS and quality and an increase in acuity levels was expected. The LOS was found to decrease from 14.7 days before DRGs to 12.5 days after DRGs. The acuity level, however, dropped unexpectedly from 1.41 to 1.37. The researchers recommended another study be conducted with different DRGs to determine if acuity levels would still decrease. An unexpected increase in quality care was found. Van Hoesen and Eriksen attributed this to organizational factors such as inservice programs and the development of standards of care.

As studies were performed in 1987 one thesis built upon a previous study (Runner, 1989). Acuity systems were repeated in several studies. In general, though, the independence in nursing research studies continued.

Studies Conducted in 1988

An unpublished study by Mitchell and Bostrom-Ezrati (1988) collected information on nursing care hours, nursing costs, and patient's severity of illness. A sample of 1,501 patients reflecting 11 DRGs over an 18 month period was monitored, although data were provided on 1,523 patients. A PCS developed at the hospital was used to determine nursing care hours and costs. Patient severity was calculated with Horn's Severity of Illness Index.

Mitchell and Bostrom-Ezrati determined that within DRGs there was a wide range of nursing care hours and direct nursing costs. When the levels of severity were included several DRGs became more homogeneous. This supported the idea that DRGs were not homogeneous in terms of nursing resources.

The values provided in this study on direct nursing costs by DRG were found to be tenfold higher than any other primary study's findings. During a phone conversation with one of the investigators, a decision was reached that the values were probably incorrect. Therefore, for purposes of this meta-analysis, the direct nursing cost values were omitted.

Studies Conducted in 1989

The costs of direct nursing care were studied by Kyle and Kinder (1990) at a Veterans Administration Medical Center. Thirty-seven patients with two specific DRGs were monitored on three separate units. Age, LOS, nursing care hours, and costs by acuity level were reported. An acuity based PCS was used to identify nursing care hours.

Graphs were used to report most of the findings so specific values by DRG were not obtainable. Nursing care hours per patient per day were stated to be 1.25 hours. The overall LOS ranged from 2 to 59 days with an average of 23.8. Kyle and Kinder concluded that nursing was the most unpredictable portion of DRGs and that nurse administrators

needed to be able to clearly define nursing costs. The research revealed it was possible to identify the relationship between DRGs and nursing care costs.

An extensive search of the nursing literature and Dissertations Abstracts did not reveal any additional studies conducted during 1989 and 1990. Some articles that discussed various reasons or benefits for costing out nursing services were located, but not any additional studies.

Summary of the Literature Review

Very few studies used the same PCS methodology although some, such as Medicus, RIM, and AS-SCORE, were repeated. Most hospitals customized or redesigned a PCS making cost comparisons more difficult. Many articles did not report the reliability or validity testing conducted on the acuity system. Wide variations were found between the acuity systems in terms of nursing care costs (Wilson et al., 1988). This implied that the individual acuity instruments did not consistently measure the same nursing items in a similar fashion.

Many studies did not define what activities were included in direct and indirect nursing care or costs while some authors provided a variety of definitions for each. Schaefers (1985) included salaries, overtime, benefits, orientation, education, and retirement in direct care costs. Mitchell et al. (1984) used only wages and benefits of

direct care givers to determine direct costs, but did not mention which employees were included as direct care givers. In some articles the nursing staff was comprised of all RNs (Dahlen & Gregor, 1985) or the cost information was calculated according to only RN data (Grohar et al., 1986).

Radically different sample sizes were found in the research studies. McClain and Selhat (1984) examined only 20 patients. Others such as Grohar et al. (1986) and Lagona and Stritzel (1984) used samples as small as 35. At the opposite end of the spectrum samples sizes as large as 70,000 or 80,000 subjects were reported (Marquess & Petit, 1987; McCormick, 1986; Petit, Kavois, & Glandon, 1988). Ethridge (1985) examined 58,272 patient days, but did not mention how many separate patients this comprised. If the studies were weighted for meta-analysis the ones with larger sample sizes would have substantially more influence on the findings.

Other differences between the studies included an assortment of DRGs and varying numbers of facilities. Kreitzer et al. (1984) studied 73 DRGs at one institution while Sherman (1986) compared only one DRG at 13 hospitals. Most studies collected data from one facility. Yet, some authors did use multiple settings such as Joel (1984) who studied eight hospitals, Rieder and Kay (1985) who examined five, and Trofino (1988) who worked with six facilities.

These inconsistencies reflect the viable, changing environment surrounding the concept of costing out nursing services. While hospitals continue to independently develop acuity tools, the ability to make comparisons between facilities becomes increasingly more difficult. When a PCS had been found reliable and valid at one institution, that nursing department could use the results to justify their portion of the hospital's DRG reimbursement.

The diminished number of studies in 1989 and 1990 reflected a disquieting concern. This researcher was not certain if the deficit was from nursing departments abandoning the idea of costing out or from a lack of reporting in publications. It is hoped that this meta-analytic study will provide some clarification about whether costing out nursing services should be pursued.

Identification of Research Variables

Attempting to compare findings from studies utilizing different PCSs and different definitions of nursing costs was what Glass, McGaw and Smith (1981) called comparing apples and oranges. Meta-analysis lends itself to such integrative reviews. The researcher must identify the relevant studies that address the necessary variables and remove the incomplete and irrelevant studies.

Before relevant studies can be identified a complete database of information presented in each reviewed study must be compiled. Information about the study variables and

findings has been assembled and can be seen on Table B-1 in Appendix B.

For this meta-analysis the necessary variables were identified as LOS, direct and total nursing costs, hours of direct nursing care, hospital costs, and DRG reimbursement. Studies reporting these elements were included in the meta-analysis unless major limitations or flaws were found in the study critique. If a study included only direct or total nursing costs but not both, it was still included and analyzed accordingly. The various studies related to the specific research questions used for the meta-analysis are identified in Chapter Three.

Summary

To decide which variables are available for a meta-analytic review, a complete summary of the literature must be conducted. This chapter outlined the research studies that either directly or indirectly addressed the concept of costing out nursing services.

A few studies, such as Caterinicchio (1984) and McKibbin, Brimmer, Clinton, Galliher, and Hartley (1985), advocated that the DRG allotment to hospitals adequately reflected nursing costs. These studies concluded there was no need for nursing to specifically identify costs. A majority of the primary studies suggested that the wide variation of nursing care needs and costs within the DRG framework demanded a more explicit identification of nursing

costs (Grohar et al., 1986; Lagona & Stritzel, 1984; Mitchell et al., 1984; Mowry & Korpman, 1985; Reschak et al., 1988; Sanders, 1985; Wolf & Lesic, 1986).

This meta-analytic study statistically examined nursing costs between studies. Primary research studies providing information about the variables were analyzed from a common metric to identify relationships between the variables. In the next chapter the specific studies addressing each research question will be identified.

CHAPTER 3

METHODOLOGY

In this chapter a description of meta-analytic techniques applicable to this research study is presented. How studies were located and which factors were included in the meta-analysis are discussed. Finally the specific statistical methods used for each research question are explained.

Meta-Analysis as it Pertains to this Study

The various studies comprising the database for this research utilized different methodologies to identify nursing costs. To make comparisons between the studies meta-analytic techniques were required. The characteristics needed for meta-analysis as identified by Curlette and Cannella (1985) and Glass et al. (1981) were noted in this study. The studies were independent and were not prejudged for quality. The results of each individual study were quantitatively examined and the findings were generalized. In addition the meta-analytic process was described so the study could be reproduced.

The mathematical techniques used in meta-analysis are partially determined by the type of studies that are to be integrated. The study format and the data provided dictate, to some extent, the statistical methods that can be used to

manipulate the findings. With this group of studies the findings for each variable were usually reported in terms of means or averages.

For this descriptive meta-analytic study one objective was to describe the current information available on costing out nursing services. This was done in Chapter Two. Results of studies addressing the concept of costing out nursing services were then synthesized to identify what benefits are available when costing out nursing. The idea of integrating the concept into nursing practice and incorporating it into nursing research was explored.

Location of Studies

One critique of meta-analytic research involved the potential bias that could result when locating studies (Glass et al., 1981). If an extensive search was not conducted, a bias could occur based upon which studies were found and, therefore, included in the research. For this reason it was necessary to locate as many published and unpublished studies as possible. Several techniques were used to eliminate potential bias from the literature search.

Combinations of computer explorations and hand searches were done from 1976 through 1990 in the Cumulative Index of Nursing and Allied Health Literature (CINAHL). Key words that were investigated included acuity of care, case mix, costs and cost analysis, diagnostic related groupings (DRGs), nursing costs, patient acuity, and patient

classification systems (PCS). Computer searches through 1990 were also done in Dissertations Abstracts. Key words utilized for these searches were costing out, nursing and costs, nursing care, nursing service, charges, and price.

Bibliography and reference lists from located articles and primary studies were also pursued. In addition, informal networking among fellow nursing students and community contacts occurred. The U.S. Department of Health and Human Services published a list of hospitals involved with costing out nursing services (Lampe, 1987). Contacts were made with these facilities in an attempt to locate any additional studies.

A total of 63 studies and 10 dissertations were located. Three studies were unpublished. The location sources can be identified from Table B-2, page 154, in Appendix B.

McCain, Smith, and Abraham (1986) noted that in meta-analysis, information from each primary study must be carefully coded. Each located study for this analysis was coded by author, publication data, how the study was located, funding sources, monitored variables, study quality, findings, and conclusions. Other elements that were felt to be relevant were also recorded. These included the type of PCS used, the specific DRGs studied, the size of the hospital, the type of hospital unit, and the education and employment backgrounds of the authors. These elements

provided information that further described the primary studies.

Identification of Studies for Meta-Analysis

After carefully coding the located studies, identification of the specific variables for analysis in this research study was determined. It was noted during the coding process that most studies provided information on the patient's length of stay (LOS), nursing care costs per stay, and hours of nursing care per stay. The amounts of the hospital's DRG reimbursements and the hospital costs were also found in several studies. Some studies stated that the variables of age and sex had been monitored, although analysis of the primary study findings established that not all examined variables were included in the published results.

The quality of the located studies was critiqued in Chapter Two. Some problems were found that prevented various studies from being included in the meta-analysis. For example, nursing costs identified as direct or total nursing costs were usable. But studies that defined nursing costs as incorporated in the room rate could not be included.

One study provided direct nursing cost information that was tenfold greater than any other report. During a phone conversation with one of the authors, it was agreed that the

data should be omitted from this meta-analysis as it was probably inaccurate.

Studies that used graphs to report their findings posed another limiting factor. If numerical data was not presented in the narrative, the graphs were not accurate enough to obtain values. In addition some studies reported different information such as grouping results by unit, acuity level, or time allotment.

To provide as large a database as possible for the meta-analysis, studies including the relevant variables for each research question were included. Though a study may not have provided information on all the examined DRGs, the reported data was used when possible. Since each research question addressed different variables, the studies that were available for each question varied.

The first eight research questions treated the results of each study as only one finding. Here studies that did not identify specific DRGs but utilized the relevant variables were included. In the first question, total nursing costs and LOS were examined. The eleven usable studies are reported on Table C-1.

For the second research question, 17 studies addressed direct nursing costs and LOS. Some primary studies examined direct and total nursing costs so were incorporated in the database for multiple questions. The list of applicable studies are on Table C-2 in Appendix C.

The variables of total nursing costs and hours of direct nursing care were examined in the third research question. The twelve studies containing the relevant variables are on Table C-3.

When hours of direct care were compared to direct nursing costs 12 studies were found. The specific usable studies are reported on Table C-4.

When nursing costs were compared to hospital costs or DRG reimbursements fewer studies were applicable. The fifth question identified the relationship between total nursing costs and hospital costs. Only five studies were located and they are noted on Table C-5.

For the sixth question, eight studies provided data to compare direct nursing costs to hospital costs. A list of the studies can be found on Table C-6 in Appendix C.

The seventh question dealt with the relationship between total nursing costs and the hospital's DRG reimbursement. The six studies that included this information are reported on Table C-7.

The last question in this group examined direct nursing costs and the hospital's DRG reimbursement. The five specific studies located here can be found on Table C-8.

The next set of research questions addressed the linear relationships between the same variables as questions one through eight, but dealt with specific DRGs. The focus of these questions was to determine any consistencies for

frequently studied DRGs. Calculations for the meta-analysis were done on any DRG listed at least three times among the various primary studies.

The database of primary studies for each of the second eight research questions varied from the first eight only by the exclusion of Trace (1988) and Williams (1984). These two studies did not identify their findings by specific DRGs. Identification of the usable studies for specific DRGs is reported in Chapter Four.

Some research studies incorporated data about nursing costs, hospital costs, and DRG reimbursement rates for specific DRGs as percentages instead of as values for each variable. To provide as much information as possible about the group of primary studies, four questions were included in this meta-analysis that addressed these percentages. The individual studies reporting percentages for specific DRGs are reported in Chapter Four.

Though the same variables were examined, the number of primary studies comprising the database varied. The number of applicable studies for the individual research questions ranged from five to seventeen studies. To provide as large a database as possible for the statistical analyses, all relevant studies for each question were included.

Methods of Analysis

The research questions for this study critically examined the cost of nursing care services. Meta-analysis

required that study findings be converted into a common metric to compare results between independent studies (Hunter & Schmidt, 1990). For these research questions two different calculations were computed.

For the first set of eight questions the results of each study was dealt with as advocated by Glass et al. (1981) and Mullen (1989). The findings from each study were combined to create one value per variable per study. Each variable was then correlated to another variable. The linear relationships between the respective variables were then computed using Pearson r correlations.

The second group of research questions focused on specific DRGs. With this group of questions many primary studies provided information on more than one DRG. The DRGs from various studies were then combined to determine one value per variable per DRG. The linear relationship between two variables was then calculated by applying Pearson r correlations.

With the last four research questions, percentages provided for the variables on specific DRGs were analyzed. For DRGs monitored at least twice, all percentages were averaged together giving a mean percent value for the ratio between the two relevant variables. The range of the percents was also reported. The results from these analyses were then discussed to identify any generalizable findings.

Summary

Meta-analytic technique is a quantitative methodology that allows for comparisons between research studies. Descriptive meta-analysis provides a basis to identify gaps in the current knowledge base, develop theory, and contribute to nursing practice. It also contributes to the identification of areas needed for future research studies. The concept of costing out nursing services was examined in this study to determine the benefits costing out services provides for nursing practice.

Using meta-analytic procedures, this research study identified the linear relationships between LOS, nursing care hours, nursing costs, hospital costs, and DRG reimbursements. Studies were treated as a group and by frequently reported DRGs. Pearson r correlations and mean percents were calculated. Findings from the statistical analyses of the various research questions are reported in Chapter Four.

CHAPTER 4

FINDINGS AND DISCUSSION

A description of the findings for the research questions and a discussion of these findings are presented in this chapter. Depending upon the question, Pearson *r* correlations and percentages were calculated utilizing SPSS/PC version 4.0. When specific diagnostic related groupings (DRGs) are identified, only an abbreviated name is given. The complete DRG titles are provided in the appropriate tables.

Findings from Research Questions 1-8

The first eight questions dealt with each primary study as one finding. The values for each variable within a study were averaged together to provide one value per variable per study. The variables of length of stay (LOS), total and direct nursing costs, direct nursing hours, hospital costs, and DRG reimbursements were then correlated.

To determine the strength of a linear relationship between two variables, Munro, Visintainer, and Page (1986) identified the following categories for Pearson *r* correlations:

0.00 - 0.25	little, if any
0.26 - 0.49	low
0.50 - 0.69	moderate

0.70 - 0.89 high

0.90 - 1.00 very high.

The number of studies applicable to these eight questions ranged from 5 to 17. Due to such small sample sizes this research did not utilize random sampling. Instead all relevant studies were applied. Significance levels were two-tailed. Table 1 identifies Pearson r correlations and significance levels for the first eight questions.

Between the variables of LOS and total nursing costs, a moderately strong linear relationship was noted ($r = .65$, $p \leq .05$). Direct nursing costs were found to have a stronger correlation to LOS ($r = .83$, $p \leq .001$). One explanation for direct costs having a stronger relationship could be the difference in sample sizes. The first question, dealing with total nursing costs, had 11 usable studies while the one addressing direct nursing costs used 17 primary studies. This is a 54.5% increase in sample size.

Examination of the specific studies available for these two questions revealed a recurrent use of the Medicus PCS to identify nursing costs. Three studies measuring total nursing costs and LOS were found in the database for the first research question. A correlation was done on these three studies to determine if using the same PCS would affect r. Total nursing costs were found to be very highly

Table 1

Pearson r Correlations for Research Questions 1-8

	TNCOST	DNCOST	DHOURS	HOSPCO	DRGREIM
LOS	.65* (11)	.83*** (17)	.84*** (20)	.95*** (10)	.52 (9)
TNCOST		.88* (6)	.85*** (12)	.99*** (5)	.71 (6)
DNCOST			.94*** (12)	.95*** (8)	.45 (5)
DHOURS				.97*** (7)	.45 (8)
HOSPCO					-.12 (3)

Note. Sample sizes are given in parentheses. LOS = length of stay; TNCOST = total nursing costs; DNCOST = direct nursing costs; DHOURS = direct nursing care hours; HOSPCO = hospital costs; DRGREIM = DRG reimbursements. Two-tailed p values. $^{*}p \leq .05$; $^{**}p \leq .01$; $^{***}p \leq .001$.

correlated to LOS among the three Medicus studies (r = .98, p = .136). This correlation for the Medicus studies was a stronger linear relationship than was noted with the entire database (r = .65).

For the second question, direct nursing costs to LOS, four studies were found using the Medicus system. The correlation conducted on these studies, however, was not as high as the r value reported for the entire group. The entire group had an r = .83 while the Medicus studies revealed only an r = .75 (p = .252). The group of Medicus studies appeared to be more consistent in the definitions of total nursing costs than direct nursing costs. Variations in the definition of direct nursing care affected which employees and which items were included in direct care costs. These inconsistent definitions of direct nursing care hours appear to have a significant affect on the values found for direct and total nursing costs.

For the third and fourth research questions, results were calculated from 12 studies, although different primary studies were utilized for each database. Total nursing costs and hours of direct nursing care were found to be highly correlated (r = .85, $p \leq .001$). Direct nursing costs and hours of direct nursing care, the fourth question, were very highly correlated (r = .94, $p \leq .001$).

Within the database used for the third question three Medicus studies were located. A correlation based upon

these three was performed and a stronger linear relationship was noted, r = .92 (p = .255), than the r = .85 revealed for the entire group. No additional repetition of any PCS methodology was found in the database for any of the other questions.

In the fifth and sixth questions the variables of nursing costs and hospital costs established very high linear correlations. With only a sample size of five, the correlation for total nursing costs to hospital costs was r = .99 ($p \leq .001$). For direct nursing costs and hospital costs, an r = .95 ($p \leq .001$) was found using eight studies.

The seventh and eighth questions dealt with DRG reimbursements and nursing costs. Six primary studies comprised the database for the seventh question while five were applicable to the eighth research question. Results of the Pearson r correlations found the relationships to be statistically nonsignificant, meaning the correlations could have occurred by chance.

Discussion of Research Questions 1-8

For six of the first eight research questions, a statistically significant positive linear relationship greater than r = .70 was found between nursing costs and a second variable. Total nursing costs were found to have a stronger correlation than direct nursing costs when related to the variable of hospital costs. The relationships of direct nursing costs to LOS and to direct hours were found

to be higher than when total nursing costs were compared to LOS or direct hours. When LOS was used as one of the variables, the correlation coefficients for total and direct nursing costs were very diverse.

As the sample sizes decreased to six or less, the level of significance usually increased. Munro et al. (1986) stated that the level of significance is greatly affected by the size of the sample. The correlations between nursing costs and DRG reimbursements and the three done with only the Medicus studies revealed p levels ranging from .116 to .451. Small sample sizes are one possible explanation for the nonsignificant findings.

Another potential reason for some of the elevated p levels could be how the DRG reimbursement rates are determined. Reimbursements are determined from a medical orientation, not from the amount of nursing care required (Levine & Abdellah, 1984; Piper, 1983). Therefore, correlations between nursing costs and DRG reimbursements should not be expected to be strong.

Two factors greatly affected the correlational coefficients for these eight questions. The practice of developing individual PCSs at each hospital to determine nursing costs and nursing hours results in a lack of precision concerning how costs and hours are identified. In addition, when different definitions exist concerning which

care givers are included in direct nursing hours, the total and direct costs for these nursing services will vary.

Findings from Research Questions #9-16

The second group of research questions focused on DRGs, within the primary studies, that were reported at least three times. Total and direct nursing costs were again correlated to LOS, direct nursing care hours, hospital costs and DRG reimbursements. The majority of the correlations were found to be nonsignificant. Only 8 of the 54 reportable DRGs were statistically significant. For research questions 9 through 16, Table 2 identifies the Pearson r correlations for the statistically significant DRGs.

The variables of total nursing costs and LOS, in the ninth research question, reported an $r = .89$ ($p \leq .05$) for DRG 182, esophagitis and other digestive disorders. It was located five times.

Two DRGs were statistically significant for the tenth question, dealing with direct nursing costs and LOS. Circulatory disorders with acute myocardial infarct (AMI) without complications, DRG 122, reflected a high correlation of $r = .79$ ($p \leq .05$). DRG 25, seizures, found a perfect correlation of $r = 1.00$ ($p \leq .001$).

The eleventh research question, correlating total nursing costs to direct hours of nursing care, also reported two statistically significant findings. DRG 140, angina,

Table 2

Statistically Significant Pearson r Correlations for Research Questions 9-16

Variables	DRG	Correlations
Total Nursing Costs and LOS (Question #9)	182 (5)	$r = .89^{*}$
Direct Nursing Costs and LOS (Question #10)	25 (3)	$r = 1.00^{***}$
	122 (7)	$r = .79^{*}$
Total Nursing Costs and Direct Nursing Hours (Question #11)	14 (7)	$r = .88^{**}$
	140 (9)	$r = .92^{***}$
Direct Nursing Costs and Direct Nursing Hours (Question #12)	122 (6)	$r = .84^{*}$
	127 (6)	$r = .89^{*}$
	140 (3)	$r = 1.00^{*}$

Note. Sample sizes are in parentheses. DRG 14 = specific cerebrovascular disorders except transient ischemic attacks; DRG 25 = seizure and headache, age 18-69 without complications; DRG 122 = circulatory disorders with acute myocardial infarct without cardiovascular complications, discharged alive; DRG 127 = heart failure and shock; DRG 140 = angina pectoris; DRG 182 = esophagitis, gastroenteritis and miscellaneous digestive disorders, age > 69 with complications. Two-tailed p values. $^{*}p \leq .05$; $^{**}p \leq .01$; $^{***}p \leq .001$.

was followed in nine studies with an $\underline{r}$ = .92 ($\underline{p} \leq .001$). For DRG 14, cerebrovascular disorders, an $\underline{r}$ = .88 ($\underline{p} \leq .01$) was found in the seven studies monitoring the specific variables.

Three statistically significant DRGs were located for the twelfth question, direct nursing costs to nursing care hours. Each was significant at $\underline{p} \leq .05$. Angina, DRG 140, was noted to have an $\underline{r}$ = .9998, or 1.00 when rounded to two places. DRG 127, heart failure, was located six times and reflected an $\underline{r}$ = .89. Circulatory disorders with AMI without complications, DRG 122, reported an $\underline{r}$ = .84.

Although the majority of the correlations for the research questions 9-16 were found to be nonsignificant, some interesting findings were located. For the remainder of this chapter, tables that are discussed can be located in the Appendix D.

For the ninth research question, total nursing costs to LOS, eight DRGs were monitored between three and six times. Table D-1 provides information on these correlations. The level of significance for these DRGs ranged from $\underline{p}$ = .044 to $\underline{p}$ = .681. One DRG monitored four times, DRG 39, lens procedures, provided an $\underline{r}$ = -.34. This negative correlation requires additional research.

The tenth research question addressed direct nursing costs and LOS for specific DRGs. Fifteen DRGs reported between three and seven times are reported on Table D-2,

page 169. The level of significance ranged from $p = .000$ to $p = .932$.

Between the ninth and the tenth research questions three DRGs changed signs, although negative relationships were not consistently recorded for either total or direct nursing costs. DRG 39, lens procedures, was negative for total costs in the ninth question ($r = -.39$), but positive for direct costs in the tenth question ($r = .58$). Angina, DRG 140, reported an $r = .50$ with the variable of total nursing costs but an $r = -.86$ in the tenth research question, dealing with direct costs.

The third DRG to change signs between research questions nine and ten was DRG 127, heart failure. It reflected an $r = -.47$ for direct costs in the tenth question but a stronger positive correlation for total costs in the ninth question ($r = .63$). DRG 127 was reported seven times for the ninth question and six times for the tenth. When the results of direct costs and LOS for DRG 127 were plotted on a scattergram, a negative slope was revealed but the findings were very scattered. This implied that perhaps a linear relationship was not the best fit and other curves should be considered in future research.

Two other DRGs reported negative correlations for the tenth question, direct nursing costs and LOS. Hysterectomy, DRG 355, reflected a low negative correlation of $r = -.41$. Major joint procedures, DRG 209, revealed an $r = -.75$.

These, like the other negative correlations, require more research studies to get a better understanding of the findings.

The linear relationships between total nursing costs and direct hours of nursing care were reported in the eleventh research question. Table D-3, page 175 in Appendix D, provides the findings. DRG frequencies were reported between three and nine times with significance levels ranging from $p \leq .001$ to $p = .888$. One negative correlation was found in DRG 39, lens procedures ($r = -.79$), which was reported three times.

For the twelfth research question the relationships for specific DRGs were examined for the variables of direct nursing costs and direct hours of nursing care. Table D-4 gives the data of the nine located DRGs. Three provided significant levels of $p \leq .05$, while the others ranged from $p = .071$ to $p = .440$. No negative correlations were revealed.

The thirteenth and fourteenth research questions addressed the relationships between nursing costs and hospital costs for specific DRGs. Total nursing costs and hospital costs, measured in question #13, are reported on Table D-5, page 183. For each of the three DRGs reported, the level of significance ranged from $p = .528$ to $p = .968$. One negative linear relationship ($r = -.68$) was noted for DRG #182, esophagitis and other digestive disorders. This

negative report indicates the need for further examination requiring additional costing out studies. Even if hospital costs increase over time, a reduction in nursing costs might occasionally happen, but more data is required to validate this finding.

Direct nursing costs and hospital costs were compared in the fourteenth question. Only three DRGs were found and the level of significance ranged from $p = .159$ to $p = .256$. Refer to Table D-6 in Appendix D for the specific findings.

The correlations between total nursing costs and DRG reimbursements were monitored in the fifteenth research question. The levels of significance for these DRGs varied extensively, from $p = .095$ to $p = .931$. Table D-7, page 187, provides the information about the six specific DRGs. No negative correlations were reported.

The final question in this group examined direct nursing costs and hospital DRG reimbursements. The sample size was small, only three, with the level of significance ranging from $p = .356$ to $p = .765$. The results for this sixteenth question are located on Table D-8.

Discussion of Research Questions #9-16

The findings for these eight questions as a whole were not strong or conclusive. Several DRGs changed their sign when correlations were performed between total and direct nursing costs, even though the second variable was consistent. Total nursing costs were found to provide

stronger relationships for some DRGs while direct costs reflected stronger correlations in others.

Several explanations might provide some insight into the negative relationships between nursing costs and a second variable. During the eleven years when the primary studies were conducted, several changes occurred in the American health care system that have affected the cost of nursing services. Due to advances in medical technology many surgical operations, such as DRG 39 (lens procedures), are frequently done as outpatient procedures. Diagnostic work-ups and a variety of scopes relevant to DRG 182, esophagitis and other digestive disorders, can also be performed on an outpatient basis. More advanced surgical techniques have also affected the LOS for some gynecological operations included in DRG 355, hysterectomy. As a patient's LOS decreases, nursing costs can be expected to drop.

When examining the study findings, however, it is important to remember that for the DRGs reflecting negative correlations, there was no consistency. At times direct costs were negative and other times total costs were negative. No DRG reported both total and direct costs to be negative when the second variable remained constant. Since the majority of the linear relationships were positive, more information is required to identify reliable results from these negative correlations.

Sample sizes were very small. The majority of the DRGs were monitored only three times. Such small sample sizes may indicate a tendency for a given correlation but cannot be considered solid evidence. Additional research studies delineating nursing costs for specific DRGs are required to strengthen the results.

The levels of significance were found to be as widely varied as the correlation coefficients. Only eight specific DRGs reported significant levels at $p \leq .05$. The others ranged from $p = .065$ to $p = .968$. The small sample sizes strongly affected the levels of significance.

Some interesting findings are apparent when the first eight research questions are compared to the second eight questions. When hospital costs were correlated to nursing costs in the first eight questions, very strong significant correlations were found. Yet when Questions #13 and #14 were examined, comparing nursing costs and hospital costs for specific DRGs, not one DRG was found to be statistically significant. Few DRGs were reported at least three times creating very small sample sizes and a limited number of DRGs to inspect.

For the research questions addressing nursing costs and DRG reimbursements no statistical significance was found either when the studies were treated as a single finding or when individual DRGs were monitored. Since DRG reimbursement rates were not established with nursing care

as a primary consideration, this lack of significance in the correlations is not unexpected.

Findings and Discussion for Research Question #17

Some primary studies provided the percentages of nursing costs to hospital costs and to hospital DRG reimbursements. To obtain as much information as possible from the database, four research questions focused on the given percentages. The seventeenth question addressed the percent of total nursing costs to hospital costs for specific DRGs. Twenty-two DRGs were reported between two and five times. The means and ranges for these DRGs were calculated and are provided in Appendix D on Table D-9, page 191.

Heart failure, DRG 127, was located five times. The studies revealed that on the average, total nursing costs accounted for 23.66% of hospital costs. The ranges of the study findings were from 18% to 31.72%. The mean percents were similar but slightly smaller for the six DRGs listed four times.

Total costs for DRG 15, transient ischemic attacks (TIA), averaged 18.08% of hospital costs. For pneumonia, DRG 89, the average was 23.16% with a range of 15% to 31.3%. A mean of 20.11% was recorded by DRG 138, cardiac arrhythmia. The widest range for the DRGs monitored four times was a 20.49 point spread noted on DRG 140, angina, which had a mean of 20.65%. Esophagitis and other digestive

disorders, DRG 182, presented total nursing costs to be an average of 20.2% of hospital costs. For DRG 243, medical back problems, a mean of 21.03% was found.

Three DRGs were reported three times. Cerebrovascular disorders, DRG 14, reported a higher average of total nursing costs to hospital costs, 30.58%, than the DRGs monitored four times. The width of the range for DRG 14 was very wide, 21.65 points. A range from 15% to 22.5% was found for bronchitis, DRG 96, with a mean of 18.16%. For DRG 174, GI hemorrhage, also reported three times, an average of 25.58% was provided.

Total nursing costs were compared to hospital costs in two research studies for twelve different DRGs. For DRG 5, extracranial procedures, a range of total costs to hospital costs of 9.5% to 20.17% and a mean of 14.84% was presented. A smaller average, 11.25%, was found for DRG 39, lens procedures. Respiratory neoplasms, DRG 82, reported a mean of 27.53% and a range from 20% to 35.06%. The narrowest range of the DRGs reported twice was noted for DRG 88, COPD, at only 1.16 points. Total costs for DRG 88 were noted to be an average of 20.73% of hospital costs.

Six DRGs reported range widths between 6.25 points and 1.70 points. A mean of 25.13% and a range from 22.9% to 27.35% was found for DRG 122, circulatory disorders with AMI without complications. With DRG 125, circulatory disorders except AMI, an average of 16.87% for total nursing costs to

hospital costs was given. Peripheral vascular disorders, DRG 130, reported a mean of 28.8% and a range of only 1.79 point spread. Chest pain, DRG 143, noted an average of 22.57% with a 3.13 range width. For DRG 148, small and large bowel procedures, an average of 17% of total nursing costs to hospital costs was revealed. Diabetes, DRG 294, with a range from 18.73% to 23.4%, found a mean of 21.07%.

The last two DRGs for this research question revealed larger means and wide ranges. Nutritional disorders, DRG 296, noted an average of 32.13% with a 22.26 point spread. Kidney and urinary infections, DRG 320, reported a range of total costs to hospital costs of 22% to 34.2% with an average of 28.1%.

For the seventeenth research question, total nursing costs were between 11.25% and 32.13% of hospital costs. For the 22 DRGs reported, the average of total costs to hospital costs was 22.15%. DRGs with a more narrow range provided more consistency in the study findings.

Findings and Discussion for Research Question #18

The percentages of direct nursing costs to hospital costs were examined in the eighteenth question. One DRG was recorded three times and six were noted twice. The findings are presented on Table D-10, page xxx.

Major joint procedures, DRG 209, revealed a very low percent, 7.1%, of direct costs to hospital costs. The range

for the three studies utilized went from 6.3% to 8%. For the DRGs monitored twice, the mean percents were higher.

Cerebrovascular disorders, DRG 14, reported an average of 13.5% with a range width of 3.0. DRG 25, seizures, found 24.94% for the mean. For COPD, DRG 88, on the average, direct nursing costs were noted to be 16.95% of hospital costs. A similar mean, 15.35%, was presented for DRG 122, circulatory disorders with AMI without complications. Heart failure, DRG 127, revealed an average of 12.55% and a range from 9.1% to 16%. The final DRG for this question, DRG 355, hysterectomy, reported direct costs as 19.38% of hospital costs.

In general, the average percent of direct costs to hospital costs was 15.68%. This was 6.47% lower than the average of total nursing costs to hospital costs found in the seventeenth question. It is logical to expect direct nursing costs to be lower than total nursing costs since total costs include direct and indirect costs.

Findings and Discussion for Research Question #19

When the percent of total nursing costs to hospital DRG reimbursements were examined, only three DRGs were found, each reported three times. Results are reported in Appendix D on Table D-11, page 200.

The ranges for these three DRGs were fairly small. The widest range for this question was noted on DRG 127, heart failure. A 3.99 point spread was found with an average of

17.8%. Lens procedures, DRG 39, revealed a mean of 7.6% with a range from 7.3% to 7.9%. An average of 13.4% of total nursing costs to DRG reimbursements was revealed for DRG 89, pneumonia. It also presented the smallest range with a width of only 0.4.

Overall total nursing costs accounted for 12.93% of the hospital DRG reimbursements. The ranges measured from a point spread of 0.4 to 3.99 points. On the average the percent of total nursing costs to DRG reimbursement rates was about 10% less than the average percent of total nursing costs to hospital costs found in Question #17.

Before a nursing department accepts only 12.93% of the DRG reimbursement rate, it must be careful to identify its fair share since the preset reimbursements are not based upon nursing care. All hospital costs are not automatically reimbursed within the preset DRG rates and if nursing requires 22.15% of the hospital costs to meet expenses, specific costing information for nursing is required. More costing out studies are required to identify the accuracy of this information.

Findings and Discussion for Research Question #20

The final question for this meta-analysis dealt with the percent of direct nursing costs to DRG reimbursements. Only one DRG was found that was reported more than once in the various primary studies. Results are given in Appendix D on Table D-12.

DRG 121, circulatory disorders with AMI with complications, was located twice revealing a mean of 38.99%. The range, 17.5% to 60.48%, was the widest point spread reported on any question. This extreme distribution, with only two data points, does not provide enough information to accurately describe expected percentages of direct nursing costs to reimbursement rates.

The 38.99% reported here is more than double the percent of direct nursing costs to hospital costs revealed in the eighteenth research question. An average of only 15.68% was reported there. More research studies addressing these variables are needed to obtain more complete results.

Summary of the Results

The findings for this study were mixed. Although a total of 73 studies were examined, many did not contain the relevant variables. When each study was treated as a single finding the correlation coefficients were positive. Six of the first eight questions revealed relationships that were statistically significant, at least $p \leq 05$.

Total and direct nursing costs in the first eight questions presented the strongest correlations with hospital costs. Total costs correlated .99 and direct costs compared .95 to hospital costs. The relationships between nursing costs and direct nursing hours were also fairly strong. Direct costs revealed a stronger relationship, $r = .94$, than total costs, $r = .84$, to direct nursing hours. These strong

findings show how closely related nursing costs are to hospital costs and direct nursing hours.

Although LOS did not correlate as strongly with nursing costs as hospital costs and direct hours, reasonably strong relationships were found. As noted with the variable direct nursing hours, the correlation for direct costs was higher, $\underline{r}$ = .83, than with total nursing costs, $\underline{r}$ = .65.

Most of the findings related to individual DRGs were not statistically significant. When the sample sizes were less than five, the reported levels of significance were frequently high. Some negative correlations were revealed, although the validity of these negative findings was difficult to assess due to the very small sample sizes.

Most of the DRGs used to answer the research questions were reported only two or three times. When determining linear relationships the sample must be greater than two, as two points automatically represent a straight line, or a perfect correlation. When examining specific DRGs, the small samples found in this study can only provide a suggestion concerning linear relationships between the variables.

The questions dealing with percentages for specific DRGs provided some general information. This study found total nursing cost to be an average of 22.15% of hospital costs. Direct nursing costs were noted to be only 15.68% of hospital costs.

Few studies provided information about the percent of nursing costs to DRG reimbursements. Total nursing costs were noted to account for 12.93% of DRG reimbursement rates. The single data point on the percent of direct costs to reimbursement rates was presented at 38.99%. Unlike the percentages found for nursing costs and hospital costs, direct costs were reported to be higher than total costs when compared to hospital DRG reimbursements.

Some conclusions can be drawn based upon findings from the first eight questions. When individual DRGs were examined the small sample sizes and the inconsistent results lend themselves more to implications from the findings than strong conclusions. All conclusions and implications for nursing practice will be presented in Chapter Five.

CHAPTER 5

CONCLUSIONS AND IMPLICATIONS

This chapter is divided into three sections. The first area addresses conclusions derived from the research findings. The second portion focuses on the implications this study has for nursing practice. The final section will discuss future research activities based upon the study findings.

Conclusions from the Research Findings

This meta-analytic study investigated primary research studies dealing with the concept of costing out nursing services. The 73 located studies had been conducted from 1979 through 1989. The relevant variables were identified as total and direct nursing costs, length of stay (LOS), direct nursing care hours, hospital costs, and diagnostic related grouping (DRG) reimbursement rates. Pearson *r* correlations were performed using each study as a single finding and on frequently monitored DRGs. Percentages were calculated for nursing costs, hospital costs, and DRG reimbursements.

Although Pearson *r* correlations are not based upon cause and effect, the strength of the relationship between two variables describes how one variable reacts when a second variable changes. Based upon findings from this

meta-analysis, nurse administrators can expect total and direct nursing costs to strongly correlate with nursing hours and hospital costs.

It has been well documented in the literature that hospital costs are rapidly increasing (Kalisch & Kalisch, 1986; McCarthy & Thorpe, 1986; Wagner, 1991; Woolsey, 1991). This research study showed that total and direct nursing costs are strongly correlated to hospital costs, so as hospital costs soar, nursing costs will increase. Nurse administrators must be able to identify and monitor nursing costs in order to control expenses and provide cost effective care.

Acuity levels have also increased over time (Joel, 1987; Schaefers, 1985). As acuity levels rise, more direct nursing care hours are required. The strong correlation between direct hours and total and direct nursing costs shown in this study means that increased acuity and expanded hours result in greater nursing costs. Nurses have no control over how sick patients are when they are admitted to a facility, but nursing must justify and control costs so it can maintain the financial support required to supply nursing care.

Even though nursing costs were not as strongly correlated to LOS, nurse administrators should monitor general LOS trends, since nursing costs were noted to increase with extended LOS. Staff nurses can have a major

impact on LOS by knowing a patient's recommended LOS and preparing a patient and the family to provide care at home (Toth, 1984). Being able to discharge patients earlier, whenever possible, saves the facility money that can be used to cover additional expenses, including nursing costs.

The primary studies provided less information on the relationships of nursing costs to DRG reimbursement rates. These variables were not found to correlate with any statistical significance. With reimbursement rates being preset, it is necessary for nursing to be aware that the rates are not determined from nursing's perspective. Medical diagnoses and procedures influence the current DRG reimbursement rates.

This meta-analytic study, in the second eight research questions, did not reveal vigorous results for relationships between the variables when specific DRGs were examined. The DRG that most frequently reported the relevant variables was DRG 127, heart failure, noted in each of the eight questions. Within the primary study database, the most frequently monitored DRG was #14, cerebrovascular disorders, although it was applicable in only four of the eight research questions.

The majority of correlations for the specific DRGs were not statistically significant, meaning the relationships could have occurred by chance. The eight relationships that reported statistical significance had high correlations even

though the variables used in the eight correlations were not the same. Since most correlations were not statistically significant, and the significant ones did not use the same variables, results from this group of research questions were inconclusive. Small sample sizes for the specific DRGs affected the validity of the findings for these eight questions.

It is valuable for a facility to know which DRGs result in higher nursing costs, longer LOS, and more extensive nursing hours. A hospital cannot refuse to admit a patient needing immediate medical attention but, being aware of the type of DRGs admitted and the corresponding expenses, can provide data about general expenses the hospital can expect to incur.

When the percents of nursing costs were calculated to hospital costs, overall, total nursing costs were found to be 22.15% of hospital costs and direct costs were reported as 15.68% of hospital costs. When the percent of nursing costs to hospital costs were examined by specific DRG, the small sample sizes created a concern in the validity of the results. The wide ranges reported for the various DRGs reflected the diverse definitions of direct and total nursing costs utilized by the primary studies.

If a hospital consistently admitted the same mix of DRGs, it would be easier to determine what portion of the budget nursing required. Nursing's percent would be

consistent. However, when the type of patient changes rapidly, it is important for nurse administrators to know if additional financial support is needed to provide nursing services. Therefore, it is crucial for a facility to know what portion of hospital costs nursing requires for the most commonly admitted DRGs.

The two questions addressing the percent of nursing costs to DRG reimbursements revealed only a minimum of data. More primary studies are needed to obtain more definitive results. The lack of nursing's input into the DRG reimbursement rates affects expected correlations between the variables. A sample, comprised of three DRGs from the primary studies, revealed total nursing costs accounted for 12.93% of the reimbursement rate. The percent of direct nursing costs to reimbursement rates was determined from a sample of one DRG, showing a mean of 38.99%. These percentages were very different from those found relating nursing costs to hospital costs.

Based upon this meta-analysis, nurse administrators should expect nursing costs to strongly correlate with nursing care hours and hospital costs. If the nursing staff can positively influence the patient's LOS, the correlations between nursing costs and LOS should become stronger. Knowledge about DRG reimbursements may be useful to a nurse administrator, however no strong correlation to nursing costs should be expected.

Implications for Nursing Practice

Several implications for nurse administrators, as they direct nursing practice, can be noted from this research study. Administrators must be aware of how changes in the health care field affect nursing. The continued need to identify what nursing is doing and what the delivery of nursing service costs must also be monitored. Finally administrators must determine what specific financial information should be available within nursing departments.

Hospital costs have risen for a variety of reasons, most of which have a direct impact on nursing costs. The advent of the computer and discoveries in the field of biomedical research have created a variety of changes within health care (Kalisch & Kalisch, 1986). The proliferation of intensive and coronary care units, hemodialysis, transplant surgeries, and chemotherapy are only a few examples of the extensive changes in technology. As technology has become more sophisticated, nurses must be better trained to provide the required nursing services. The need for more extensive training demands more educational funding and results in higher salaries for nurses.

In addition, medical costs have risen due to economic inflation, population growth, and increased longevity of life (McCarthy & Thorpe, 1986). During the 1990s technology is expected to increase, the workforce is expected to age, and the number of uninsured Americans is expected to rise

(Fields, Lilly, & Sutton-Bell, 1991). The cost of delivering nursing services can be expected to increase as technology continues to expand. As the general population ages and senior citizens live longer, more chronic illness will need to be treated. Nurses must continue expanding their roles to address geriatric nursing, home health care, and medical care for the indigent.

To justify the funding required to provide the various nursing services needed within the health care arena, nurse administrators cannot afford to treat nursing costs in a casual fashion. After 1987 a marked decrease occurred in the number of journal articles reporting studies on costing out nursing services. Nurse administrators could infer from this lack of research that costing out nursing services is not advantageous to nursing practice. However, with the emphasis in health care on cost control and cost awareness, nurse administrators must be extremely knowledgeable about expenses within their department. While the federal government, insurance companies, and the American public demand that medical costs be contained, medical institutions must know which costs are rising and why. Costs cannot be controlled if they cannot be identified.

The DRG reimbursement system has established limited resources for health care. To successfully compete for the available financial resources, nursing must be efficient, productive, and be able to identify the cost of delivering

nursing services (Johnson, 1989). In addition, nursing must be able to determine how their expenses relate to the priorities identified by the facility. Hospital administrators must be made aware of how providing cost effective nursing care allows the hospital to meet its objectives.

Identifying the cost of nursing services can benefit hospitals, nurses, and patients in the competitive health care environment of today. As hospitals are better able to identify their specific costs, including nursing, more accurate pricing information becomes available to determine realistic discounts that can be offered in health care contracts (Mitchell, 1987). A hospital can also market and advertise the methods it is implementing to provide the public with cost effective medical care (Engelhart, 1987).

In addition, if a facility wishes to change their patient mix, for example by increasing the number of telemetry beds, accurate cost benefit analysis must be conducted. The cost of providing nursing care on a specialty unit must be clearly identified to determine if such a change is cost effective for the hospital. To proceed with major changes that affect the type of DRGs a hospital treats without careful financial considerations is not sound financial business practice.

Nurses benefit from identifying the cost of their services in several ways. An increase in professional

accountability results when nursing identifies its costs (Johnson, 1989; Mahrenholtz, 1990). As nurses obtain knowledge about nursing's financial contributions to a hospital, an increase in nursing's power position within the facility results. The ability to negotiate budgets and monetary contributions to the hospital's bottom line results in more professional respect between hospital administration and the nursing department. As nursing is able to identify the cost contributions it provides the facility, nursing becomes a revenue-generating department, not a cost expenditure for the institution (Grandbouche, 1982; Mahrenholtz, 1990).

Furthermore, staff nurses serve as the primary public relations representative for hospitals (Shaffer & Preziosi, 1988). When nursing can position itself to be the patient's ally, nursing becomes the major link between quality and costs. To best serve as a patient advocate, nurses need to be informed about expenses and the impact costs have on the health care system, nursing, and patients.

As patients, the consumers of the health care system, become more aware of increasing health care costs, they tend to question the necessity of medical services. Increasing medical costs are a concern for the general public. In 1991 the average American family spent $4,300 on health care (Woolsey, 1991). Businesses, in the form of company insurance plans, paid about 34% of the families' bill.

Woolsey noted that at the current rate of inflation within health care, this value can be expected to increase to $9,397 per family per year by the year 2000.

Patients are also made aware of rising medical costs within the political arena. The role of Medicare, Medi-Cal, and Medicaid in providing medical services to the elderly and the poor are supported by state and federal Governments through general taxes (Kalisch & Kalisch, 1986). A national health insurance plan to control health care costs has been frequently discussed in Congress, although no definitive plan has yet been decided upon.

Each hospital patient requires individualized nursing care as needs vary tremendously, but one patient's medical costs should not subsidize another. A patient should pay for the services received (Mahrenholtz, 1990; Payson, 1987). By delineating nursing care costs patients can identify what specific services were used instead of having nursing costs hidden in the room rate or in expensive supplies such as a box of tissues or lotion. Having an informed group of consumers in terms of health care costs will create more incentive to control costs and keep down prices.

Another concern for nurse administrators as they regulate nursing practice addresses the availability of financial information within the nursing department. A major aspect of a nurse administrator's job is to represent nursing's needs effectively and disseminate information

about relevant issues on an ongoing basis (Shaffer, 1984). In today's competitive health care system, costs are a very relevant issue. Finances must be openly discussed at all levels of nursing and a general understanding of the value of being cost effective must be prevalent within the department. Nurse administrators must not conceal financial data required to educate nurses about finances and about how health care costs affect the nursing budget.

The inability of most nursing departments to identify the cost and intensity of the services it provides puts nursing in an economically compromised position (Joel, 1987). To survive under the DRG system, or any prospective payment methodology, each nursing unit must be efficiently run and the limited resources maximized. The need to identify costs within the nursing department in an accurate fashion cannot be ignored if nursing wishes to control the delivery of patient care.

Nursing services cannot be costed out properly without input from all levels of nursing; administrators, managers, and staff nurses. Nurse administrators must be familiar with costs in order to do strategic financial planning for their department. Nurse managers must be aware of what revenues and expenses their units generate to keep resources at a high enough level to provide quality care, to provide appropriate staffing levels, and to supply nursing's share of the hospital budget.

Staff nurses need to understand what is financially involved in the services they provide and why cost considerations are important (Higgerson, 1987). This improves accountability and allows staff nurses to recognize the contribution they make to the facility. If information about the budget or specific nursing costs are hidden from the staff, it will be very difficult to generate knowledge and understanding on the importance of finances within the current cost-conscious health care environment.

To develop and implement a costing out methodology for nursing requires time and commitment. Van Slyck (1991) identified a systems approach to managing nursing services which involved several steps. The first stage was the development of a belief system, or philosophical foundation, on the need to identify nursing costs. The second step was to develop a reliable and valid PCS. Staffing standards could then be generated leading to effective productivity monitoring. An audit system must also be instituted and included in each step of the process. Nursing services could then be realistically identified and costed out. The final step was to develop patient charges based upon nursing costs.

The future of nursing practice revolves around nursing's ability to adapt to the changing health care environment. Accurate information about nursing costs are needed for nurse administrators to compete for the limited

available resources. Specific financial information about the nursing department can best support the goals for nursing practice.

Implications for Nursing Research

Based upon this study, two implications for nursing research need to be addressed. The first deals with the inconsistencies in defining direct nursing costs and direct nursing care hours. The second involves meta-analytic techniques and its implications for nursing.

Although identifying nursing costs is relevant in the current health care environment, this meta-analytic study revealed that few guidelines have been followed while conducting nursing research in this area. Meta-analysis was designed to integrate multiple similar studies to identify any generalizable conclusions (Glass et al., 1981). Glass et al. recognized that the primary studies would vary and the analysis could be referred to as comparing apples and oranges.

For this descriptive meta-analysis the primary studies were definitely different which became evident as only 29 of the 73 located studies were usable for analysis. A major limitation was found to be in the definition of the variables. Direct nursing care was not consistently defined among the primary studies. Some researchers recognized ward secretaries and unit managers in direct care costs while others only focused on individuals doing "hands on" patient

care. The variables of hours of direct nursing care and direct nursing costs were affected by the definition of direct nursing care.

Among the primary studies, the definition of total nursing costs also varied. Some researchers calculated a standard indirect cost that included nursing administration and educational expenses. This was then added to direct costs to provide total nursing costs. Other primary studies included a value for hospital overhead, such as building maintenance, when identifying total nursing costs. Occasionally a study would delineate the benefit package, employee's vacation time and sick leave, as being included in the indirect expenses, but this was not consistently addressed.

The need for consistent definitions of nursing care services was discussed by Higgerson (1987). She noted that comparisons of cost information between facilities requires standardized definitions of direct nursing care. Even though each facility must develop an acuity tool that is appropriate for the facility, a few standardized definitions would contribute to nursing's ability to compare cost data between hospitals.

To provide some uniformity in future research projects, this researcher recommends the following definitions for direct nursing care hours and for direct and total nursing costs. Direct nursing care hours should be defined as only

the individuals providing "hands on" patient care. This involves all registered nurses, licensed vocational nurses, and nurse assistants on duty during a 24 hour day. Only the hourly wages for these people should comprise direct nursing costs.

The second component of total nursing costs, indirect costs, should be a constant value generated specifically for each hospital. Indirect costs should included all supportive services required to provide direct nursing care. The unit manager, ward secretary, nursing education, nursing administration, the employee benefit package, and any additional technical services specific to the facility, such as orderlies or transporters, should be incorporated.

Although some researchers may wish to include unit managers and ward secretaries in direct nursing costs, some hospitals do not have these positions on all nursing units. To provide consistency in the definition of nursing care, it is therefore necessary to put these services in indirect care and indirect costs. The cost of these indirect services can be calculated on a per day basis and be assigned to patients in accordance with their LOS.

Total nursing costs should include direct and indirect nursing costs. If the definitions of nursing care can reflect some consistency between hospitals, more accurate examinations of nursing costs between facilities can occur. Hospital overhead expenses, housekeeping services, and

nutritional services should be included in the hospital's room rate. These are not nursing costs and should not be included in nursing expenses.

The second consideration for nursing research deals with the role of meta-analysis. Some advocates of meta-analytic studies, such as Glass et al. (1981), Hunter and Schmidt (1990), Mullen (1989), and Rosenthal (1984), primarily discuss the use of experimental or correlational studies for meta-analysis. However, descriptive studies can also be examined with meta-analytic techniques (Strube & Hartmann, 1983).

As nurse professionals advocate conducting nursing research studies, meta-analysis can serve as a method for summarizing nursing knowledge and affecting nursing practice or theory. This meta-analytic study expanded knowledge on nursing costs by revealing highly correlated findings with nursing costs and nursing hours and between nursing costs and hospital costs. Moderately strong relationships were found between nursing costs and LOS. The quantitative approach of meta-analysis provides a precise, objective, and replicative focus to use in examining a group of similar research studies.

Meta-analysis can also identify problems within a group of similar studies. In this research study, diverse definitions were found to be a hindrance even though the concept of costing out services cannot afford to be ignored.

The health care environment of today demands accurately identified costs. It is obvious from the limited number of usable studies found addressing this concept that consistency does not currently exist for the concept of costing out nursing services. More consistent definitions of the reported variables are required as the concept of costing out nursing continues to be studied.

Summary

The purpose of this descriptive meta-analytic study was to investigate studies that focused on costing out nursing services. The primary studies were integrated to identify the relationships between nursing costs and a second variable. Pearson r correlations and percentages were statistically performed on the most commonly reported variables.

When each study was treated as a single finding, total and direct nursing costs were found to correlate closely to nursing care hours and hospital costs and to correlate moderately to LOS. The majority of linear correlations for specific DRGs were not found to be statistically significant. The research questions that addressed percentages provided more definitive information on the relationship between nursing costs and hospital costs than on nursing costs and DRG reimbursements.

Although reported studies on the concept of costing out nursing services have decreased since 1989, the importance

of having an accurate methodology to tract nursing costs was identified. Escalating health care costs have become a major concern for insurance companies, governmental organizations, members of the medical field and the general public. Within the cost-conscious health care environment of today, providing cost effective care with limited resources is of primary importance. Nursing must clearly delineate its expenses to maintain the ability to regulate nursing practice and have a voice in the future of health care.

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APPENDIX B

SUMMARY TABLES OF ALL COSTING STUDIES REVIEWED AND SOURCES OF LOCATION

Table B-1

Studies Considered for Meta-Analysis, Their Variables, and Their Findings

Studies	Variables	Findings
Studies conducted prior to 1982		
Caterinicchio (1984)	LOS, nursing care hours, nursing costs, percent of nursing costs to reimbursement, age, sex, race, payor status, diagnosis index, and procedure index	LOS is the most significant predictor of nursing care regardless of patient age or complexity of medical problem.
Grimaldi & Micheletti (1983)	LOS, age, nursing resource clusters, number of medical diagnoses, number of procedures	The RIM and the per diem method of costing out nursing services yield very similar results.
Kreitzer, Loebner, & Roveti (1984)	LOS, hospital charges, and acuity ratings	DRGs are not consistently homogeneous with respect to LOS, acuity, and changes.
Halloran (1985); Halloran & Halloran (1985)	LOS, nursing acuity, age, sex, race, payor status, nursing and medical diagnoses	Nursing workload correlates 77% to LOS. Nursing diagnosis explains more variance in nursing workload than medical diagnosis.

table continues

Studies	Variables	Findings
Studies conducted in 1982		
Riley & Schaefers (1983)	LOS, nursing care hours, nursing costs, hospital costs, percent of nursing to hospital costs, and acuity levels	Nursing costs can be measured on the basis of acuity. Nursing costs are only 17% of hospital costs.
Atwood, Hinshaw, & Chance (1986)	LOS, nursing costs, patient charges, and acuity levels	DRGs predict nursing care needs better in ICUs than on general units. Charging for nursing in the room rate does not account for acuity levels.
Sovie, Tarcinale, Van Putte, & Stunden (1986)	LOS, nursing care hours, nursing costs, percent of nursing costs to room rate	DRGs can predict nursing hours when combined with a PCS.
Van Putte, Sovie, Tarcinale, & Stunden (1985)	Nursing care hours by acuity	Hours and acuity are positively correlated.
Studies conducted in 1983		
Joel (1984)	LOS, nursing and hospital costs, and percent of nursing to hospital costs	RIMs reflect nursing costs more equitably than per diem rates.

table continues

Studies	Variables	Findings
Lagona & Stritzel (1984)	LOS, nursing care hour, and nursing costs	Nursing hours and costs vary between DRGs.
Mitchell, Miller, Welches, & Walker (1984)	Nursing care hours, nursing costs, hospital charges, and percent of nursing to hospital costs	PCS can identify nursing hours. Nursing hours varied within DRGs.
Rieder & Kay (1985)	LOS and acuity levels	Acuity tools assist in predicting LOS. Acuity levels are higher in the beginning of hospital stays.
Williams (1984)	LOS, nursing costs, and acuity levels	Acuity systems assist in identifying nursing costs.
Studies conducted in 1984		
Harrell (1984); Harrell (1986)	LOS, nursing care hours, nursing costs, hospital charges, DRG reimbursements, acuity levels, age, sex, and productivity	Nursing costs range from 6.5% to 13.9% of hospital costs. LOS can assist in predicting nursing costs. Nursing hours, acuity and productivity can help define nursing costs by DRG.

table continues

Studies	Variables	Findings
Schaefers (1985)	LOS, nursing care hours, and nursing costs	Nursing hours and costs increase when LOS decreases.
Arndt & Skydell (1985); Skydell & Arndt (1988)	LOS, nursing care hours, nursing costs, and age	When age is independently examined, older patients require more nursing care. This difference is not found when LOS is controlled.
Sherman (1986)	LOS, nursing care hours, hospital costs, acuity levels, age, sex, and ICU stays	Hospital charges are highly correlated with LOS and nursing hours.
McKibbin, Brimmer, Clinton, Galliher, & Hartley (1985); McKibbin, Brimmer, Galliher, Hartley, & Clinton (1985)	LOS, nursing care hours, nursing costs, hospital costs, percent of nursing to hospital costs, reimbursements, and ICU costs	A positive relationship exists between DRG reimbursement rates and nursing hours.
Wolf & Lesic (1986)	Nursing costs, hospital costs, and acuity levels	Nursing salary costs are about 25% of hospital costs.

table continues

Studies	Variables	Findings
Dahlen & Gregor (1985)	Nursing costs, hospital costs, and percent of nursing to hospital costs	Using an all RN staff is cost effective. Nursing costs are only 14% of hospital costs.
Reitz (1985)	Acuity levels	The Nursing Intensity Index can determine acuity levels.
Bailie (1986)	LOS, hospital charges, DRG reimbursements, and acuity levels	The cost of providing nursing care is not adequately reflected in DRG reimbursements.
McClain & Selhat (1984)	LOS, nursing care hours, nursing costs, and days in ICU	Nursing costs can be described in terms that relate to LOS.
Bargagliotti & Smith (1985)	LOS, nursing care hours, nursing costs, percent of nursing to hospital costs, percent of nursing to room rate, and age	Although nursing costs are less than 25% of hospital costs, a wide range of nursing costs are found within and between DRGs.
Ethridge (1985)	Nursing and hospital costs by acuity levels	Costs can be identified by acuity levels.

table continues

Studies	Variables	Findings
Mowry & Korpman (1985)	LOS, nursing costs, DRG reimbursements, percent of nursing to DRG reimbursements, acuity levels, and nursing labor requirements	Some DRGs vary up to 500% in nursing costs per day.
Reschak, Biordi, Holm, & Santucci (1988)	LOS, nursing care hours, nursing costs, reimbursements, percent of nursing to DRG reimbursements, age, and sex	Nursing services can be accurately accounted for by DRG.
Grohar, Myers, & McSweeney (1986)	LOS, nursing care hours, nursing costs, and acuity levels	Nursing resource usage fluctuates widely when based upon LOS, acuity levels, and DRGs.
Wilson, Prescott, & Aleksandrowicz (1988); Prescott (1986)	LOS, nursing costs, hospital costs, percent of nursing to hospital costs, acuity levels, age, sex, and payor status	Within DRGs the use of nursing resources is not homogeneous. More consistent methods to study nursing costs are needed.
Trofino (1986)	LOS, nursing care hours, and nursing costs	Alternatives to RIM exist as methods to cost out nursing.

table continues

Studies	Variables	Findings
Studies conducted in 1985		
Sanders (1985)	LOS, nursing care hours, nursing costs, acuity levels, age, and sex	LOS, nursing hours, and nursing costs vary greatly within DRGs.
Replogle (1985)	LOS, nursing care hours, nursing costs, DRG reimbursements, percent of nursing to DRG reimbursements, and acuity levels	Wide variations in nursing costs per LOS are found within specific DRGs. Nursing costs can be determined using a PCS.
Domask (1986)	LOS, nursing care hours, nursing costs, DRG reimbursements, percent of nursing to reimbursements, and acuity levels	Costs for nursing services vary extensively within DRGs. Average nursing costs per DRG reimbursement rate range from 3.71% to 19.49% in three specific DRGs.
Fosbinder (1986)	LOS, nursing care hours, nursing costs, DRG reimbursements, percent of nursing to reimbursements, and acuity levels	The preset DRG reimbursements do not allow for individual differences in nursing care services.

table continues

Studies	Variables	Findings
Rosenbaum, Willert, Kelly, Grey, & McDonald (1988)	LOS, nursing care hours, nursing costs, DRG reimbursements, percent of nursing costs to reimbursements, acuity levels, and census	LOS and nursing care hours vary widely within DRGs. No correlation was found between patient acuity and staffing hours.
Donovan & Lewis (1987)	Nursing care hours and acuity levels	The percent of the hospital budget used by nursing decreased from 1972 to 1985.
Thomas & Vaughan (1986)	LOS, nursing care hours, and payor status	Costing out nursing can be a natural results of the PCS.
Richards, Hexum, & Anderson (1987)	Nursing care requirements and age	Patterns of required nursing care can be monitored within DRGs to provide information about nursing costs.
Wolf, Lesic, & Leak (1986)	LOS, hospital costs, and acuity levels	Despite higher acuity ratings, nursing costs on the primary care unit are less than on the team nursing unit.

table continues

Studies	Variables	Findings
Lucke & Lucke (1986)	LOS, hospital costs, acuity levels, and age	Nursing intensity is important in predicting hospital costs.
Cheatwood & Martin (1986)	LOS, nursing care hours, age, and number of nursing diagnoses	No definite relationship was found between nursing care hours and nursing diagnoses.
Martin & Kelly (1986)	LOS, nursing care hours, nursing costs, hospital charges, percent of nursing to hospital charges, age, and sex	On the orthopedic unit, hip and shoulder patients require the highest amount of nursing care.
Trace (1988)	LOS, nursing care hours, nursing costs, hospital charges, percent of nursing to hospital costs and to room rate, and age	As LOS and nursing care hours increase or decrease the costs of nursing care directly reflect the changes.
Studies conducted in 1986		
Trofino (1988); Trofino (1989a); Trofino (1989b)	LOS and nursing care hours	LOS and nursing care hours are similar across hospitals.

table continues

Studies	Variables	Findings
Sochalski (1988)	LOS, nursing costs, acuity levels, age, and operative status	Large variations in using nursing resources are found between patients. LOS was not found to correlate completely to acuity.
Clippard (1987)	LOS, nursing care hours, nursing costs, hospital costs, reimbursements, percent of nursing to hospital costs, and acuity levels	A positive relationship exists between LOS, nursing costs and DRG reimbursement rates.
Johnson (1986)	LOS, nursing care hours, nursing costs, reimbursements, and percent of nursing to DRG reimbursements	There are significant variations in nursing costs and services among and within DRGs.
Williams (1987)	LOS, nursing care hours, nursing costs, hospital costs, percent of nursing to hospital costs, and acuity levels	Nursing costs are highest for ICU patients. General medical patients have higher nursing costs than general surgical patients.

table continues

Studies	Variables	Findings
Flood & Diers (1988)	LOS, hospital costs, acuity levels and staffing ratios	Nurse staffing can affect LOS.
Marks (1987)	LOS, nursing care hours, and acuity levels	PCS can be used as a beginning step to cost out nursing.
D'Arco (1988)	Nursing activities	To identify nursing costs, awareness of what tasks nursing performs is required.
Scherubel & Swartz (1988)	LOS, nursing care hours, hospital costs, age, sex, race, and payor status	Wide variations of resources occur within DRGs.
Petit, Kavois, & Glendon (1988)	LOS, nursing care hours, nursing costs, acuity levels, age, sex, payor status, and nursing diagnosis	Nursing costs vary greatly between and within DRGs.
McCormick (1986)	LOS, nursing costs, and percent of RN costs	Direct nursing costs represent only 17.8% of the DRG reimbursement.

table continues

Studies	Variables	Findings
Marquess & Petit (1987)	LOS, nursing costs, percent of RN care, and percent of time in ICU	No correlation was found between the percent of RN staff and nursing costs.
Green, McClure, Wintfeld, Birdsall, & Rieder (1988)	LOS, nursing care hours, nursing costs, acuity levels, and ancillary costs	Acuity levels and the Severity of Illness Index are positively correlated.
Shafer, Frauenthal, & Tower (1987)	LOS, nursing care hours, nursing costs, hospital costs	Patient acuity accounts for both LOS and intensity of care.
Studies conducted in 1987		
Sherman (1987)	LOS, nursing care hours, nursing costs, hospital costs, acuity levels, age, and sex	The Iowa work-sampling method and the San Joaquin PCS are positively correlated.
Runner (1989)	LOS, nursing care hours, nursing costs, hospital costs, percent of nursing to hospital costs, acuity levels, age, sex, and race	A strong positive relationship exists between nursing hours, nursing costs, hospital costs, and DRG ratings.

table continues

Studies	Variables	Findings
Bost & Lawler (1989)	LOS, hospital charges, and acuity levels	DRGs were not homogeneous with respect to nursing intensity.
Barhyte & Glandon (1988)	Nursing costs and acuity levels	Costing out nursing is more accurate with a PCS.
Munoz, Josephson, Tenenbaum, Goldstein, Shears, & Wise (1989)	Hospital costs, DRG reimbursements, age, and severity of illness	ICU patients over age 65 have longer LOSs and greater severity of illness.
Sullivan, Carey, & Saunders (1988)	LOS, nursing care hours, nursing costs, percent of nursing to room rate, acuity levels, and age	The PCS can be used to develop a variable billing rate for nursing.
Van Hoesen & Eriksen (1990)	LOS, acuity levels, and quality of nursing care	LOS and acuity decreased after DRGs were implemented but quality increased.
Studies conducted in 1988		
Mitchell & Bostrom-Ezrati (1988)	Nursing care hours, nursing costs, and acuity levels	A lack of homogeneity in the use of nursing resources was found for DRGs.

table continues

Studies	Variables	Findings
Studies conducted in 1989		
Kyle & Kinder (1990)	LOS, nursing care hours, nursing costs, acuity levels, and age	It is possible to examine nursing costs as they relate to DRGs.

Table B-2

Sources of Obtained Studies

Sources	Number located
CINAHL	34
Dissertations abstracts	10
Bibliographies from other sources	13
Books	12
Professional Networking--unpublished	3
Professional Networking--published	1
Total	73

Note. CINAHL = Cumulative Index of Nursing and Allied Health Literature.

APPENDIX C

TABLES DEPICTING USABLE STUDIES

FOR RESEARCH QUESTIONS 1-8

Table C-1

Studies for Research Question #1: What is the Linear Relationship between Total Nursing Costs and LOS?

Studies conducted in 1982

Riley & Schaefers (1983)

Studies conducted in 1983

Williams (1984)

Studies conducted in 1984

Schaefers (1985)

McKibbin, Brimmer, Clinton, Galliher, & Hartley (1985)

Reschak, Biordi, Holm, & Santucci (1988)

Studies conducted in 1985

Sanders (1985)

Domask (1986)

Fosbinder (1986)

Trace (1986)

Studies conducted in 1986

Clippard (1987)

Studies conducted in 1987

Runner (1989)

Table C-2

Studies for Research Question #2: What is the Linear Relationship between Direct Nursing Costs and LOS?

Studies done prior to 1982

Caterinicchio (1984)

Studies conducted in 1982

Riley & Schaefers (1983)

Sovie, Tarcinale, Van Putte, & Stunden (1986)

Studies conducted in 1983

Joel (1984)

Lagona & Stritzel (1984)

Studies conducted in 1984

Harrell (1984)

McClain & Selhat (1984)

Mowry & Korpman (1985)

Reschak, Biordi, Holm, & Santucci (1988)

Wilson, Prescott, & Aleksandrowicz (1988)

Studies conducted in 1985

Sanders (1985)

Replogle (1985)

(table continues)

Domask (1986)

Trace (1988)

Studies conducted in 1986

Williams (1987)

McCormick (1986)

Marquess & Petit (1987)

Table C-3

Studies for Research Question #3: What is the Linear Relationship between Total Nursing Costs and Hours of Direct Nursing Care?

Studies conducted in 1982

Riley & Schaefers (1983)

Studies conducted in 1984

Schaefers (1985)

Arndt & Skydell (1985)

McKibbin, Brimmer, Clinton, Galliher, & Hartley (1985)

Reschak, Biordi, Holm, & Santucci (1988)

Studies conducted in 1985

Sanders (1985)

Domask (1986)

Fosbinder (1986)

Trace (1988)

Studies conducted in 1986

Clippard (1987)

Johnson (1986)

Studies conducted in 1987

Runner (1989)

Table C-4

Studies for Research Question #4: What is the Linear Relationship between Direct Nursing Costs and Hours of Direct Nursing Care?

Studies conducted in 1982

Riley & Schaefers (1983)

Sovie, Tarcinale, Van Putte, & Stunden (1986)

Studies conducted in 1983

Lagona & Stritzel (1984)

Mitchell, Miller, Welches, & Walker (1984)

Studies conducted in 1984

Harrell (1984)

McClain & Selhat (1984)

Reschak, Biordi, Holm, & Santucci (1988)

Studies conducted in 1985

Sanders (1985)

Replogle (1985)

Domask (1986)

Trace (1988)

Studies conducted in 1986

Williams (1987)

Table C-5

Studies for Research Question #5: What is the Linear Relationship between Total Nursing Costs and Hospital Costs?

Studies conducted in 1982

Riley & Schaefers (1983)

Studies conducted in 1984

McKibbin, Brimmer, Clinton, Galliher, & Hartley (1985)

Dahlen & Gregor (1985)

Studies conducted in 1985

Trace (1988)

Studies conducted in 1987

Runner (1989)

Table C-6

Studies for Research Question #6: What is the Linear Relationship between Direct Nursing Costs and Hospital Costs?

Studies conducted in 1982

Riley & Schaefers (1983)

Studies conducted in 1983

Joel (1984)

Mitchell, Miller, Welches, & Walker (1984)

Studies conducted in 1984

Harrell (1984)

Dahlen & Gregor (1985)

Wilson, Prescott, & Aleksandrowicz (1988)

Studies conducted in 1985

Trace (1988)

Studies conducted in 1986

Williams (1987)

Table C-7

Studies for Research Question #7: What is the Linear Relationship between Total Nursing Costs and the Hospital DRG Reimbursement?

Studies conducted in 1984

McKibbin, Brimmer, Clinton, Galliher, & Hartley (1985)

Reschak, Biordi, Holm, & Santucci (1988)

Studies conducted in 1985

Domask (1986)

Fosbinder (1986)

Studies conducted in 1986

Clippard (1987)

Johnson (1986)

Table C-8

Studies for Research Question #8: What is the Linear Relationship between Direct Nursing Costs and the Hospital DRG Reimbursement?

Studies conducted in 1984

Harrell (1984)

Mowry & Korpman (1985)

Reschak, Biordi, Holm, & Santucci (1988)

Studies conducted in 1985

Replogle (1985)

Domask (1986)

APPENDIX D

FINDINGS FOR RESEARCH QUESTIONS 9-20

Table D-1

Results for Research Question #9: What is the Linear Relationship between Total Nursing Costs and LOS for Specific DRGs?

DRGs	Pearson r	p level	Studies
Reported 6 times			
#127--heart failure and shock	.63	.183	Riley & Schaefers (1983); Schaefers (1985); McKibbin, Brimmer, Clinton, Galliher, & Hartley (1985); Domask (1986); Fosbinder (1986); & Clippard (1987)
Reported 5 times			
#89--simple pneumonia and pleurisy, age > 69 with complications	.71	.175	Schaefers (1985); McKibbin et al. (1985); Fosbinder (1986); Clippard (1987); & Runner (1989)

(table continues)

(Table D-1 continued)

DRGs	Pearson *r*	*p* level	Studies
#182--esophagitis, gastroenteritis, and miscellaneous digestive disorders, age > 69 with complications	.89	.044*	Schaefers (1985); McKibbin et al. (1985); Fosbinder (1986); Clippard (1987); & Runner (1989)
Reported 4 times:			
#39--lens, surgical procedures	-.34	.664	Schaefers (1985); McKibbin et al. (1985); Reschak, Biordi, Holm, & Santucci (1988); & Fosbinder (1986)
#138--cardiac arrhythmia and conduction disorders, age > 69 with complications	.39	.606	Schaefers (1985); McKibbin et al. (1985); Fosbinder (1986) & Clippard (1987)

(table continues)

(Table D-1 continued)

DRGs	Pearson *r*	*p* level	Studies
#243--medical back problems	.75	.247	Schaefers (1985); McKibbin et al. (1985); Fosbinder (1986); & Runner (1989)
Reported 3 times:			
#125--circulatory disorders except AMI with cardiac cath, without complications	.48	.681	McKibbin et al. (1985); Sanders (1985); & Domask (1986)
#140--angina pectoris	.50	.664	Schaefers (1985); McKibbin et al. (1985); & Clippard (1987)

Note. AMI = acute myocardial infarct.

Table D-2

Results for Research Question #10: What is the Linear Relationship between Direct Nursing Costs and LOS for Specific DRGs?

DRGs	Pearson r	p level	Studies
Reported 7 times:			
#122--circulatory disorders with AMI without cardiovascular complications, discharged alive	.79	.035*	Sovie, Tarcinale, Van Putte, & Stunden (1986); Lagona & Stritzel (1984); Harrell (1984); Wilson, Prescott, & Aleksandrowicz (1988); Replogle (1985); Domask (1986); & McCormick (1986)
#127--heart failure and shock	-.47	.286	Riley & Schaefers (1983); Sovie et al. (1986); Harrell (1984); Replogle (1985);

(table continues)

(Table D-2 continues)

DRGs	Pearson r	p level	Studies
			Domask (1986); Williams (1987); & McCormick (1986)
Reported 6 times:			
#121--circulatory disorders with AMI and cardio-vascular complications, discharged alive	.33	.524	Caterinicchio (1984); Sovie et al. (1986); Lagona & Stritzel (1984); Wilson et al. (1988); Replogle (1985); & McCormick (1986)
Reported 5 times:			
#88--chronic obstructive pulmonary disease	.68	.210	Sovie et al. (1986); Harrell (1984); McClain & Selhat (1984); Wilson et al. (1988); & McCormick (1986)

(table continues)

(Table D-2 continues)

DRGs	Pearson *r*	*p* level	Studies
Reported 4 times:			
#14--specific cerebro-vascular disorders except TIA	.58	.415	Sovie et al. (1986); Harrell (1984); Williams (1987); & McCormick (1986)
#39--lens, surgical procedures	.58	.424	Caterinicchio (1984); Harrell (1984); Mowry & Korpman (1985); and Reschak, Biordi, Holm, & Santucci (1988)
#355--nonradical hysterectomy, age < 70 without complications	-.41	.594	Joel (1984); Harrell (1984); Mowry & Korpman (1985); & Marquess & Petit (1987)

(table continues)

(Table D-2 continues)

DRGs	Pearson r	p level	Studies
Reported 3 times:			
#25--seizure and headache, age 18-69 without complications	1.00	.000***	Caterinicchio (1984); Joel (1984); & Harrell (1984)
#89--simple pneumonia and pleurisy, age > 69 with complications	.11	.932	Sovie et al. (1986); Williams (1987); & McCormick (1986)
#125--circulatory disorders except AMI with cardiac cath, without complications	.57	.614	Sovie et al. (1986); Sanders (1985); & Domask (1986)
#140--angina pectoris	-.86	.343	Sovie et al. (1986);

(table continues)

(Table D-2 continues)

DRGs	Pearson *r*	*p* level	Studies
			Replogle (1985); & Williams (1937)
#174--GI hemorrhage with complications	.60	.587	Riley & Schaefers (1983); Sovie et al. (1986); & McCormick (1986)
#182--esophagitis, gastroenteritis and miscellaneous digestive disorders, age > 69 with complications	.91	.274	Sovie et al. (1986); Harrell (1984); and Mowry & Korpman (1985)

(table continues)

(Table D-2 continues)

DRGs	Pearson r	p level	Studies
#209--major joint and limb reattachment procedures	-.75	.462	Harrell (1984); Williams (1987); & McCormick (1986)
#210--hip and femur procedures except major joint procedures, age > 69 with complications	.98	.117	Reschak et al. (1988); Williams (1987); & McCormick (1986)

Note. AMI = acute myocardial infarct; TIA = transient ischemic attacks; GI = gastrointestinal

Table D-3

Results for Research Question #11: What is the Linear Relationship between Total Nursing Costs and Hours of Direct Nursing Care for Specific DRGs?

DRGs	Pearson r	p level	Studies
Reported 9 times:			
#140--angina pectoris	.92	.000***	Schaefers (1985); [a]Arndt & Skydell (1985): McKibbin, Brimmer, Clinton, Galliher, & Hartley (1985); Clippard (1987); & Johnson (1986)
Reported 7 times:			
#14--specific cerebro-vascular disorders except TIA	.88	.010**	Schaefers (1985); [a]Arndt & Skydell (1985); & McKibbin et al. (1985)

(table continues)

(table D-3 continues)

DRGs	Pearson *r*	*p* level	Studies
Reported 6 times:			
#89--simple pneumonia and pleurisy, age > 69 with complications	.75	.084	Schaefers (1985); McKibbin et al. (1985); Fosbinder (1986); Clippard (1987); Johnson (1986); & Runner (1989)
#127--heart failure and shock	.36	.484	Riley & Schaefers (1983); Schaefers (1985); McKibbin et al. (1985); Domask (1986); Clippard (1987); & Johnson (1986)

(table continues)

(table D-3 continues)

DRGs	Pearson r	p level	Studies
Reported 4 times:			
#182--esophagitis, gastroenteritis and miscellaneous digestive disorders, age > 69 with complications	.90	.098	Schaefers (1985); McKibbin et al. (1985); Clippard (1987); & Runner (1989)
#243--medical back problems	.93	.065	Schaefers (1985); Arndt & Skydell (1985); McKibbin et al. (1985); & Runner (1989)
Reported 3 times:			
#39--lens, surgical procedures	-.79	.423	Schaefers (1985); McKibbin et al. (1985); & Reschak, Biordi, Holm, & Santucci (1988)

(table continues)

(table D-3 continues)

DRGs	Pearson *r*	*p* level	Studies
#96--bronchitis and asthma, age > 69 with complications	.87	.326	Arndt & Skydell (1985); McKibbin et al. (1985); & Clippard (1987)
#125--circulatory disorders except AMI with cardiac cath without complications	.91	.277	McKibbin et al. (1985); Sanders (1985); & Domask (1986)
#138--cardiac arrhythmia and conduction disorders, age > 69 with complications	.17	.888	Schaefers (1985); McKibbin et al. (1985); & Clippard (1987)

Note. TIA = transient ischemic attacks; AMI = acute myocardial infarct.

[a]Study provided five data reports for different hospitals.

Table D-4

Results for Research Question #12: What is the Linear Relationship between Direct Nursing Costs and Hours of Direct Nursing Care for Specific DRGs?

DRGs	Pearson r	p level	Studies
Reported 6 times:			
#122--circulatory disorders with AMI without cardiovascular complications, discharged alive	.84	.036*	Sovie, Tarcinale, Van Putte, & Stunden (1986); Lagona & Stritzel (1984); Mitchell, Miller, Welches, & Walker (1984); Harrell (1984); Replogle (1985); & Domask (1986)
#127--heart failure and shock	.89	.019*	Riley & Schaefers (1983); Sovie et al. (1986); Harrell (1984); Replogle (1985);

(table continues)

(Table D-4 continues)

DRGs	Pearson r	p level	Studies
			Domask (1986) & Williams (1987)
Reported 4 times:			
#121--circulatory disorders with AMI and cardio-vascular complications, discharged alive	.56	.440	Sovie et al. (1986); Lagona & Stritzel (1984); Mitchell, Miller, Welches, & Walker (1984); Harrell (1984); Replogle (1985); & Domask (1986)
Reported 3 times:			
#14--specific cerebro-vascular disorders except TIA	.87	.331	Sovie et al. (1986); Harrell (1984); & Williams (1987)

(table continues)

(Table D-4 continues)

DRGs	Pearson *r*	*p* level	Studies
#88--chronic obstructive pulmonary disease	.94	.226	Sovie et al. (1986); Harrell (1984); & McClain & Selhat (1984)
#125--circulatory disorders except AMI with cardiac cath without complications	.99	.071	Sovie et al. (1986); Sanders (1985); & Domask (1986)
#140--angina pectoris	1.00	.014*	Sovie et al. (1986); Replogle (1985); & Williams (1987)
#209--major joint and limb reattachment procedures	.98	.122	Mitchell et al. (1984); Harrell (1984); & Williams (1987)

(table continues)

(Table D-4 continues)

DRGs	Pearson *r*	*p* level	Studies
#210--hip and femur procedures except major joint procedure, age > 69 with complications	.78	.434	Mitchell et al. (1984); Reschak, Biordi, Holm, & Santucci (1988); & Williams (1987)

Note. AMI = acute myocardial infarct; TIA = transient ischemic attacks.

Table D-5

Results for Research Question #13: What is the Linear Relationship between Total Nursing Costs and Hospital Costs for Specific DRGs?

DRGs	Pearson *r*	*p* level	Studies
Reported 3 times:			
#127--heart failure and shock	.25	.841	Riley & Schaefers (1983); McKibbin, Brimmer, Clinton, Galliher, & Hartley (1985); & Dahlen & Gregor (1985)
#182--esophagitis, gastroenteritis and miscellaneous digestive disorders, age > 69 with complications	-.68	.528	McKibbin et al. (1985); Dahlen & Gregor (1985); & Runner (1989)

(table continues)

(Table D-5 continues)

DRGs	Pearson *r*	*p* level	Studies
#243--medical back problems	.05	.968	McKibbin et al. (1985); Dahlen & Gregor (1985); & Runner (1989)

Table D-6

Results for Research Question #14: What is the Linear Relationship between Direct Nursing Costs and Hospital Costs for Specific DRGs?

DRGs	Pearson *r*	*p* level	Studies
Reported 4 times:			
#127--heart failure and shock	.74	.256	Riley & Schaefers (1983); Harrell (1984); Dahlen & Gregor (1985); & Williams (1987)
#209--major joint and limb reattachment procedures	.81	.189	Mitchell, Miller, Welches, & Walker (1984); Harrell (1984); Dahlen & Gregor (1985); & Williams (1987)

(table continues)

(Table D-6 continues)

DRGs	Pearson r	p level	Studies
Reported 3 times:			
#14--specific cerebro-vascular disorders except TIA	.97	.159	Harrell (1984); Dahlen & Gregor (1985); & Williams (1987)

Note. TIA = transient ischemic attacks.

Table D-7

Results for Research Question #15: What is the Linear Relationship between Total Nursing Costs and Hospital DRG Reimbursements for Specific DRGs?

DRGs	Pearson *r*	*p* level	Studies
Reported 5 times:			
#127--heart failure and shock	.81	.095	McKibbin, Brimmer, Clinton, Galliher, & Hartley (1985); Domask (1986); Fosbinder (1986); Clippard (1987); & Johnson (1986)
Reported 4 times:			
#89--simple pneumonia and pleurisy, age > 69 with complications	.56	.440	McKibbin et al. (1985); Fosbinder (1986); Clippard (1987); & Johnson (1986)

(table continues)

(Table D-7 continues)

DRGs	Pearson *r*	*p* level	Studies
Reported 3 times:			
#39--lens, surgical procedures	.11	.931	McKibbin et al. (1985); Reschak, Biordi, Holm, & Santucci (1988); & Fosbinder (1986)
#138--cardiac arrhythmia and conduction disorders with complications	.55	.632	McKibbin et al. (1985); Fosbinder (1986); & Clippard (1987)
#140--angina pectoris	.73	.480	McKibbin et al. (1985); Clippard (1987); & Johnson (1986)

(table continues)

(Table D-7 continues)

DRGs	Pearson *r*	*p* level	Studies
#182--esophagitis, gastroenteritis and miscellaneous digestive disorders, age > 69 with complications	.85	.350	McKibbin et al. (1985); Fosbinder (1986); & Clippard (1987)

Table D-8

Results for Research Question #16: What is the Linear Relationship between Direct Nursing Costs and Hospital DRG Reimbursements for Specific DRGs?

DRGs	Pearson r	p level	Studies
Reported 3 times:			
#39--lens, surgical procedures	.32	.765	Harrell (1984); Mowry & Korpman (1985); & Reschak, Biordi, Holm, & Santucci (1988)
#122--circulatory disorders with AMI without cardiovascular complications, discharged alive	.68	.521	Harrell (1984); Replogle (1985); & Domask (1986)
#127--heart failure and shock	.85	.356	Harrell (1984); Replogle (1985); & Domask (1986)

Note. AMI = acute myocardial infarct.

Table D-9

Results for Research Question #17: What is the Percent of Total Nursing Costs to Hospital costs for Specific DRGs?

DRGs	Mean	Range	Studies
Reported 5 times:			
#127--heart failure and shock	23.66	18.00 - 31.72	Riley & Schaefers (1983); McKibbin, Brimmer, Clinton, Galliher, & Hartley (1985); Wolf & Lesic (1986); Dahlen & Gregor (1985); & Clippard (1987)
Reported 4 times:			
#15--transient ischemic attacks	18.08	8.70 - 24.90	McKibbin et al. (1985); Wolf & Lesic (1986); Dahlen & Gregor (1985); & Clippard (1987)

(table continues)

(Table D-9 continues)

DRGs	Mean	Range	Studies
#89--simple pneumonia and pleurisy, age > 69 with complications	23.16	15.00 - 31.30	McKibbin et al. (1985); Wolf & Lesic (1986); Bargagliotti & Smith (1985); & Clippard (1987)
#138--cardiac arrhythmia and conduction disorders with complications	20.11	10.50 - 30.24	McKibbin et al. (1985); Wolf & Lesic (1986); Dahlen & Gregor (1985); & Clippard (1987)
#140--angina pectoris	20.65	9.60 - 30.09	McKibbin et al. (1985); Wolf & Lesic (1986); Dahlen & Gregor (1985); & Clippard (1987)

(table continues)

(Table D-9 continues)

DRGs	Mean	Range	Studies
#182--esophagitis, gastroenteritis and miscellaneous digestive disorders, age > 69 with complications	20.20	14.60 - 26.00	McKibbin et al. (1985); Wolf & Lesic (1986); Dahlen & Gregor (1985); & Clippard (1987)
#243--medical back problems	21.03	16.00 - 24.60	McKibbin et al. (1985); Wolf & Lesic (1986); Dahlen & Gregor (1985); & Bargagliotti & Smith (1985)
Reported 3 times:			
#14--specific cerebro-vascular disorders except TIA	30.58	17.00 - 38.65	McKibbin et al. (1985); Wolf & Lesic (1986); & Dahlen & Gregor (1985)

(table continues)

(Table D-9 continues)

DRGs	Mean	Range	Studies
#96--bronchitis and asthma, age > 69 with complications	18.16	15.00 - 22.50	McKibbin et al. (1985); Wolf & Lesic (1986); & Clippard (1987)
#174--GI hemorrhage with complications	25.58	21.00 - 32.24	Riley & Schaefers (1983); McKibbin et al. (1985); & Wolf & Lesic (1986)
Reported 2 times:			
#5--extracranial vascular procedures	14.84	9.50 - 20.17	Wolf & Lesic (1986); & Dahlen & Gregor (1985)
#39--lens, surgical procedures	11.25	10.30 - 12.19	McKibbin et al. (1985); & Wolf & Lesic (1986)

(table continues)

(Table D-9 continues)

DRGs	Mean	Range	Studies
#82--respiratory neoplasms	27.53	20.00 - 35.06	Wolf & Lesic (1986); & Bargagliotti & Smith (1985)
#88--chronic obstructive pulmonary disease	20.73	20.30 - 21.16	McKibbin et al. (1985); & Wolf & Lesic (1986)
#122--circulatory disorders with AMI without cardio-vascular complications, discharged alive	25.13	22.90 - 27.35	McKibbin et al. (1985); & Wolf & Lesic (1986)
#125--circulatory disorders except AMI with cardiac cath without complications	16.87	13.80 - 19.93	McKibbin et al. (1985); & Wolf & Lesic (1986)

(table continues)

(Table D-9 continues)

DRGs	Mean	Range	Studies
#130--peripheral vascular disorders age > 69 with complications	28.80	27.90 - 29.69	McKibbin et al. (1985); & Wolf & Lesic (1986)
#143--chest pain	22.57	21.00 - 24.13	Wolf & Lesic (1986); & Clippard (1987)
#148--major small and large bowel procedures age > 69 with complications	17.00	14.00 - 20.00	McKibbin et al (1985); & Dahlen & Gregor (1985)
#294--diabetes age > 36	21.07	18.73 - 23.40	McKibbin et al. (1985); & Wolf & Lesic (1986)

(table continues)

(Table D-9 continues)

DRGs	Mean	Range	Studies
#296--nutritional and miscellaneous metabolic disorders age > 69 with complications	32.13	21.00 - 43.26	Wolf & Lesic (1986); & Clippard (1987)
#320--kidney and urinary tract infections age > 69 with complications	28.10	22.00 - 34.20	McKibbin et al. (1985); & Clippard (1987)

Note. TIA = transient ischemic attacks; GI = gastrointestinal; AMI = acute myocardial infarct.

Table D-10

Results for Research Question #18: What is the Percent of Direct Nursing Costs to Hospital costs for Specific DRGs?

DRGs	Mean	Range	Studies
Reported 3 times:			
#209--major joint and limb reattachment procedures	7.10	6.30 - 8.00	Mitchell, Miller, Welches, & Walker (1984); Harrell (1984); & Williams (1987)
Reported 2 times:			
#14--specific cerebro-vascular disorders except TIA	13.50	12.00 - 15.00	Harrell (1984); & Williams (1987)
#25--seizure and headache, age 18-69 without complications	24.94	11.60 - 38.27	Joel (1984); & Harrell (1984)

(table continues)

(Table D-10 continues)

DRGs	Mean	Range	Studies
#88--chronic obstructive pulmonary disease	16.95	7.90 - 26.00	Harrell (1984); & Wilson Prescott, & Aleksandrowicz (1988)
#122--circulatory disorders with AMI without cardiovascular complications, discharged alive	15.35	10.70 - 20.00	Harrell (1984); Wilson et al. (1988)
#127--heart failure and shock	12.55	9.10 - 16.00	Harrell (1984); & Williams (1987)
#355--nonradical hysterectomy, age < 70 without complications	19.38	9.90 - 28.85	Joel (1984); & Harrell (1984)

Note. TIA = transient ischemic attacks; AMI = acute myocardial infarct.

Table D-11

Results for Research Question #19: What is the Percent of Total Nursing Costs to the Hospital DRG Reimbursement for Specific DRGs?

DRGs	Mean	Range	Studies
Reported 3 times:			
#127--heart failure and shock	17.80	15.50 - 19.49	Domask (1986); Fosbinder (1986); & Johnson (1986)
Reported 2 times:			
#39-- lens, surgical procedures	7.60	7.30 - 7.90	Reschak, Biordi, Holm, & Santucci (1988); & Fosbinder (1986)
#89--simple pneumonia and pleurisy, age > 69 with complications	13.40	13.20 - 13.60	Fosbinder (1986); & Johnson (1986)

Table D-12

Results for Research Question #20: What is the Percent of Direct Nursing Costs to the Hospital DRG Reimbursement for Specific DRGs?

DRGs	Mean	Range	Studies
Reported 2 times:			
#121--circulatory disorders with AMI and cardio-vascular complications, discharged alive	38.99	17.50 - 60.48	Caterinicchio (1984); & Replogle (1985)

Note. AMI = acute myocardial infarct.