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**A MODEL FOR USING THE NATIONAL BOARD DENTAL HYGIENE
EXAMINATION RESULTS AS A METHOD OF
OUTCOMES ASSESSMENT**

by

Debra Scott Schultz

**A Dissertation
Submitted to the
Faculty of The Graduate College
in partial fulfillment of the
requirements for the
Degree of Doctor of Philosophy
Department of Teaching, Learning, and Leadership**

**Western Michigan University
Kalamazoo, Michigan
December 2004**

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CHAPTER I

INTRODUCTION

Overview of the Study

There is an emerging trend in the United States towards increased educational accountability, with such accountability having an enormous impact on educators in higher education. Strong external pressures are causing many to realize that the issue of accountability must be precisely and immediately addressed (Polomba & Banta, 2001).

Within higher educational, occupational education programs (i.e., those that require credentialing), have long been held accountable either formally or informally. In order for occupational education programs to be most successful, such accountability requirements must be mandatory and continuous since the primary outcome of occupational education is to provide graduates who are competent, qualified workers. In many cases graduates of occupational education programs must be licensed or certified in order to secure jobs in their chosen occupation, which requires passing externally developed, comprehensive examinations. If the graduates are unsuccessful on the credentialing exams, the respective occupational program and institution is often held responsible and accountable.

Dental hygiene programs, an example of an occupational education program commonly found in community colleges in the United States, experience both existing

and growing accountability pressures. Dental hygiene programs must remain accredited by the American Dental Association in order for their respective graduates to take the national and state board examinations. Such licensure exams must be passed in order to practice dental hygiene (Michigan Board of Dentistry, 2000). The National Board Dental Hygiene Examination (NBDHE) is one of the two exams that are required for Dental Hygiene licensure.

The Joint Commission on National Dental Examinations is responsible for the NBDHE, which is a 350-item, multiple-choice exam. Receiving a passing score of at least 75% on the NBDHE is mandatory for every dental hygiene graduate in the United States of America to obtain licensure. The NBDHE provides every school with its students' and institution's results in the following 13 subject areas: (1) anatomic sciences, (2) physio-biochem-nutrition, (3) microbiology-immunology, (4) pathology, (5) pharmacology, (6) patient assessment, (7) radiology, (8) management of dental hygiene care, (9) periodontology, (10) preventive agents, (11) supportive treatment, (12) community dentistry, and (13) case-based items. In addition, the NBDHE provides the respective institutions with results of how well each school performed compared to the national average in each subject area, and how each respective institution ranked nationally. The results can be used for outcomes assessment and to make subsequent program improvements (Bragg, 1994).

The NBDHE is accepted by all states within the United States, and by all provinces within Canada. The examination is used to assess the candidates' ability to understand important information regarding basic biomedical, dental, and dental

hygiene sciences, and to apply the information in a problem-solving context (Joint Commission on Dental Examinations, 2003a). If a dental hygiene graduate does not pass the NBDHE, the graduate will not receive licensure and cannot be employed as a dental hygienist. Therefore, it is beneficial to use the performance data from the NBDHE as a method of the overall evaluation of a given dental hygiene program.

The content area results of the NBDHE, provided respectively to each dental hygiene program by the American Dental Association's Joint Commission on Dental Examinations, contain a wealth of data. Such data can be used as a critical assessment tool to track student learner outcomes and to evaluate programs. The NBDHE results can serve as one important component of outcomes assessment plan to drive curriculum revision on an ongoing, annual basis.

Since dental hygiene program graduates must pass the NBDHE to obtain licensure, dental hygiene programs and staff are ultimately held accountable for student success (i.e., the pass rates) on board exams. Dental hygiene programs are also held accountable for outcomes assessment plans through a 7-year accreditation cycle under the auspices of the American Dental Association's (ADA) Council on Dental Accreditation. According to the Commission on Dental Accreditation (1998), accountability must be a thoughtful process that requires a plan of continuous outcome assessment, using a variety of indicators, one of which is NBDHE results.

American Dental Association (ADA) accreditation standards require that dental hygiene programs have a comprehensive, ongoing outcomes assessment plan. These standards were established to provide accredited programs with the latitude to

use whatever outcomes assessment tools the respective programs choose. In the dental hygiene accreditation outcomes assessment standard, NBDHE scores are cited as an example of an acceptable evaluation tool. Since the ADA accreditation standards recognize NBDHE results as an acceptable evaluation tool, these results serve as a key variable examined in this study.

The NBDHE results for a dental hygiene program within a single community college located in Michigan (i.e., Grand Rapids Community College, GRCC) are the focus of this research study. This community college was chosen since it has a fairly large dental hygiene program, and the researcher had ready access to the data necessary to complete this research.

A key goal of this research was to determine the effectiveness of curriculum changes made over time to GRCC's dental hygiene program, by examining what happened to NBDHE scores following the implementation of several key curriculum revisions. In the past, curriculum changes at GRCC were based largely on thoughtful decisions, but those decisions were not necessarily data-driven. This study used the NBDHE scores to determine if any correlations existed between specific programmatic changes, and improvements in subject area scores and the overall scores of the NBDHE. This study provides dental hygiene programs in Michigan and elsewhere, with an example of how NBDHE results can be useful to their outcomes assessment planning process.

Statement of the Problem

As previously indicated, dental hygiene programs must achieve and maintain accreditation. A formal outcomes assessment plan is required for such accreditation. The content area results of the NBDHE provides each dental hygiene program accredited by the American Dental Association's Joint Commission on Dental Examinations with a wealth of data. Such data can be used as an assessment tool to track student learner outcomes and to evaluate programs. The use of NBDHE scores is suggested by the Commission on Dental Accreditation (1998), as part of a comprehensive outcomes assessment plan. The NBDHE results can help drive curriculum revision on an ongoing, annual basis.

At the time of this study GRCC's dental hygiene program had not implemented a formal plan, a requirement of accreditation, for the use of data from the NBDHE within its comprehensive outcomes assessment plan. Indeed, a review of the literature did not produce any detailed information regarding how dental hygiene programs anywhere in the nation are using the NBDHE results to guide program improvements. Therefore, this research was needed. The results of this study provide a model for the use of NBDHE results for curriculum and program improvement at GRCC and elsewhere.

Background of This Research Study

Several programmatic changes have occurred at GRCC over the last 8 years, with the goal of improving the dental hygiene curriculum and subsequent NBDHE

scores. However, specific improvement objectives and rationale were not formally stated and no follow-up data were analyzed to determine if the changes had the desired results. This study used NBDHE data, in a retrospective manner, to determine if any correlation exists between specific programmatic changes, and improvement of subject area scores and overall scores of the NBDHE. But, even more importantly, this study shows the benefits of using this type of data in a proactive manner to drive curriculum change.

Beginning in 1996, four major curriculum-related events occurred within the dental hygiene program at GRCC. An overview of the key dates and events follows:

1. In 1996, the dental hygiene faculty began the implementation of a new dental hygiene curriculum, while writing an accreditation self-study.
2. In 1997, the ADA accreditation site visit took place and resulted in many curriculum recommendations.
3. In 1998, curriculum changes were made in response to a change in the NBDHE, whereby one half of future exams would be in a case-based format.
4. In 2001, additional curriculum changes were implemented as a result of the 1997 accreditation review recommendations.

Prior to the 1997 ADA accreditation site-visit, the GRCC dental hygiene faculty implemented a new dental hygiene curriculum in 1996 that reflected major structural changes. These changes involved merging courses and course objectives. For example, objectives for foundational dental hygiene courses such as nutrition, preventive dentistry, pharmacology, dental anatomy, and oral pathology were

incorporated into preclinical and clinical dental hygiene courses. The result of these changes was fewer courses with larger, more ambiguous objectives, which made it more difficult to assess learner outcomes. The second year of this new dental hygiene curriculum was not yet completed at the time the ADA site visitors arrived in 1997.

The ADA accreditation site-visit team and their report stated that the new course objectives were ambiguous and difficult to determine the exact depth and scope of what was being taught. As a result of the 1997 accreditation site-visit, major curricular changes were required that included separating courses that had become consolidated and rewriting objectives, so that student achievement could more easily be determined. The changes resulted in a dental hygiene program, which resembled the original, pre-1996, curriculum structure. The dental hygiene faculty implemented some of these changes in the 1998 curriculum. The impact of the changes on students was reflected in the 1999–2002 NBDHE scores.

Another major event took place in 1998 when the NBDHE changed from having 400 multiple-choice questions to having 350 multiple-choice questions (with 150 of the questions in a case-based format). The purpose for changing the NBDHE to a case-based format was to be able to better assess the students' ability to critically think and problem solve in simulated patient scenarios (Kramer & DeMarais, 1997).

In an effort to better prepare students for this new testing format, the faculty in 1998 (a) required students to have a stronger human biology foundation by adding an additional semester of anatomy and physiology, and (b) required more critical thinking and problem solving within the curriculum by adding the concept of dental

hygiene diagnosis and requiring that students develop case studies. The addition of a second anatomy and physiology course is reflected in the 2000 NBDHE scores, and the addition of the concept of the dental hygiene diagnosis is reflected in the 2001 NBDHE scores. Major curriculum changes did not occur until 2001, due to the lengthy curriculum revision process. Such 2001 curriculum changes are reflected in the 2003 NBDHE scores. It is felt by the faculty that the effectiveness of the changes in the dental hygiene curriculum should result in improved NBDHE scores. A timeline of the changes and events for the dental hygiene program at Grand Rapid Community College is shown in Appendix A.

The initial step within the accreditation process for dental hygiene programs is to conduct a self-study. The first dental hygiene accreditation standard to be addressed in such a self-study is labeled "Institutional Effectiveness," and it states in part, "The program must demonstrate its effectiveness using a formal and ongoing planning and assessment process that is systematically documented . . ." (Commission on Dental Accreditation, 1998, p. 9). It is suggested in the self-study process that the outcomes assessment plan include an explanation of how the program uses the NBDHE results as part of the overall comprehensive assessment plan. The American Dental Association's Commission on Dental Accreditation suggests that dental hygiene programs use a data-driven system like "Plan, Do, Check, and Act," as explained in the ADA's *Outcomes Assessment* (Commission on Dental Accreditation, 1999).

A data-driven decision-making process and the use of outcomes assessments are not new to GRCC. In the early 1990s, a process called the systems approach to Continuous Quality Improvement (CQI) was made available to all interested departments at GRCC. Besides using the “Plan, Do, Check, and Act” concepts, CQI adds components such as goals, subgoals, stakeholders, and results to form an assessment framework that is comprehensive, interrelational, dynamic, and perpetual.

The GRCC dental hygiene program utilized the CQI process successfully in two previous projects. These two CQI projects were conducted to improve (a) the admissions process, and (b) the operation of the dental clinic. The CQI process, however, has not been used in GRCC’s dental hygiene program for outcomes assessment, even though it was successfully used in other areas. The incorporation of CQI principles and data-driven decision-making (using NBDHE data) into a potential outcomes assessment plan is one key aspect of this study.

Building upon the core elements of CQI, an expanded data-driven, decision-making model was created by the researcher and used in the development of the research questions for this study. This model that incorporates CQI principles and annual use of data from the NBDHE can be found in Appendix B.

Significance of the Study

One of the most important charges given to educators, especially those in higher education, is to employ the principles of data-driven decision-making in all areas. This is particularly important for proposed curriculum improvements.

Curriculum changes should be made using informed choices based on solid data. For maximum effectiveness and accountability, curriculum revision must be ongoing and continuous.

The data-driven model developed as a result of this study proposes that NBDHE results be used as an ongoing measure of outcomes assessment. Use of the NBDHE results within this model allows for curriculum decisions to be data-driven and not based solely on thoughtful decision-making as had occurred in the past. This study determined if there were significant correlations between GRCC's NBDHE scores and specific programmatic changes that had taken place over the last 6 years at GRCC, all of which had been made using the "thoughtful" decision-making process, not driven by data. The results of this study are intended to determine the validity of using a type of data-driven model in the future, by determining whether the previous curricular changes resulted in significant changes in the NBDHE scores.

This study examined two important aspects of student performance: how the GRCC dental hygiene graduates performed on the various NBDHE subject areas, and how NBDHE preparation strategies and preparation resources correlated with actual NBDHE scores. The subject area performance results will aid in making future data-driven curriculum and program decisions. The information gained from the student preparation strategies and resources aspect of this study will be used to assist future students with NBDHE preparation on an ongoing basis.

A third aspect of the study correlated program and/or curricular changes made over the last 6 years with the resulting NBDHE scores. The results of this study will

become part of an ongoing, comprehensive outcomes assessment plan at GRCC, which is a requirement for program accreditation (Commission on Dental Accreditation, 1998).

This study was needed because a thorough review of the literature found few studies and limited information on how the National Board Dental Hygiene Examination scores have been used as an outcomes assessment tool.

Conceptualization Framework

The conceptualization for this research study was developed using the “Plan, Do, Check, Act” assessment framework recommended by the Commission on Dental Accreditation (1999), combined with the general questions addressed in this research study. The three general questions to be addressed by this research study were as follows: (a) Could a correlation be made between improvement in subject areas scores on the NBDHE since 1998, and various curriculum changes? (b) Were certain subject areas giving students difficulty in achieving a passing score of 75% on the NBDHE? and (c) Was there a correlation between NBDHE preparation strategies and resources, and success on the NBDHE? The GRCC’s Dental Hygiene Program outcomes assessment plan using the National Board Dental Hygiene Examination (NBDHE) results is found in Table 1.

Table 1

**GRCC's Dental Hygiene Program Outcomes Assessment Plan Using
the National Board Dental Hygiene Examination (NBDHE) Results**

Plan	Do	Check	Act
Review results of the NBDHE	Match NBDHE overall and content area results with specific curriculum changes	Analyze NBDHE results to determine improvement relative to specific curriculum changes	Validate or reassess specific curriculum changes according to NBDHE results
Review results of the NBDHE	Determine content area failures ^a	Analyze areas that resulted in NBDHE failures	Determine and implement strategies to reduce the number of NBDHE failures
Administer the post-NBDHE Student Survey	Correlate student preparation resources and strategies used to prepare for the NBDHE with NBDHE scores	Determine strength of the correlation of preparation resources and strategies used to prepare for the NBDHE with NBDHE scores	Present results of correlation to faculty and to future students preparing to take the NBDHE

^aAn overall score $\geq 75\%$ is required to pass the NBDHE; therefore, a score $< 75\%$ is considered a failing score.

Research Questions

The research questions for this study were primarily developed to determine the effectiveness of previous curriculum changes through an examination of outcomes data, and to create a potential tool for an ongoing continuous curriculum improvement process. Question 1 addresses GRCC's NBDHE performance over the last 6 years as compared to the national NBDHE performance. Question 2 determines

if certain subjects were continuously causing students to fail the NBDHE by comparing passing scores with failing scores in all subject areas, (a passing score on the NBDHE is $\geq 75\%$). Question 3 focuses on three specific program changes that were made and compares GRCC's pre- and post-change scores with national NBDHE scores, as well to GRCC's own pre- and post-change scores.

Question 4 has a focus different than the first three questions and reviews student preparation strategies for taking the NBDHE. Question 4 is used to determine if a relationship exists between the use of particular preparation resources and preparation strategies and NBDHE scores. The specific questions are as follows:

1. How did the following National Board Dental Hygiene Examination (NBDHE) scores for Grand Rapids Community College's dental hygiene students compare to the average national NBDHE examination: (a) composite scores, and (b) scores segregated by subject area test components for the years 1998–2003?

2. What is the relationship between the performance on individual subject area test components for the following two groups of GRCC's dental hygiene students: (a) those who passed the overall NBDHE examination with a score $\geq 75\%$, and (b) those who failed the NBDHE with a score $< 75\%$?

3. How did the following specific curriculum changes in the dental hygiene program at GRCC impact NBDHE student performance scores: (a) the addition of one human anatomy and physiology course to the curriculum in 1998, (b) the addition of the concepts of dental hygiene diagnosis and case studies to the curriculum in

2000, and (c) the restructuring of the curriculum and the reinstatement of nutrition and preventive dentistry as separate courses in 2001?

4. What is the correlation between the NBDHE scores of the 2003 dental hygiene graduates and their use of various (a) NBDHE preparation resource materials, and (b) NBDHE preparation strategies?

CHAPTER II

LITERATURE REVIEW

Licensure and certification are required in many occupational areas to assess an individual's competency prior to entering a field of work. Licensure is a governmental function established to protect the public, and passing an examination is required in many professions in order for a person to practice. Certification, on the other hand, is a function of professional organizations and serves as a means of recognizing a predetermined level of competency (Bragg, 1994). Occupational education programs use licensure and certification exams as two methods for assessing outcomes in occupational areas. Detailed results from these two methods provide occupational programs with performance feedback, which is used to make program improvements. Federal legislation, such as the Carl D. Perkins Vocational and Applied Technical Act of 1990 as amended, requires extensive outcomes assessment reports as a requirement for continued funding of occupational education programs.

This study explored the benefits and uses of data-driven decision-making in the development and implementation of outcomes assessment plans in postsecondary occupational education, specifically within accredited dental hygiene programs. The literature review addresses the call for institutional effectiveness and accountability in education by examining various methods of evaluation. A specialized approach to

evaluation, which is called accreditation, was explored with an emphasis on occupational education programs, particularly dental hygiene program accreditation. The importance of using data, particularly data from licensure and certification examinations, in outcomes assessment of occupational programs is discussed in this chapter. Finally, the literature review provides examples of previous outcomes assessment studies.

Institutional Effectiveness and Accountability in Education

Effective assessment of student learning in higher education is driven by the need for accreditation, accountability, performance indicators, and funding sources. In higher education, learner outcomes are assessed in virtually all areas including the following: general education, transfer programs, career and occupational education, graduate programs, remedial and developmental courses. Student assessment is also expected in all three domains of learning: affective, cognitive, and psychomotor (Seybert, 2002). Unlike many initiatives and reforms in higher education that come and go, the assessment movement is being mandated in so many ways and from so many directions, that outcomes assessment is here to stay and is gaining momentum.

Morganstein (1990) writes that the need for outcomes assessment in higher education became increasingly important in the late 1980s, as a result of strong criticism of higher education. Morganstein noted that numerous organizations are also interested in the development of outcomes assessment, since outcomes are used in the

accreditation processes and in the development of various standardized professional tests.

Assessment in community colleges has similarities with 4-year institutions, with the exception that the scope of assessment in community colleges is much broader due to the diverse demographics of the students, as well as the diversity of programs that are offered (Seybert, 2002). Since the 1950s, occupational programs have assumed increasing importance in the mission of community colleges. In many community colleges, enrollment in career and occupational programs has equaled or surpassed that of the more traditional transfer programs (Seybert, 2002).

Measurement of occupational outcomes in community colleges is a requirement of federal and state legislation. Many occupational programs within community colleges are mandated through the accreditation process to use data and to have outcomes assessment plans in place. Prior to the development and implementation of an outcomes assessment plan, a thorough understanding and buy-in of the concept and purpose of outcomes assessment needs to take place within an organization, at all administrative and faculty levels (Grimes, 1999). These assessment plans begin with a thorough program evaluation. Once outcome assessment plans are developed, a major problem a plan may encounter is that the plan is not followed uniformly and/or consistently. Grimes goes on to say outcomes assessments are valuable only to the degree that the results are utilized to foster program improvements and to identify problem areas in need of review and revision.

Evaluation

Overview of Evaluation in Education

Occupational education programs have traditionally measured student economic outcomes such as job placement, earnings, occupational competence, program retention, and completion. According to Brown (1997), the Carl D. Perkins Vocational and Applied Technology Act of 1990 increased the scope of evaluation to include all three domains of learning (cognitive, psychomotor, and affective) and all levels of learning within Bloom's taxonomy. Inger (1995) proposed that occupational education assessment do more than just examine student outcomes, by requiring valid and reliable information regarding programs needs from students, employers, and society.

Program evaluations, like those required for accreditation purposes, are holistic in the manner that a program is examined, but many program evaluations are not supported with data to make to the process continuous. The various methods of outcome assessments serve as diagnostic tools to determine the health of a program. All aspects of an educational situation should be examined in order to ascertain what is working well, where, and how improvements need to be made. The fact remains that few curricula are actually subjected to rigorous, systematic assessments.

According to Finch and Crunkilton (1999), the reason that this type of assessment is lacking is quite simple. Educators often feel they do not have the time, the expertise, nor the inclination to carry out the type of comprehensive assessment

that is actually needed. Unfortunately, few realize that an assessment does not have to take up much time. In fact, much of the curriculum development work that is already taking place can easily be part of an assessment effort, if meaningful standards and measures are used, and if data are collected, analyzed, and applied to program improvements. Data should drive the process (thus the term *data-driven*). Therefore, the data used in the process of evaluation should ensure that the evaluation process is continuous. The key aspect of successful evaluation systems is data, because the continuous evaluation and use of data will drive a program to new heights (Schmoker, 1996).

Evaluation is perceived by many in education to be an activity that comes periodically in conjunction with accreditation procedures. Outcomes need to be explicit in order to be fully assessed. Curriculum evaluation has to be an ongoing activity—one that is planned, conducted, and evaluated using data in a systematic, continuous manner. Finch and Crunkilton (1999) further state that attitudes regarding outcomes assessment must change. Administrators and instructors must all recognize the value of assessment and integrate assessment efforts into ongoing curriculum development activities.

A combination of evaluation approaches may be conducted to achieve the best results. For these approaches to be effective, they must build in a data collection piece and be data-driven. The various methods require that the evaluator(s) develop the criteria and evaluation mechanisms. A variety of methods of evaluation should be

explored, as institutions examine their own particular needs, in the areas of outcomes assessment and academic planning.

Worthen, Sanders, and Fitzpatrick (1997) present an entire spectrum of program evaluations with several transition methods of evaluation in between. Worthen et al. state that the best and most thorough evaluations are conducted by using both quantitative and qualitative evaluation methods. The various methods are presented as a continuum from objective-oriented approaches at one end of the spectrum to qualitative (also called subjective or naturalistic) approaches at the other end. The use of a combination of methods is called triangulation and is defined as the practice of comparing results from various types of data. Triangulation is designed to measure the same construct, but the data are collected from different sources using different methods to increase certainty about the validity of the construct. There is strong support in the literature for the use of multiple evaluation approaches. Finch and Crunkilton (1999) believe that if curriculum assessors are to be truly effective, they should understand both quantitative and naturalistic techniques, have a broad perspective about assessment, and focus on the real concerns of the audiences.

Worthen et al. (1997) write that there are two basic, overlaying distinctions in evaluation that need to be considered prior to conducting an evaluation. These differences include whether the role of an evaluation is meant to be formative, used in making program improvements, or summative, used to determine a program's worth or merit, and whether the evaluation should be carried out internally or with the use of an external source. Worthen et al. also feel that the stakeholders, the various

individuals, and groups of people affected by the program being evaluated need to be identified prior to the start of an evaluation. The characteristics of the stakeholders will have a strong bearing on the method of evaluation that is used. Once these issues are decided, an evaluation can begin.

Five methods of evaluation are examined: objective-oriented, management-oriented, consumer-oriented, Total Quality Management (TQM), and expertise-oriented. The first four methods are considered quantitative or objective-based methods of evaluation. These methods are presented along with examples of their exemplary application to education.

The last method of evaluation is the expertise-oriented approach, which is considered to be more in the realm of a qualitative evaluation. These evaluation methods were chosen because they have components that would fit into a comprehensive evaluation system or model, which is required for accredited occupational educational programs.

The Objective-Oriented Approach to Evaluation

The objective-oriented approach to evaluation is based on the use of goals and objectives in determining to what extent they have been obtained (Worthen et al., 1997). This method of evaluation was initially credited to Ralph W. Tyler and was referred to as the Tylerian evaluation approach. Variations of the original approach are commonly used today in occupational education. One example is the use of behavioral performance objectives, which are very specific and written for every

course. These performance objectives are presented at the beginning of a class and include the method and the acceptable attainment level for each objective. In recent years community colleges are moving away from performance objectives to outcome statements in an effort to broaden the scope and level of learning. The objective-oriented approach to evaluation approach is often used in occupational education programs, because most accrediting agencies require that programs formally state their program goals and show how the goals are attained. Data to back up goal attainment are not necessarily a requirement of this approach.

The Management-Oriented Approach to Evaluation

Stufflebeam developed a model where the context of a situation, the inputs, the processes, and the products all require examination and evaluation (Stufflebeam & Shinkfield, 1985). This method of evaluation is called the CIPP model, which stands for context, input, process, and product. Finch and Crunkilton (1999) support the CIPP method of evaluation for education. They say these four elements are essential to a comprehensive program development and evaluation because the areas of curriculum planning, development, operation, and refinement are all covered in the CIPP model. The context aspect of the CIPP evaluation model assists with planning decisions by helping to determine what needs will be addressed by a program, which in turn leads to defining objectives for the program. The input section of the CIPP model assists with structuring decisions and facilitates the design of program procedures. The process part of the model analyzes the procedural and the

implementation aspects of evaluation, which allows for monitoring, controlling, and refining of procedures. The product evaluation section is the last aspect of the model. In product evaluation, the evaluation questions pertain to program attainment. In other words, did the product that was originally planned turn out just like it was planned?

Finch and Crunkilton (1999) explain that the CIPP model should be taken to a new dimension by including four levels of assessment. These levels are reaction, learning, behavior, and results. For the purposes of this study, the fourth level, results, is where the focus should be because it is at this level that outcomes of a curriculum are examined. Finch and Crunkilton say that the results level should review, for example, the percentage of practical nursing program graduates who pass the state examination on the first attempt and/or the scores they receive. This information further supports the need for this study and the use of an evaluation model such as the CIPP model, emphasizing the use of data to drive the process.

In this evaluation approach, an educational institution would determine the goals, make a plan to accomplish the objectives, implement the plan, evaluate the product, and assess the outcomes to determine if the outcomes met original goals. Therefore, this approach is highly applicable to education and parallels the desired results of most educational programs.

The Consumer-Oriented Approach to Evaluation

Another evaluation method, developed by Scriven (1991), is called the consumer-oriented approach. This method is different from the previous objective-based methods, because it also takes the human service aspects into consideration. Since education is all about human services, this approach needs to be considered in a comprehensive outcomes assessment plan.

Scriven (1991) incorporated the concepts of formative versus summative evaluation. Formative evaluation is conducted to provide program staff with evaluative information useful in improving a program. Summative evaluation is conducted and made public to provide program decision-makers and potential consumers with judgments about a program's worth or merit in relation to important criteria. Both formative and summative evaluations are necessary for the improvement of outcomes. The application of aspects of this approach to occupational education can be readily seen, but there is an absence of collecting and monitoring data to be used for the continuous improvement of the evaluation process.

The Total Quality Management Approach to Evaluation

Total Quality Management (TQM) is another model of program evaluation that fits nicely into the educational arena. TQM is the first objective-based method that requires the use of data. TQM appears to be a blending of the management-oriented and the customer-oriented approaches to evaluation. TQM primarily focuses on customer satisfaction by studying the input, process, and output of systems. TQM

principles are followed in an effort to make programs run more efficiently and effectively. Efficiency, effectiveness, and the data-driven aspect of this method would benefit occupational education, and academic education, in general.

TQM originated with the work of W. Edwards Deming. Deming focused on organizational efficiency in the corporate world, specifically in manufacturing. TQM is viewed as a systems approach to problem-solving and is data-driven. Deming's TQM method uses data, compiled through multiple and systematic methods, to evaluate effectiveness and develop the means for improvement. Deming believed that workers closest to the job knew best what problems existed, and the workers also had the best vantage point to recommend changes (Schmoker & Wilson, 1993).

TQM principles fit nicely into the educational arena for two specific reasons. The first reason is that education is always looking for ways to be more effective in its output in the least costly, most efficient way. A second reason that TQM fits nicely into education is that it offers a positive solution to dealing with the difficult problem of instituting change. When the workers are recognized as stakeholders, they become empowered to make systems work more effectively and efficiently and are far less resistant to change (Worthen et al., 1997).

One successful example of the use of TQM principles can be applied to dental hygiene programs at Grand Rapids Community College. The goal was to improve student-patient experiences by reducing patient "no-show" appointments in the dental hygiene clinic. Since TQM principles require decisions to be data-driven, detailed patient attendance data were collected over the course of a month. The data were

charted on a Pareto chart to determine if there was a difference in attendance at the various clinic times. The staff conducted an analysis of the charts, and it was determined that early morning clinics had the greatest "no-show." This "no-show" rate had many reasons and it was ascertained that the best solution was to change the morning clinics to afternoon clinics. The changes were made accordingly and the number of patient no-shows decreased dramatically. Projects like this one can be applied to all aspects of program assessment. Business and industry have led the way in the implementation and use of the objective-based methods of evaluation. Objective-based methods of evaluation are now being applied to education with exemplary results. Objective-based evaluation approaches are all data-driven and that contributes to their tremendous success.

To enhance the use of objective-based evaluation approaches, awards, prizes, and registrations have been developed and are already in place. Three examples include the Malcom Baldrige Quality Award, the Deming Application Prize, and ISO 9000 Registration. According to Brown (1997), when comparing quality standards for business and occupational education, two common themes are evident: (1) assessment of standards for learning and performance (for students and employees), and (2) assessment of education/management process and design (schools and business/industry). All three of these examples provide criteria and offer blueprints for assessing quality in occupational education, and all use data to drive their systems, but they each have a slightly different focus.

The Malcom Baldrige Award has seven criteria that need to be addressed, but it has customer service as its primary goal. The Deming Application Prize uses statistical methods to determine the achievement of standards relating each of Deming's 14 quality principles. The focus of the ISO 9000 Registration is on the quality of an organization's systems and whether the systems are consistently used and followed (Brown, 1997).

These awards provide evidence that the business world continues to focus on the process of program evaluation and that it incorporates a multiplicity of approaches to suit its needs. Education can follow the lead of business by adopting, or adapting, and utilizing the various business evaluation systems already developed (Brown, 1997). Outcomes assessment is an essential diagnostic component of program evaluations. Understanding the benefits and uses of various types of outcomes assessment is essential prior to the development of a program's individualized evaluation plan.

The Expert-Oriented Approach to Evaluation

According to Worthen et al. (1997), the expert-oriented approach to evaluation is qualitative in nature and depends primarily on the direct application of professional expertise to judge the quality of whatever endeavor is being evaluated. Worthen et al. state that this method of evaluation is probably the oldest, most widely used and differs greatly from the objective-based methods, because of its open reliance on subjective professional expertise as the primary evaluation strategy.

Usually one person will not possess the knowledge to do a comprehensive evaluation, so a team of experts is more likely to complete this type of evaluation.

Expert-oriented evaluation is a component of a formal professional review system called accreditation. For example, in the ADA accreditation process, a team of experts who conduct the site-visit use the accreditation standards as the basis to determine if objectives are being met to an acceptable level. This approach combined with an extensive self-study of a program based on a set of profession specific standards.

Accreditation—A Specialized Approach to Evaluation

According to Worthen et al. (1997), accreditation is the process whereby an organization grants approval of institutions and/or programs within an institution. According to Bogue and Saunders (1992), accreditation benefits institutions and students in several ways. Accreditation serves institutions as a stimulus for periodic self-evaluation and continuous improvement. It also enhances the institution's reputation, because of the high regard for accreditation. Accreditation is required by many postsecondary occupational programs in order for program graduates to become licensed and/or certified. Accreditation also benefits students by assuring them that the accredited institutions and/or programs will meet their educational needs at the institution and beyond.

Education is not the only profession that uses the accreditation process to determine and regulate the quality of its institutions. Worthen et al. (1997) state that

beginning in the late 1800s, national and regional accreditation agencies started evaluating education in the United States, using a system that was borrowed from Western Europe. By the 1930s, educational accreditation in the United States became a strong force. Parallel efforts for the accreditation of other professions, such as medicine and law, were simultaneously taking place.

In regard to assessing student competence in accredited disciplines, regional and disciplinary accrediting agencies may be the most stable and thus powerful external sources of pressure for assessment (Palomba & Banta, 2001). This pressure increased in 1988 when then Secretary of Education William Bennett issued an executive order requiring accrediting agencies to include criteria requiring documentation of student achievement for degree granting institutions. The threat of losing federal funding caused many accrediting agencies to revise their criteria to include a focus on programs outcomes. According to Palomba and Banta (2001), amendments to the Higher Education Act of 1998 further enforced the executive order of 1988. In an effort to encourage the implementation of outcomes assessments, many accrediting agencies offer their constituencies assistance in meeting the new requirements.

The need to incorporate outcomes into program evaluation was a philosophical change for many programs, including health professions. As one example, up to the point of the new outcomes assessment requirements, nursing programs ran on a system of internal accountability where it was assumed that programs yielded desired results. It was a major change in the perspective of nursing

educators to have to now prove outcomes to an external source (Palomba & Banta, 2001). This paradigm shift also took place in dental hygiene programs.

Dental Hygiene Program Accreditation

Outcomes assessment, as stated earlier, has become an important focus of most accreditation agencies. Dental hygiene accreditation is no exception, and in the last revision of their accreditation standards, assessment was placed in the beginning of the first standard. In 1989, Dinham conducted a study to show the connectedness between assessment, accreditation, and licensure. In this study she discussed how these three entities, if tied together properly, should complement each other. As a result of her study, Dinham found that the connectedness between assessment, accreditation, and licensure is often lacking or conflicting, making it difficult for educational program to know which direction to follow.

Licensure is a requirement for entrance into many professions and is a requirement to practice in health occupations, such as nursing and dental hygiene. Applicants for dental hygiene licensure must prove that they have graduated from an accredited institution before they are allowed to sit for the National or State Board exams (Michigan Board of Dentistry, 2000).

The American Dental Association's (ADA) Commission on Dental Accreditation is the regulatory body for dental hygiene. Since 1952, all dental hygiene programs have participated in an accreditation process to ensure adherence to a predetermined set of national standards. These accreditation standards are reevaluated

on a 5-year schedule (Commission on Dental Accreditation, 1995). Outcomes assessment has become a very important aspect of the accreditation process, especially in the case of dental hygiene and will be discussed in the next section.

Outcomes Assessment

Overview of Outcomes Assessment

Assessing outcomes is the process of systematically collecting information about the attainment of an academic endeavor. It is different from previously mentioned forms of evaluation because outcomes assessment serves as a piece of the evaluation process. Feldman and Desjardins (1995) state that educational institutions should implement a formalized outcomes assessment process to validate existing efforts and make recommendations for program improvements and planning and for use in accreditation.

Successful occupational education assessment programs develop comprehensive plans of assessment that include a variety of measures, which are internal and external, direct and indirect, simple and complex (Seybert, 2002). The Commission on Dental Accreditation (1999) observed that successful programs treat assessment as an ongoing process and that the successful programs used data in planning and decision-making.

According to Dinham (1989), outcomes assessment in professional schools is more promising than most academic situations because the faculties are accustomed to the rigors of periodic accreditation review. In addition, Dinham said that

professional schools have the advantage of a more tangible audience beyond the school's door, that of the practicing professional community. In her 1989 study, Dinham also referred to the possible use of certification and licensure information as an attractive possibility for broadening the assessment base.

In the early 1970s, the Commission on Dental Accreditation began to focus on the outcomes/results of the education process, as well as the process itself. The Commission on Dental Accreditation (1998), in the *Accreditation Standards for Dental Hygiene Education Programs*, provides criteria for what is considered an acceptable assessment plan. The document says that the intent of Standard #1 labeled "Institutional Effectiveness" is to ensure that an evaluation system is broad-based, systematic, and continuous. This standard is designed to promote the achievement of program goals to maximize student success. The accreditation process is very comprehensive, and outcomes assessment is a very important aspect of dental hygiene accreditation.

Data-Driven Decision-Making in Outcomes Assessment

According to Finch and Crunkilton (1999), contemporary curriculum cannot function properly unless it is data-based. For curriculum to function properly, a variety of data and data collection methods should be used and must be built into a curriculum. Furthermore, the data must be continuously monitored and analyzed to determine if goals and objectives are being met. Decisions about curriculum should be made after the variety of data is gathered and examined. Finch and Crunkilton state

that the cycle is complete once the curriculum is adjusted according to the findings. Finch and Crunkilton further state that educators neglect using data to make curriculum decisions, because the relationships that should exist between data and curriculum are not fully understood. Therefore, the quality of curriculum and the ability to make curriculum dynamic suffer.

Schmoker (1996) states, "If we look at Deming's 'Plan, Do, Study, Act' (PDSA) cycle, we can see that (as educators) we do, do, do, but seldom study" (p. 31). Schmoker says it is not unusual to find teams of educators that concentrate almost solely on the "do" phase by generating solutions to a problem without considering the plan, study, and act steps. He goes on to say that we fail to examine data that can guide us to act and then wonder why we do not get the results we desire. According to Schmoker, consistent use of the PDSA cycle will aid in both team learning and team problem-solving.

The Commission on Dental Accreditation (1999) states that a successful outcomes assessment process needs to be consistent with the four aspects of continuous quality improvement, which are: Plan, Do, Check, Act. The Commission on Dental Accreditation says that the entire process should be data-driven and the mechanisms for data collection should be incorporated in the "Plan" phase. These built-in quantifiable measures enable the data to be collected during the "Do" phase in an ongoing and systematic manner. The data are subsequently analyzed during the "Check" phase to help determine a program's strengths and deficiencies. Finally, the results of this process and analysis are used in the "Act" phase to implement the

identified corrective measures in order to strengthen the program. The Commission on Dental Accreditation does not require that a program use this method of assessment, but the Commission does say that “whatever process best fits your program must be ongoing, a longitudinal collection of data, and a comprehensive and systematic assessment of the outcomes of your program and the results of the assessment must be used” (1999, p. 7). Table 1 (page 12) and Appendix B were developed for the conceptualization of this study and both use the Plan, Do, Check, and Act method of outcomes assessment.

Methods of Outcomes Assessment

Various methods and uses of outcomes assessment are used in occupational education. Improved assessment measures are being continuously developed. Among the most commonly used and effective methods of outcomes assessment are surveys of alumni, students, employers, and clinical sites (Seybert, 2002). Examples of outcome assessments provided by an institution might include student grades, program completion rates, job placement rates, and success rates of graduates on state licensing examinations, national boards, and certification exams. Outcome information from state labor departments often includes employment, wage, and salary data. More complex, educationally based assessment methods include detailed results of external evaluations (licensing, certification, and national board exams), and validity connections that are made between external evaluations and internal grades/assessments. The previous assessment methods are worthwhile only if they are

conducted to provide diagnostic data, which in turn, are used to improve programs (Grimes, 1999).

*The Use of Licensure and Certification Examination Results
in Outcomes Assessment*

Colleges and universities were initially affected when the Manpower Development and Training Act of 1962 required that licensure in certain professional occupations be coupled with graduation from an accredited university program (Lenn, 1987). Licensure exams are widely used to protect the health and welfare of the general public. The difference between licensure and certification is that licensure is a governmental function, but certification is a function of professional organizations. In some medical occupations such as nurse aides, dental laboratory technicians, and dental assistants, where licensure is not required, certification is a means of recognizing a predetermined level of competency (Bragg, 1994).

According to Bragg (1994), there are two main functions of licensure examination results in assessment: student outcomes assessment and program assessment. The data obtained from these results can also serve as an important part of a system that provides uniformity and curriculum consistency among similar programs at various postsecondary institutions.

Bogue and Saunders (1992) stated that licensure is a form of quality assurance that may go relatively unnoticed as a means for colleges and universities to evaluate program quality. On the other hand, Bogue and Saunders stated that there are dangers in relying too heavily on the licensure results. Further, there is evidence in

some professions, such as law, that supply and demand may affect the tightening or loosening of the standards for the examinations. Shifting standards, which are out of the control on institutions, lead to a questioning of the reliability and validity of the use of licensure examination results in outcomes assessment. The Joint Commission on National Dental Examinations (2003b) goes to great length to prove the validity and reliability of the NBDHE by publishing *Technical Report—The National Board Dental Hygiene Examination*. It appears that this 55-page report supports the integrity of the NBDHE in a very detailed manner.

Dinham (1989) wrote that some of the licensure and/or certification results are worth using as a data source and some are too ambiguous to be worthwhile. Dinham noted specific criteria that should be considered prior to using licensure and/or certification results as part of an outcomes assessment plan. According to Dinham, licensure and/or certification results should be used only if the requirements for taking the examinations are consistent among all candidates, the information supplied to the schools can be tied to particular candidates, and the results are reported by subject area. Bragg (1994) stated criteria very similar to Dinham, when he wrote that the extent to which the results of licensure and certification exams are useful is directly proportional to the detail that is provided in the feedback. If the detail is explicit and reported categorically and/or individualized according to each student, it can serve as a great measurement of outcomes. This type of detail is true of the National Board Dental Hygiene Examination results.

The Application of Outcomes Assessment in Dental Hygiene Programs

The National Board Dental Hygiene Examination and Results

According to the Joint Commission on Dental Examinations (2003b), in *Technical Report—The National Board Dental Hygiene Examination*, the purpose of the NBDHE is to measure whether a candidate possesses what, in the judgment of experts, is an entry-level of knowledge adequate for the competent practice of a dental hygienist. The report goes on to say that this knowledge includes the ability to recall and apply pertinent information in a problem-solving context. The report contains the specifics regarding the development, administration, and scoring of the NBDHE. Issues of validity and reliability are also thoroughly covered. The NBDHE is accepted by all licensing jurisdictions. Along with the push from the ADA's Council on Dental Accreditation for more comprehensive outcomes assessment in the accreditation process came a major change in the 1998 National Board Dental Hygiene Examination (NBDHE). The NBDHE is administered by the Council on Dental Education of the American Dental Association (ADA) and is required for dental hygiene licensure. The NBDHE went from an 8-hour, 350 (stand-alone) multiple-choice question exam, to one where the morning section is 200 (stand-alone) multiple-choice questions and the afternoon section of the exam is a case study format, with 150 multiple-choice questions.

The new format of the NBDHE was said to enhance the validity of the dental hygiene examination in three ways. By using a case study format, a candidate's ability

to use critical thinking is now evaluated. The second change in the exam assessed the candidate's ability to use and apply knowledge in a patient-centered setting. The third change involved incorporating basic science information, as it relates to patient treatment (Kramer & DeMarais, 1997).

The new case-based format of the National Board Dental Hygiene Examination was viewed as a positive change and a great stride towards determining if dental hygiene graduates are truly competent. This improvement forced programs to incorporate higher order teaching/learning in the form of real-life application, analysis, and critical thinking. The case-based format has been utilized in nursing educational programs for quite some time and is currently used exclusively in nursing licensure exams (Rane-Szostak & Robertson, 1996).

The results of the NBDHE are a rich source of data that should be included in a comprehensive outcomes assessment plan (Commission on Dental Accreditation, 1998). The explicit exam results of each accredited program are reported to the respective program, for each student in that program, each time the exam is given. The results are reported for each of the 13 categories according to the number of items in each category and how each student performed in the respective categories. A comparison of national averages and an individual college's averages for the various categories is provided to each accredited dental hygiene programs, as well as that college's national standing among accredited dental hygiene programs.

Up to two instructors from each institution can schedule a trip to the ADA, where they can view the most recent NBDHE. The selected instructors can also

request to have an item analysis to see how their particular school scored on each item, as well as the national average for each question.

It is required for a dental hygiene graduate to pass the NBDHE in order to receive a license to practice dental hygiene. The Joint Commission on Dental Examinations provides every accredited dental hygiene program detailed subject-area results of the NBDHE performance. Furthermore, the Commission on Dental Accreditation suggests that dental hygiene programs use board results as an aspect of a comprehensive of outcomes assessment plan. Therefore, it only makes sense that dental hygiene programs should use the results as of the NBDHE as formative and summative measure of performance.

Dental Hygiene Accreditation Outcomes Assessment Standard

Since 1988, outcomes assessment has been of growing importance to the ADA's Commission on Dental Accreditation Dental Hygiene Accreditation Standards. The ADA's first dental hygiene outcomes assessment accreditation standard entitled Standard 11: Assess Outcomes became effective in 1988 (Commission on Dental Accreditation, 1988). This standard mandated that dental hygiene programs regularly and formally evaluate the degree to which their program goals were being effectively met. Subsequently, in 1995 the American Dental Association's Commission on Dental Accreditation revised the standard, calling it Standard 12: Outcomes Assessment (Commission on Dental Accreditation, 1995).

This standard required an even more substantial and directive criteria to assess outcomes.

In 1998 the ADA completed a major revision of the accreditation standards, which became effective in July 1, 2000. The dental hygiene accreditation standard decreased the number of standards from 12 to 6. With the latest change, the outcomes assessment standard became part of the Dental Hygiene Accreditation Standard 1, Institutional Effectiveness and is section 1-1, called Planning and Assessment (Commission on Dental Accreditation, 1998). The requirement of outcomes assessment has matured in the area of dental hygiene education. It is obvious from comparing the standards over the last three revisions that the expectation is that outcomes assessment must be substantiated and intrinsic in everything that is taught in dental hygiene programs.

During the 1980s the federal government mandated the increased requirements for effective outcomes assessment. The ADA's Commission on Dental Accreditation followed the federal government's lead and increased the outcomes assessment expectations through inclusion in the accreditation standards. Outcomes assessment and expectations require that a continuous, usable outcomes assessment system should be in place for all accredited postsecondary programs, including dental hygiene programs.

Dental Hygiene Programs Outcomes Assessment Studies

In a 1989 national survey of outcomes assessments used within dental hygiene programs, conducted by Betty Oliver Smith, found that 97% of the respondents used the NBDHE results as means of outcomes assessment. Survey respondents in this study noted that the data obtained from the NBDHE were used for program improvement (91%), program planning (86%), accountability (60%), and budget decisions (32%). A few respondents noted that such data were also tied to funding. Smith's survey also reported the following areas as changed because of the NBDHE data: curriculum revision (80%), future program planning (70%), and, to a lesser degree, additional assessment measures, and remedial assistance (Smith, 1989).

However, a study by McCann and Schneiderman (1995) of dental hygiene program directors showed that the directors were less than satisfied with their assessment practices and how they used their assessment data. The directors responded that about 75% used alumni and employer surveys, over 50% used curriculum surveys by students, and over 33% used patient satisfaction surveys and performed student exit interviews. Program directors were asked the number of assessment instruments they used and the response was as follows: 9% used more than five, 59% used between five and three instruments, 24% used two or one, and 8% used no assessment instruments. Finally, when asked how the programs utilized data received from their assessment instruments, the response was as follows: 84% for curriculum revision, 76% for future planning, 56% for reporting purposes, 26% for adding assessment measures, 25% for institutional remediation, 22% for gaining

resources, 15% for increasing budget, 11% for increasing class size, and 11% for gaining more faculty.

McCann and Schneiderman (1995) concluded from their study that program directors know program assessment is required as part of the accreditation process, but that the program directors do not know how to fully use such data to improve their programs. As seen from the results of the McCann and Schneiderman study, most of the program directors surveyed are using assessment instruments. However, they are using the instruments and applying the results incorrectly—in areas not directly connected with those instruments and the data they reveal.

Grimes (1999), in a study of 22 dental hygiene program directors, found that every dental hygiene program in the country had been through at least one accreditation self-study and accreditation site-visit, so they were all familiar with the outcomes assessment expectations and standard. Grimes' study concluded that directors were increasing their use of outcome assessments and were more comfortable with using assessments to improve program effectiveness. The Grimes study showed that programs directors are moving towards using multiple measures of outcomes assessment. The most commonly used methods in this study were: alumni surveys (95%), results of the NBDHE and other licensing exams (86%), employer surveys (64%), student exit interviews (59%), patient satisfaction surveys (55%), and faculty/course evaluations (41%). There was no mention as to how the NBDHE results were utilized, just that the results were used as an outcomes assessment measure.

Grimes' 1999 study showed that the information obtained from assessments was being used most often to make program improvements and to demonstrate accountability. The program directors said that policy and faculty/administrative support were essential to successful implementation of needed changes. The program directors also said the time required to carry out a thorough assessment program is definitely a drawback to implementation. According to Grimes (1999), several program directors reported that they appreciated the fact that the outcomes assessment accreditation standard facilitated a continual process of summative and formative evaluation.

Grimes (1999) stated that previous outcomes assessment measures focused on the requirements of external sources rather than on the internal academic environment. She also noted that programs are starting to place more emphasis on program improvement, which focuses on student success. It was found that a student success approach is more costly, time-consuming, and controversial, but is also described as more productive for a program. Grimes concluded the report of her study by stressing the benefits of outcomes assessment and the need for more research and training for staff in this area.

Overall, the findings of McCann and Schneiderman's 1995 study indicated a positive trend in terms of the implementation of assessments, but no mention was made of using the data from the NBDHE as an assessment tool. The lack of mention of the use of NBDHE in the 1995 study is intriguing because in the prior study by Smith (1989), 97% of the respondents said they used the NBDHE results as a means

of outcomes assessment. In the study by Grimes (1999), the use of the NBDHE results was reported by 86% of the respondents, but she also mentioned that the outcomes assessment emphasis was shifting from external to internal measures of evaluation.

Summary

“Teaching influences learning, learning influences outcomes, and assessment of outcomes is used to influence/improve teaching and ultimately learning. Awareness of this inter-relationship illustrates the critical utility of outcomes assessment” (Commission on Dental Accreditation, 1999, p. 1). This statement makes outcomes assessment seem so simple, yet to truly be successful, outcomes assessment must be interwoven into the fabric of a program. A successful assessment program needs to be consistent with the principles of academic planning and steps of continuous quality improvement, which includes four key pieces: plan, do, check, and act. An outcomes assessment system must be individualized to fit the particular program, ongoing to include longitudinal data, comprehensive, and systematic to assess outcomes of the particular program and utilize that information to improve the educational process.

Evaluation of educational outcomes serves to identify strengths and weaknesses, highlight the good, and expose the faculty to areas that need improvement, but it cannot single-handedly correct problems (Worthen et al., 1997). Data also can be used to show us when, where, and how we are progressing, so that we can continue to progress. In education, the success of evaluations or assessments

lies in the use of the results to improve teaching, learning, and the delivery of services to students.

There is a limited amount of research regarding the use of data from licensure exams for programmatic improvement. Data-driven decision-making gives creditability to occupational programs' outcomes assessment plans, which are a requirement for accreditation.

A review of the literature produced few studies that discuss the use of the NBDHE as a wealthy source of outcomes assessment data, nor how other programs use these data to evaluate programs or curriculum. Although some studies found that many program directors report using such data, other studies found no evidence that this actually occurs.

CHAPTER III

RESEARCH METHODOLOGY

Overview of Research Methodology

Accreditation requires dental hygiene programs to develop comprehensive, continuous outcomes assessment plans whereby program and course outcomes are evaluated in multiple ways. One means to assess such outcomes, suggested by the Commission of Dental Accreditation, is the use of National Board Dental Hygiene Examination (NBDHE) results (Commission on Dental Accreditation, 1998). NBDHE subject area results and individual dental hygiene student results are sent to the respective schools whenever the NBDHE is administered.

This study examined NBDHE results from 1998 to 2003 program to answer four questions:

1. How did GRCC's dental hygiene program perform on the NBDHE compared to the national NBDHE averages?
2. Did any subject areas consistently lower GRCC's NBDHE scores?
3. Did curriculum changes in Grand Rapids Community College's dental hygiene program impact NBDHE scores?
4. Does a correlation exist between NBDHE scores and particular preparation resource and/or preparation strategies?

A description of the research methods, participants, data collection procedures, methods of data analysis, and limitations of this study are included in this chapter. A review of the literature revealed a few previous studies in which outcomes assessments were used in dental hygiene programs. However, nowhere in these previous studies was there a specific discussion of how the NBDHE results were being used as a means of outcomes assessment. Therefore, this study is unique and desirable in that it specifically used the NBDHE results (a) to determine if certain subject areas were consistently causing students to score low and/or fail the exam; (b) to evaluate program or curriculum changes; and (c) to determine what, if any, student preparation strategies and/or preparation resources enabled students to perform better on the NBDHE.

Research Data

Two sources of data were used in this study. The first source of data was the NBDHE results, for years 1998–2003. The Joint Commission on National Dental Examinations sends the respective dental hygiene programs the NBDHE results every time the NBDHE is conducted. The performance results include sections of data regarding: (a) the performance for each student in all 13 subject areas of the NBDHE, (b) the performance of the respective dental hygiene program as a whole, and (c) how the respective school performed against the national average. The results from the NBDHE were used to address each question posted for this study.

The second source of research data used for this study was a student NBDHE feedback survey, which can be seen in Appendix C. This survey was developed by the researcher, building upon an open-ended survey that had been used for the last 15 years in the dental hygiene program at Grand Rapids Community College. The newly developed survey is quantitative and uses a Likert scale, unlike the previous survey that used only open-ended questions and therefore was difficult to quantify.

A Likert scale is a measurement scale consisting of a series of statements followed by five response categories, typically ranging from strongly agree to strongly disagree (Ary, Jacobs, & Razavieh, 1996). The Likert scale options used in this survey on the resources and the preparation strategies students used to prepare for the NBDHE were derived from the last 15 years of responses to the initial survey used. The survey's Likert scale used five intervals with 1 = extremely beneficial, 2 = very beneficial, 3 = somewhat beneficial, 4 = not beneficial, and 5 = did not use. The data set from this survey was matched up with the NBDHE scores of the respective individual students to determine if a correlation existed between the study methods and resources utilized, and a student's respective NBDHE scores.

Supportive information used in this study included: documentation of faculty minutes, the 1999 GRCC Dental Hygiene Accreditation Self-Study, the accreditation site-visit response, and GRCC annual catalogues. These activities were used to identify specific programmatic and curricular changes. The NBDHE results were correlated with the years that specific GRCC dental hygiene program changes took place.

Human Subjects Institutional Review Board Approval

Western Michigan University's Human Subjects Institutional Review Board (HSIRB) approved the procedures, protocol, and methodology used in this study on May 27, 2003. For the first data set (i.e., the NBDHE scores), HSIRB protocol did not require written consent since the existing database did not contain students' names. For the student survey, written consent was received from all 32 participants of the 2003 National Board Dental Hygiene Examination survey. Copies of (a) the informational letter that accompanied the consent form and the consent form itself, and (b) the approval letter from WMU's HSIRB can be found in Appendix D and Appendix E, respectively.

Validity and Reliability

The validity and reliability of the National Board Dental Hygiene Examination is addressed in the booklet titled, *Technical Report—The National Board Dental Hygiene Examination* (Joint Commission on Dental Examinations, 2003b). According to this report, "validity refers to the degree to which logic and evidence support the use of test scores for making pass/fail decisions affecting candidates for Dental Hygiene licensure" (p. 1). This booklet is entirely devoted to addressing the issues of validity and reliability of the NBDHE. The Joint Commission on Dental Examinations states that the following organizations provide annual reports and standards for high stakes tests, which continue to be the main source of validity evidence for the NBDHE: (a) the American Educational Research Association, (b) the American

Psychological Association, and (c) the National Council on Measurement in Education. According to the Joint Commission on Dental Examinations (2003b), reliability refers to the consistency of test scores under repeated conditions. Perfect reliability of test scores produces a score reliability coefficient of +1.00, and the NBDHE average coefficient from 1998–2002 was +.896, which is considered highly reliable.

According to Ary et al. (1996), the characteristics of a good survey include: (a) that it is representative of the entire population; (b) that it is objective so that the responses are explicit; (c) that the survey be administered systemically; and (d) that it is quantifiable, so that the data can be expressed numerically. The survey used for this study fits all of the criteria for an acceptable survey with one exception. Since this is the first time this survey was conducted in a quantifiable form, it cannot be considered systemically administered even though it was carefully planned and executed.

The validity and reliability information for the survey is obtained from the facts that: (a) a similar survey has been presented in the same manner every year for at least the last 15 years, and (b) the survey results from the last 15 years served as the options for close-ended survey questions used in this study. Prior to presenting the survey to the students, the survey was reviewed by faculty in the dental hygiene program and experts in the Research and Development office at GRCC.

Data Collection Procedures

As noted previously, two main types of data were collected for this research. The first was Grand Rapids Community College's NBDHE results for the years 1998–2003. The researcher used this information with the names removed and a code in place of the names. The original NBDHE results and the master list of codes were retained in the dental hygiene program director's office.

The second data set involved a NBDHE student feedback survey. For the past 15 years, the GRCC dental hygiene students were given the opportunity to complete a NBDHE feedback survey. This survey was completed during a regularly scheduled class, two days after the completion of the NBDHE, while the students' perception of the exam was current. The survey has always been optional, and anonymous. In April 2003, because of the researcher's desire to use the survey information as part of her dissertation research and the need to follow strict protocol and confidentiality, she was advised by the administration at GRCC to use a third party to code and administer the survey.

The procedure for distribution and collection of these surveys included an unbiased third party, who assigned each dental hygiene student a random code word that was placed on the top of each individual's survey. The 2003 dental hygiene students were informed by the third party survey administrator that the information obtained from the survey would be used as part of the dental hygiene program's outcomes assessment plan and the accreditation self-study, as well as the researcher's doctoral dissertation. The students were also told by the survey administrator that

survey participation was optional and they could simply turn the survey in blank if they did not wish to participate. The survey took approximately 10 minutes for the students to complete.

Consent forms authorizing anonymous use of the NBDHE feedback survey results were signed by each of the 32 students. The completed NBDHE student surveys and the master list of names and codes were placed in an envelope, and kept in the biology department office at GRCC in a locked file cabinet (this was the office of the survey administrator), until authorization was given by Western Michigan University's (WMU) Human Subjects Institutional Review Board (HSIRB). Once authorization was received, the data were tabulated and analyzed, and the surveys were stored in the dental hygiene program office.

Participants

The participants for the first part of the study, which included a review of NBDHE scores, consisted of all Grand Rapids Community College dental hygiene graduates, 188 total, for the years of 1998–2003. For the second part of the study, the GRCC dental hygiene class of 2003, which consisted of 32 students, all participated in the NBDHE feedback survey.

Data Analysis

Research Question #1: How did the following National Board Dental Hygiene Examination (NBDHE) scores for Grand Rapids Community College's dental hygiene

students compare to the average national NBDHE (a) composite scores, and (b) scores segregated by subject area test components for the years 1998–2003?

The independent variables for Question 1 of this study were the two groups of average scores: GRCC and national. The dependent variables were the NBDHE composite mean scores and the mean scores within the 13 subject areas, for the years 1998–2003, and for (a) GRCC, and (b) the national averages. All of the data for this question came from the 1998 through 2003 NBDHE scores for GRCC and the national averages. Analysis of variance (ANOVA) tests were used to analyze the data related to this question to determine if significant differences occurred from year to year within GRCC's subject areas scores, and between GRCC's scores and the national averages for each of the 6 years. Statistical significance was determined by using a p value $\leq .05$. Descriptive statistics were also used to graph the results of this question.

Research Question #2: What is the relationship between the performance on individual subject area test components for the following two groups of GRCC's dental hygiene students: (a) those who passed the overall NBDHE with a score $\geq 75\%$, and (b) those who failed the NBDHE with a score $< 75\%$?

The independent variables for Question 2 were established by segregating two groups of students based on their overall NBDHE scores: (a) students with NBDHE scores $\geq 75\%$, and (b) students with NBDHE scores $< 75\%$ (considered a failing grade). The dependent variables were the NBDHE composite mean scores, and mean scores in each of the 13 subject areas for the years 1998–2003. ANOVA tests were

used to analyze the data related to this question and to determine if statistically significant differences occurred among the subject areas and between the two groups of independent variables over the last 6 years. Statistical significance was determined by using a p value $\leq .05$. Further analysis was conducted to determine if students consistently scored low in any particular subject areas; if so, which subject area scores were consistently low and how low were the scores? Descriptive statistics were used to display the results of this question.

Research Question #3: How did the following specific curriculum changes in the dental hygiene program at GRCC impact NBDHE student performance scores: (a) the addition of one human anatomy and physiology course to the curriculum in 1998, (b) the addition of the concepts of dental hygiene diagnosis and case studies to the curriculum in 2000, and (c) the restructuring of the curriculum and the reinstatement of nutrition and preventive dentistry as separate courses in 2001?

Question 3 was used to determine if the various programmatic changes that took place over the last 6 years in the GRCC dental hygiene program impacted the NBDHE subject area scores, and, if so, what impact did the scores reflect? To accomplish this, the independent variables were the various GRCC dental hygiene programmatic changes. The dependent variables for this question were the subject area scores of the NBDHE taken the year immediately following the implementation of the various changes. ANOVA tests were used to analyze the data related to this question, and to determine if statistically significant differences have occurred as a

result of the changes. Statistical significance was determined by using a p value $\leq .05$.

Descriptive statistics were also used to display the results of this question.

In order to comprehensively address the three aspects of this question, all subject areas of the NBDHE were considered for each curriculum change since it is not possible to isolate the effects of a given change on specific subject areas. For example, the addition of one foundational course may impact the performance of one or many subsequent courses. Therefore, for each subsection of this question, the years of NBDHE scores that reflect specific curriculum changes, before and after each respective change, were combined, averaged, and analyzed as such. For subsection (a) the change was first reflected in the 2000 NBDHE scores; therefore, 1998 and 1999 scores were averaged and compared to an average of the 2000 through 2003 scores. For subsection (b), the change was first reflected in the 2001 NBDHE scores; therefore, 1998 through 2000 scores were averaged and compared to an average of the 2001 through 2003 scores. For subsection (c), the change was first reflected in the 2003 NBDHE scores; therefore, 1998 through 2002 scores were averaged and compared to an average of the 2003 scores.

Research Question #4: What is the correlation between the NBDHE scores of the 2003 dental hygiene graduates and their use of (a) various NBDHE preparation resource materials, and (b) various NBDHE preparation strategies?

Question 4 involved the results of the 2003 NBDHE student survey that compared the dental hygiene program completers' preparation resources and methods of study (the independent variables), with the individual students' subject area and

overall scores on the NBDHE (both of which are dependent variables). The purpose of this question was to determine best preparation practices for the NBDHE.

Correlation statistical tests were used to determine if a relationship existed between the use of particular preparation resources and/or preparation methods, and NBDHE scores. The data analysis methods for the research questions are presented in Table 2.

Table 2

Data Analysis Methods for the Research Questions

Research Question	Independent Variables	Dependent Variables	Data Analysis Method
Q1: Comparison of GRCC's scores with national composites and averages	Two comparison groups: national and GRCC	Subject area scores	ANOVA
Q2: Comparison between GRCC's NBDHE failing and passing scores	Two comparison groups: passing and failing scores	Subject area scores	ANOVA
Q3: Impact of curriculum and program changes	Three sets of curriculum and program changes	Subject area scores	ANOVA
Q4: Impact of preparation for the NBDHE	Different preparation resources and strategies	Subject area scores	Correlation coefficients and descriptive statistics

CHAPTER IV

DATA ANALYSIS RESULTS

This study utilized data to determine which program areas were in need of improvement. The annual monitoring of specific data (the NBDHE scores and NBDHE student feedback survey) served as the feedback loop for subsequent curriculum evaluation, changes, or program enhancements. A secondary purpose of this study was to use data from a student survey to determine which, if any, NBDHE preparation resources and/or preparation strategies aided the students in being successful on the NBDHE.

Results of Research Question #1

Research Question #1: How did the following National Board Dental Hygiene Examination results for Grand Rapids Community College's dental hygiene students compare to the average National Board Dental Hygiene Examination (NBDHE): (a) composite scores, and (b) scores segregated by subject area test components for the years 1998–2003?

This research question determined how GRCC's mean scores on the NBDHE compared to the national mean scores in all areas addressed by the NBDHE, for the years 1998–2003. The results for Research Question #1 provided performance information and demonstrated trends over the years 1998–2003.

An ANOVA was conducted comparing the mean scores of the National Board Dental Hygiene Examination between Grand Rapids Community College and the national results in the 13 subject areas, as well as the overall scores, for the years 1998–2003. A p value $\leq .05$ was used to determine if there was a statistically significant difference in the NBDHE results, for the years 1998–2003, between GRCC means and the national means. Fourteen NBDHE scores (i.e., 13 subjects and 1 overall score) were examined for each of the 6 years, for a total of 84 different mean scores for both GRCC and the nation. Statistical significance was shown in 23 of the 84 possible areas.

The number of subject areas where GRCC scored less than the national means consistently decreased from nine areas in 1998 to zero areas in 2003. The number of areas where GRCC scores were below the national means by a statistically significant amount on the NBDHE for the years 1998 through 2003 were calculated. The number of GRCC subject area scores statistically significantly below the national means on the NBDHE for the years 1998 to 2003 are shown in Figure 1.

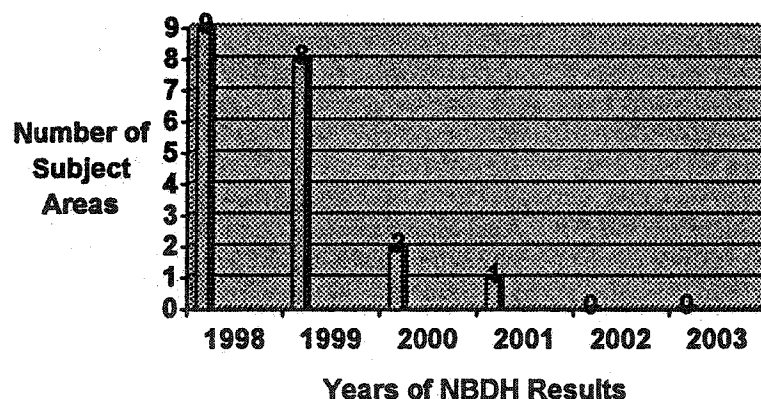


Figure 1. Number GRCC Subject Area Scores Statistically Significantly Below the National Means on the NBDHE for the Years 1998–2003.

Standard deviations of statistically significant subject areas were obtained for the GRCC NBDHE means and the national NBDHE means, for the years 1998–2003. When a subject area for GRCC was below the national mean on the NBDHE, it is noted as a negative, and when GRCC scored above the national mean, it is noted as a positive. Standard deviations of statistically significant subject areas comparing GRCC NBDHE means to national NBDHE means are shown in Table 3.

The number of areas where GRCC mean scores were statistically significant when compared to the national means scores were as follows: in 1998 there were nine areas where GRCC scored less than the national mean; in 1999 there were eight areas where GRCC scored less than the national mean; in 2000 there were two areas where GRCC scored less than the national mean and one area where GRCC scored greater than the national mean; in 2001 there was one area where GRCC scored less than the national mean; and in 2002 and 2003 GRCC scored statistically greater than the national mean in one area, and at or above the national mean in all other areas. According to these results GRCC's dental hygiene program has continuously improved their NBDHE scores, over the last 6 years, when compared to the national means.

This study found that mean scores on the NBDHE for GRCC have been continuously improving from 1998 to 2003. The direction of the statistical significance is also presented. The number of statistically significant performance areas comparing GRCC means with the national means on the NBDHE is found in Table 4. The supporting statistics for Research Question #1 is found in Appendix F.

Table 3

**Standard Deviations of Statistically Significant Subject Areas Comparing
GRCC NBDHE Means to National NBDHE Means**

Subject Areas	Years					
	1998	1999	2000	2001	2002	2003
Overall	-4.7	-3.3	no	no	no	no
Anatomic Science	no	No	no	no	no	no
Physiology- Biochemistry- Nutrition	no	No	no	no	no	+2.1
Microbiology	no	No	-2.3	no	no	no
Pathology	-4.1	No	no	no	no	no
Pharmacology	no	-2.6	no	no	no	no
Patient Assessment	-3.5	-2.6	no	no	no	no
Radiology	-3.9	-2.4	no	-2.4	no	no
Management of Care	-2.9	-5.0	no	no	no	no
Periodontology	-5.9	No	-2.5	no	+2.0	no
Preventive Dentistry	-3.9	-3.6	no	no	no	no
Supportive Treatment	-2.3	No	+2.0	no	no	no
Community Dentistry	no	-3.0	no	no	no	no
Case-Based	-5.2	-3.3	no	no	no	no

* $p \leq .05$.

Table 4
Number of Statistically Significant Performance Areas Comparing
GRCC Means With the National Means on the NBDHE

Year	Number of Areas	Direction of Statistical Significance	
		(-)	(+)
1998	9	9	0
1999	8	8	0
2000	3	2	1
2001	1	1	0
2002	1	0	1
2003	1	0	1

* $p \leq .05$.

Results of Research Question #2

Research Question #2: What is the relationship between the performance on individual subject area test components for the following two groups of GRCC's dental hygiene students: (a) those who passed the overall NBDHE with a score $\geq 75\%$, and (b) those who failed the NBDHE with a score $< 75\%$?

Research Question #2 examined subject areas where statistically significant differences occurred in the performance between students who passed the NBDHE and students who failed the NBDHE for the years 1998–2003. Areas with consistently poor performance were examined.

ANOVA was used to compare the NBDHE means of the dental hygiene graduates who passed the NBDHE with those that failed in the 13 subject areas, as well as the overall scores for the years 1998–2003. A p value $\leq .05$ was used to

determine if there was a statistically significant difference between the two groups. Statistical significance was found in 47 of the 84 possible areas, with each of those 47 areas being statistically significantly lower. The number of years of subject areas NBDHE failures (with a score < 75%) scored statistically significantly lower than graduates who passed the NBDHE for the years 1998–2003 is presented in Table 5.

A yes or no format was used to indicate where statistically significant differences occurred between passing and failing students. A “yes” indicated that there was a statistically significant difference between the passing scores and failing scores; a “no” indicated that there was no statistically significant difference between the passing scores and the failing scores. The statistically significant difference between graduates who passed the NBDHE and those who failed are shown in Table 6.

The study found that statistically significant differences occurred in 47 out of 84 possible subject areas between GRCC’s NBDHE passers and failures. This difference was evident in some subject areas more than others. Statistical significant differences occurred between students who passed the NBDHE and those who failed in the following number of years and subject areas: in 6 out of 6 years, the overall scores, and the case-based area; in 5 out of 6 years, Patient Assessment, Radiography, and Periodontology; in 4 out of 6 years, Community Dentistry; in 3 out of the 6 years, Microbiology and Management of Dental Hygiene Care; in 2 out of 6 years, Pathology, Pharmacology, Preventive Dentistry, and Supportive Treatment; and in 1 out of 6 years, Anatomic Sciences, and Physiology-Biochemistry-Nutrition. The number of years of subject areas with a statistically significant difference between

Table 5

**Number of Years of Subject Areas NBDHE Failures Scored
Statistically Significantly Lower Than Graduates Who
Passed the NBDHE for the Years 1998–2003**

Subject Areas (Ordered)	Number of Years in Which Graduates Who Failed the NBDHE Scored Statistically Significantly Lower Than Graduates Who Passed the NBDHE
Overall	6
Case-Based (CB)	6
Patient Assessment (PA)	5
Radiology (Rad)	5
Periodontology (Perio)	5
Community Dentistry (CD)	4
Microbiology (Micro)	3
Management of Dental Hygiene Care (Mgt)	3
Pathology (Path)	2
Pharmacology (Pharm)	2
Preventive Dentistry (Prev)	2
Supportive Treatment (ST)	2
Anatomic Science (AS)	1
Physiology-Biochemistry-Nutrition (PBN)	1
Total	47

* $p \leq .05$.

Table 6

**Statistically Significant Difference Between Graduates Who Passed
the NBDHE and Those Who Failed**

Subject Areas	Years					
	1998	1999	2000	2001	2002	2003
Overall	yes	Yes	yes	yes	yes	Yes
Anatomic Science	no	No	no	yes	no	No
Physiology- Biochemistry- Nutrition	no	Yes	no	no	no	No
Microbiology	yes	Yes	no	yes	no	No
Pathology	yes	Yes	no	no	no	No
Pharmacology	yes	Yes	no	no	no	No
Patient Assessment	yes	Yes	yes	yes	no	Yes
Radiology	yes	Yes	no	yes	yes	Yes
Management of Care	yes	Yes	yes	no	no	No
Periodontology	yes	Yes	no	yes	yes	Yes
Preventive Dentistry	yes	Yes	no	no	no	No
Supportive Treatment	yes	No	yes	no	no	No
Community Dentistry	yes	Yes	no	no	yes	Yes
Case-Based	yes	Yes	yes	yes	yes	Yes
Total # of Areas	12	12	5	7	5	6

* $p \leq .05$.

graduates who passed the NBDHE and those who failed for the years 1998–2003 are shown in Figure 2. The statistics for Research Question #2 can be found in Appendix G.

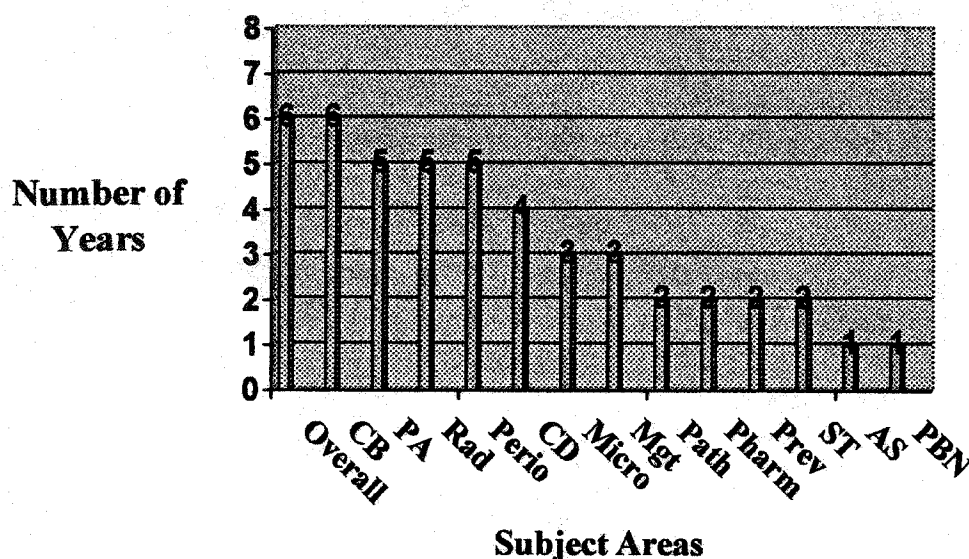


Figure 2. Number of Years of Subject Areas With a Statistically Significant Difference Between Graduates Who Passed the NBDHE and Those Who Failed for the Years 1998–2003.

Results of Research Question #3

Research Question #3: How did the following specific curriculum changes in the dental hygiene program at GRCC impact NBDHE student performance scores:

(a) the addition of one human anatomy and physiology course to the curriculum in 1998, (b) the addition of the concepts of dental hygiene diagnosis and case-studies to the curriculum in 2000, and (c) the restructuring of the curriculum and the reinstatement of nutrition and preventive dentistry as separate courses in 2001?

Research Question #3 determined if specific curriculum changes that occurred at GRCC between the years of 1998–2001 had an impact on NBDHE scores. Even though specific courses were directly affected, all NBDHE subject areas were examined to determine if they were indirectly affected. The segregation of scores is explained for each of the three sections of this question.

ANOVA statistical tests were performed for all three aspects of Research Question #3 and are as follows: (a) 1998 curriculum changes potentially affecting 2000 NBDHE results, (b) 2000 curriculum changes potentially affecting 2001 NBDHE results, and (c) 2001 curriculum changes potentially affecting 2003 NBDHE results. ANOVAs were completed comparing the appropriate years (1998–2003) of NBDHE mean results for GRCC's dental hygiene program. The independent variables for this question were the three curriculum changes listed in the question. The dependent variables were the two groups of NBDHE results (before and after the curriculum changes) for each curriculum change. For each of the three changes, the results for all 13 subject areas as well as the overall scores, were analyzed. A p value $\leq .05$ was used to determine if there was a statistically significant difference between the two groups. Statistical significance was found in 31 of the 84 possible areas.

The results of Research Question #3 (a) addressed the issue that in 1998, GRCC's dental hygiene program added one human anatomy and physiology course to the curriculum for a total of two human anatomy and physiology courses. The following results were achieved: nine subject areas showed a positive statistically significant change, three areas showed a negative statistically significant change, and three areas showed a negative change that was not statistically significant. The nine

subject areas that showed statistically significant improvement were the overall scores, anatomic sciences, physiology-biochemistry-nutrition, pathology, patient assessment, radiology, management of dental hygiene care, community dentistry, and the case based portion of the NBDHE. For this test, all improvement areas were statistically significant. The three subject areas that showed a statistically significant decrease in performance after the curriculum changes were microbiology, pharmacology, and periodontology. The two areas that showed a negative change that was not statistically significant were preventive dentistry and supportive treatment.

The results of Research Question #3 (b) addressed the fact that in 2000, the concept of dental hygiene diagnosis and the use of case studies were added to the second year of GRCC's dental hygiene curriculum. The following results were achieved: eight subject areas showed a positive statistically significant change, three subject areas showed a positive change that was not statistically significant, and three areas showed a negative change that was statistically significant. Subject areas that showed statistically significant improvement after the change in curriculum were the overall scores, anatomic sciences, pathology, patient assessment, management of dental hygiene care, preventive dentistry, community dentistry, and the case-based portion of the NBDHE. Subject areas that showed an improvement that were not statistically significant were physiology-biochemistry-nutrition, radiology, and periodontology. Subject areas that showed a statistically significant decrease in performance after the curriculum changes were microbiology, pharmacology, and

supportive treatment. For this analysis, no areas showed a decrease in performance that was not statistically significant.

The results of Research Question #3 (c) addressed that fact that in 2001, the curriculum was restructured and several curriculum changes were made as a result of the ADA accreditation site visit. The main changes consisted of (a) restructuring of the curriculum, (b) Nutrition and Preventive Dentistry being added to the curriculum as separate courses, (c) dental patients were seen 3 months earlier by first-year dental hygiene students, and (d) dental hygiene diagnosis concepts were introduced earlier in the program. The following results were achieved: six subject areas showed a positive statistically significant change, three areas showed a positive change that was not statistically significant, two areas showed a negative change that was statistically significant, and three areas showed a negative change that was not statistically significant. The six subject areas that showed statistically significant improvement after the changes in curriculum were the overall scores, patient assessment, management of dental hygiene care, supportive treatment, community dentistry, and the case-based portion of the NBDHE. The three subject areas that showed an improvement that was not statistically significant were anatomic sciences, physiology-biochemistry-nutrition, and periodontology. The two subject areas that showed a statistically significant decrease in performance after the 2001 curriculum changes were microbiology and pharmacology. The three subject areas that showed a decrease in performance that was not statistically significant were pathology, radiology, and preventive dentistry.

The study found that 31 out of 84 possible subject areas showed a statistically significant change in NBDHE scores. Of those changes, 23 showed a statistically significant improvement in NBDHE scores from before to after the changes, and eight subject areas showed a drop in NBDHE scores. Five subject areas showed a statistically significant improvement of NBDHE scores for each of the three subsequent time intervals that were examined; those areas were overall scores, patient assessment, management of dental hygiene care, community dentistry, and the case-based aspect of the NBDHE. Two subject areas showed a statistically significant decrease in scores for each of the three subsequent time intervals that were examined; those areas were microbiology and pharmacology.

The areas where statistically significant increases occurred in the means are recorded as “up,” and areas with a statistically significant decrease in the means area recorded as “down.” The curriculum changes are labeled as follows: “Question 3 (a),” was the first change and took place in 1998, with corresponding NBDHE scores in 2000; “Question 3 (b),” was the second curriculum change and took place in 2000, with corresponding NBDHE scores in 2001; and “Question 3 (c),” was the final curriculum change and took place in 2001, with corresponding NBDHE scores in 2003. In an effort to draw the most valid conclusions and add to a deeper understanding of the results, areas with an increase or decrease, but which are not statistically significant, are noted as “up” or “down” and are underlined. Statistically significant differences in subject area mean performance on the NBDHE for GRCC Dental Hygiene curriculum changes are found in Table 7.

Table 7

**Statistically Significant Differences in Subject Areas Mean Performance on the
NBDHE for GRCC Dental Hygiene Program's Curriculum Changes**

Subject Areas	Comparison Year Groupings of Curriculum Changes		
	Question 3 (a) 1998–1999 vs. 2000–2003	Question 3 (b) 1998–2000 vs. 2001–2003	Question 3 (c) 1998–2002 vs. 2003
Overall	up	up	up
Anatomic Science	up	up	up
Physiology- Biochemistry- Nutrition	up	<u>up</u>	<u>up</u>
Microbiology	down	down	down
Pathology	up	up	<u>down</u>
Pharmacology	down	down	down
Patient Assessment	up	up	up
Radiology	up	<u>up</u>	<u>down</u>
Management of Care	up	up	up
Periodontology	down	<u>up</u>	<u>up</u>
Preventive Dentistry	<u>down</u>	up	<u>down</u>
Supportive Treatment	<u>down</u>	down	up
Community Dentistry	up	up	up
Case-Based	up	up	up

Note. Underlining denotes areas that showed a change that was not statistically significant.
* $p \leq .05$.

The number of statistically significant differences in subject areas mean performance on the NBDHE for GRCC's Dental Hygiene Program curriculum changes are presented in Table 8. The supporting statistics for Research Question #3 are found in Appendix H.

Table 8

The Number of Statistically Significant Differences in Subject Areas Mean Performance on the NBDHE for GRCC Dental Hygiene Program's Curriculum Changes

	Comparison Year Groupings of Curriculum Changes					
	Question 3 (a) 1998–1999 vs. 2000–2003		Question 3 (b) 1998–2000 vs. 2001–2003		Question 3 (c) 1998–2002 vs. 2003	
Direction of Statistical Significance	(+)	(–)	(+)	(–)	(+)	(–)
Number of Statistically Significant Areas	9	3	8	3	6	2
Direction of Change (All Inclusive)	9	5	11	3	9	5

* $p \leq .05$

Results of Research Question #4

Research Question #4: What is the correlation between the NBDHE scores of the 2003 dental hygiene graduates and their use of (a) various NBDHE preparation resources materials, and (b) various NBDHE preparation strategies?

Research Question #4 determined whether specific NBDHE preparations strategies and/or preparation resources could be correlated to higher NBDHE scores.

Chi-square statistical tests were performed to correlate the various strategies and resources with NBDHE scores. Chi-square is an inferential statistic that compares the frequencies of nominal measures actually observed in a study with frequencies expected under a null hypothesis. A NBDHE feedback survey was conducted with the GRCC dental hygiene class of 2003, two days after the completion of the NBDHE. The students were asked to rank their perceived benefit of various preparations strategies and resources using a Likert scale.

Due to the small population size of 32 students, and to increase the validity of the results, the survey responses were divided into “beneficial” and “not beneficial,” and the NBDHE results were divided into a median split of scores. It was originally planned to break the scores into smaller bands, but due to the small number of participants, the appropriate statistical tests could not be performed. The NBDHE scores were then matched with the survey results of the respective students. A median split of NBDHE scores into two groups made up the independent variables for this question, which were then matched with the responses of the survey, the dependent variables for this question. A p value $\leq .05$ was used to determine if there was a statistically significant difference between the two groups.

Statistical significance was not found in any of the eight possible areas when correlated to NBDHE scores. The use of *Mosby's Review of Dental Hygiene* as a preparation resource had the lowest p value ($n = 32, p \leq .076$) and the use of *Dental Decks* had the next lowest p value ($n = 32, p \leq .092$). The results of the correlation of GRCC's 2003 NBDHE feedback survey results/ preparation resources and NBDHE scores are presented in Table 9.

Table 9

**Results of the Correlation of GRCC's 2003 NBDHE Feedback Survey
Results/Preparation Resources and NBDHE Scores**

Preparation Resource	<i>N</i>	<i>p</i> value
ADA's Pilot Exam	31	.837
Dental Decks	32	.092
Dental Hygiene Review Seminar Book	32	.525
Mosby's Review of Dental Hygiene	32	.076
Saunders's Review of Dental Hygiene	32	.460
Wilkin's Clinical Dental Hygiene	31	.396
Other Dental Hygiene Text	30	.208
Notes from a Course	30	.763

* $p \leq .05$.

Statistical significance was found in one of the seven possible areas for the survey responses regarding preparation strategies. Reading through the *Wilkin's Clinical Dental Hygiene* text in the summer prior to the second year of the program was found to be statistically significant ($n = 32, p \leq .015$). The results of the correlation of GRCC's 2003 NBDHE feedback survey results/preparation strategies and NBDHE scores are found in Table 10.

Summary

Chapter IV presented the data from the National Board Dental Hygiene Examination. The data from the NBDHE results provided statistically significant

Table 10

**Results of the Correlation of GRCC's 2003 NBDHE Feedback Survey
Results/Preparation Strategies and NBDHE Scores**

Preparation Strategy	<i>N</i>	<i>p</i> value
Attend Chicago Dental Hygiene Review	32	.427
Start Studying Fall Semester	32	.100
Study in a Group	32	.480
Accountability Partner	32	.486
Study Alone	32	.308
Read Wilkin's Text in the Summer	32	.015*
Other: Please specify	32	.370

* $p \leq .05$.

information to assist in program evaluation and to show the need for future enhancement.

The research showed that using valid and reliable data can produce concrete results that can be used to substantiate and drive curriculum decisions. Regarding Research Question #1, how GRCC performed when compared to the national means for the last 6 years, the statistics showed that GRCC has been continuously improving in many areas. The results of Research Question #2 provided helpful information as to which of the subject areas give the graduates who failed the NBDHE, the most difficulty. From Research Question #3, data were produced that provided insight into the success of three curriculum changes that took place at GRCC since 1998. The

results of Research Question #4 were not as beneficial in serving its objective, as were the first three questions, in part due to the low number of responses, and also due to the subjectivity of the survey.

The results of this study, as well as a summary of the statistical findings, were reported in this chapter. The findings could easily be adapted to fit into a comprehensive outcomes assessment plan. Conclusions of this study as well as recommendations for future research are included in Chapter V.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

The Commission on Dental Accreditation (1999) believes that successful programs treat assessment as an ongoing process and that the successful programs use data in planning and thoughtful decision-making. The results of this study support the fact that NBDHE scores can serve as a valuable diagnostic tool when used annually to validate previous curriculum changes and program improvements, as well as to guide future direction. The type of approach to outcomes assessment, exemplified by this research, can help direct the outcomes assessment plans for all areas and levels of education.

Conclusions

Conclusions for Research Question #1

The purpose of the first research question was to use data from the NBDHE to determine if GRCC's NBDHE scores improved when compared to the national results. This study showed that Grand Rapids Community College's dental hygiene program has continuously and substantially improved their NBDHE scores since 1998, when compared to the national means. Grand Rapids Community College has made major changes in their dental hygiene curriculum over the past 6 years. The accreditation process, requirements, and recommendations made by the American

Dental Association's Commission on Dental Accreditation helped drive the direction of these changes. The efforts of the dental hygiene faculty, along with the recommendations by the American Dental Association's Commission on Dental Accreditation resulted in a much-improved dental hygiene program at GRCC. The results of Research Question #1 showed the NBDHE results can be used as an effective tool in the assessment of program outcomes.

Conclusions for Research Question #2

The purpose of the second research question was to identify the subject areas that may contribute to failures on the NBDHE at GRCC. The results showed that students who failed the NBDHE scored statistically significantly lower than graduates who passed in over half of the subject areas, for the years 1998–2003. The statistical results of the study showed that some subject areas consistently showed statistical significant differences between NBDHE passers and failures. Subject areas of the NBDHE, such as the case-based section, patient assessment, periodontology, and community dentistry require critical thinking, and have shown through this research to consistently cause difficulty for the graduates who failed the NBDHE. Radiology was a subject area that also was cited in the statistics as an area of consistent difficulty for graduates who failed the NBDHE. Radiology is a subject that contains many abstract concepts. With those subject areas in mind, the GRCC dental faculty will need to determine and implement improved methods of teaching critical thinking and teaching abstract concepts in a way that will increase student learning.

The statistical results support that fact that after the first set of curriculum changes were in the place, with the scores of 2000, there was a dramatic drop in the number of subject areas that caused graduates to fail the NBDHE. In conclusion, the number of subject areas with a statistically significant difference between graduates who passed the NBDHE and those that failed, went from 12 subject areas in 1998 and 1999 to 5 subject areas in 2000. For the purpose of determining which subject areas give students difficulty in passing the NBDHE, the results of the NBDHE have again proven to be a useful tool.

Conclusions for Research Question #3

The purpose of Research Question #3 was to determine if improvements in NBDHE results took place after three different curriculum changes were instituted. With each change, a significant improvement in scores was seen.

With the first curriculum change (adding one more anatomy and physiology course to the curriculum), nine subject areas showed statistically significant improvement. Improvement in seven of the nine areas can be tied to this curriculum change. Three subject areas showed a statistically significant decrease in performance after the first curriculum change.

The second curriculum change examined as part of this study was the addition of case studies and the concept of dental hygiene diagnosis to the dental hygiene curriculum. This change occurred in the fall of 2000, in the second year of the dental hygiene program, and affected GRCC's 2001 NBDHE results. With the second

curriculum change, 8 subject areas out of 14 showed a statistically significant improvement and 3 subject areas showed a statistically significant decrease in performance. The decrease in performance of these areas cannot be explained as a result of this study, but 2 of these 3 areas showed a decrease following two of the three curriculum changes examined.

The third and final curriculum change examined in this study took place in the fall of 2001 and included several aspects of the dental hygiene curriculum at GRCC. The changes consisted of restructuring the curriculum, by adding Nutrition and Preventive Dentistry to the curriculum as separate courses, having first-year dental hygiene students work with clinical dental patients 3 months earlier in the curriculum, and introducing dental hygiene diagnosis concepts earlier in the program. Six subject areas showed a statistically significant improvement after the changes in curriculum, and all of the improvements could be directly related to the curriculum changes. A statistically significant decrease in performance occurred with the same two subject areas, microbiology and pharmacology, after each of the three curriculum changes.

Research Question #3 was used as an internal evaluation of Grand Rapids Community College's NBDHE scores relative to dental hygiene program curriculum changes. This question evaluated whether GRCC's dental hygiene program improved compared to its own scores as a result of curriculum changes. GRCC's dental hygiene program has made improvements (internally) in their NBDHE subject area scores over the last 6 years, in all subject areas except for microbiology and pharmacology. Therefore, the two subject areas of microbiology and pharmacology warrant further

study to determine how scores can be improved. In conclusion, it is beneficial to use the results of the NBDHE as a method of determining the success of curriculum changes.

Conclusions for Research Question #4

The purpose of Research Question #4 was two-fold and was conducted to determine if a correlation existed between certain (a) NBDHE preparation resources, or (b) NBDHE preparation strategies, and higher NBDHE scores. Research Question #4 demanded the most time and effort and produced the fewest results.

In the area of preparation resources, no resources proved to be statistically significant. The use of *Mosby's Dental Hygiene Review* and *Dental Decks* were shown to be the most effective preparation resource, but was not statistically significant. In the area of preparation strategies, reading through *Wilkin's Clinical Dental Hygiene* text in the summer prior to the second year of the program was statistically significant when correlated with NBDHE scores.

Implications

The most important result of this study is that data-driven program review and decision-making can provide useful information when the data are valid and reliable, as in the case of the National Board Dental Hygiene Examination. Data-driven decision-making is beneficial only when results are used to make program improvements. As a result of this research, the outcomes assessment plan used in the

conceptualization of this study will be used in the college-wide strategic improvement process at Grand Rapids Community College, curriculum revisions within GRCC's occupational programs, and the accreditation self-study of GRCC's dental hygiene program. Current and future GRCC dental hygiene students, faculty, staff, and administrators of GRCC's dental hygiene program will benefit from the use of the NBDHE results as part of the annual outcomes assessment plan. Overall, dental hygiene students at GRCC should be better prepared academically, because future program and curriculum revisions will reflect a continuous, data-driven improvement process, rather than the thoughtful process used previously.

The research results and the outcomes assessment plan using the NBDHE results will be available for use by dental hygiene programs throughout the United States and Canada. The results of this study will be presented at an annual Michigan Dental Hygiene Educators' meeting and a planned presentation at the American Dental Education Association's annual meeting.

The use of the information obtained in this study should not be limited to dental hygiene programs. All occupational education programs that have licensure and/or certification examinations could easily use their respective results as part of an outcomes assessment plan, therefore also benefiting from the example of this study. Furthermore, all educational programs would benefit from the use of data in the development and implementation of their outcomes assessment plans as well as in their strategic plans. The real key to the success of outcomes assessment and strategic plans for all educational entities is the follow-up evaluation piece to determine if

improvement measures did, in fact, work. Such plans must be ongoing and continuous.

Recommendations

The benefits of a proactive outcomes assessment system versus a retrospective approach became very evident in the statistical results of this study. The ex-post facto nature of this study showed how the use of valid and reliable data could be used to validate curriculum changes and to determine where change is still needed.

It is strongly recommended that outcomes assessment be data-driven, ongoing, and contain purposeful plans for program change and/or improvements. Furthermore, subsequent program changes and/or improvements must be tracked and substantiated with new data. The following specific recommendations are being made to accomplish this broad recommendation.

Recommendation One

As a result of this study, it is specifically recommended that the NBDHE results be used to annually monitor the performance of all dental hygiene programs as part of a comprehensive assessment plan. The NBDHE results provide both internal and external assessments on an ongoing and continuous basis. The NBDHE results should be analyzed in a timely manner and a plan put into action according to the results. The plan for action should be substantiated by the data and continuously

monitored to show improvement. The outcomes assessment model found in Appendix B can be used for this purpose.

Recommended plans of action should include, but not be limited to, new methods of instruction, professional development of the instructors, and early diagnosis and treatment of student learning problems. This recommendation can be easily adapted to fit all occupational education programs that receive valid and reliable data from their respective licensing agencies. Furthermore, it is recommended that all educational programs use data, in an outcomes assessment plan similar to the one used in this study, to drive and monitor curriculum and program changes.

Recommendation Two

The results of Research Question #2 provided evidence that there was a substantial difference in several subject areas between NBDHE passers and failures. Through the use of data, it was determined that the subject areas that presented the greatest difficulty for the NBDHE failures were those areas that required use of critical and abstract thinking. Based on that information, it is recommended that the GRCC dental faculty determine and implement improved methods of teaching critical and abstract thinking that will result in increased student learning. It is further recommended that the success of the implementation of this new approach to teaching be evaluated. Based on the results of this evaluation, further research may be warranted to determine the type of comprehensive assistance the students may need.

It is further recommended that this data-driven approach to evaluation be applied to all educational programs. The use of data to drive specific program and curriculum improvements provides insight as to where individual programs need to focus their improvement energy. Again, this type of outcomes assessment requires follow-up and needs to be conducted on a continuing, ongoing basis.

Recommendation Three

A statistically significant decrease in performance occurred with the same two subject areas, microbiology and pharmacology, after each of the three curriculum changes. The decrease in performance of these areas requires research beyond the scope of this study. Therefore, it is recommended that the two subject areas of microbiology and pharmacology be studied to determine how student learning and subsequent NBDHE scores can be improved. It may be beneficial to use the results of the previous recommendations in the achievement of this recommendation.

Recommendation Four

A review of the literature provided three research studies regarding outcomes assessment of dental hygiene programs. In the first study of dental hygiene programs conducted by Smith (1989), she noted that 97% of the respondents said that they used the NBDHE results as means of outcomes assessment, but how the results were actually used was not explained. In a second study conducted by McCann and Schneiderman (1995), they concluded that dental hygiene program directors know

that program assessment is required as part of accreditation, but they are not fully aware of how to use data to improve their programs. In a third dental hygiene program study conducted by Grimes (1999), she noted that 89% of responding programs said that they used NBDHE and other licensing exam data as part of an outcomes assessment plan. Again, there were no specific details as to how the results were utilized.

Therefore, it is recommended that further research be conducted to examine if other dental hygiene programs actually use the data from the NBDHE as a method of outcomes assessment. Furthermore, if a dental hygiene program uses the data from the NBDHE, in an outcomes assessment plan, it should be determined how data are specifically used and how they are tied to program and/or curricular improvement; and, if the NBDHE results are not used as an outcomes assessment tool, why not.

Recommendation Five

Regarding Research Question #4 and the use of the NBDHE student feedback survey, two recommendations are being made. The first recommendation is for the survey needs to be redesigned so there is a neutral response option on the survey. This is necessary to reflect a true Likert scale with a continuum of responses. The second recommendation is that the survey be administered annually to increase the validity and reliability of the results of the survey.

Closing

Grimes (1999) said that outcomes assessment plans are valuable only to the degree the results are used to foster program improvements and to identify problem areas in need of review and revision. Schmoker (1996) said that as educators we fail to examine data that can guide us to act and then wonder why we do not get the results we desire. The common theme in these two pieces of literature is that data are useful to the degree that they actually guide program improvements, not simply to reflect on performance. In support of this principle, the Commission on Dental Accreditation (1999) observed that successful programs treat assessment as an ongoing process and used data in planning and decision-making.

The dental hygiene program at GRCC was examined for the purpose of this study, but the principles of using a continuous data-driven approach to drive subsequent program improvement can be applied to all areas of education. The use of valid and reliable data, exemplified by this research, can serve as a model for outcomes assessment plans, in all levels of education. Such a data-driven dynamic systems approach to evaluation will serve to improve all educational programs.

Appendix A
Timeline of the Background for This Study

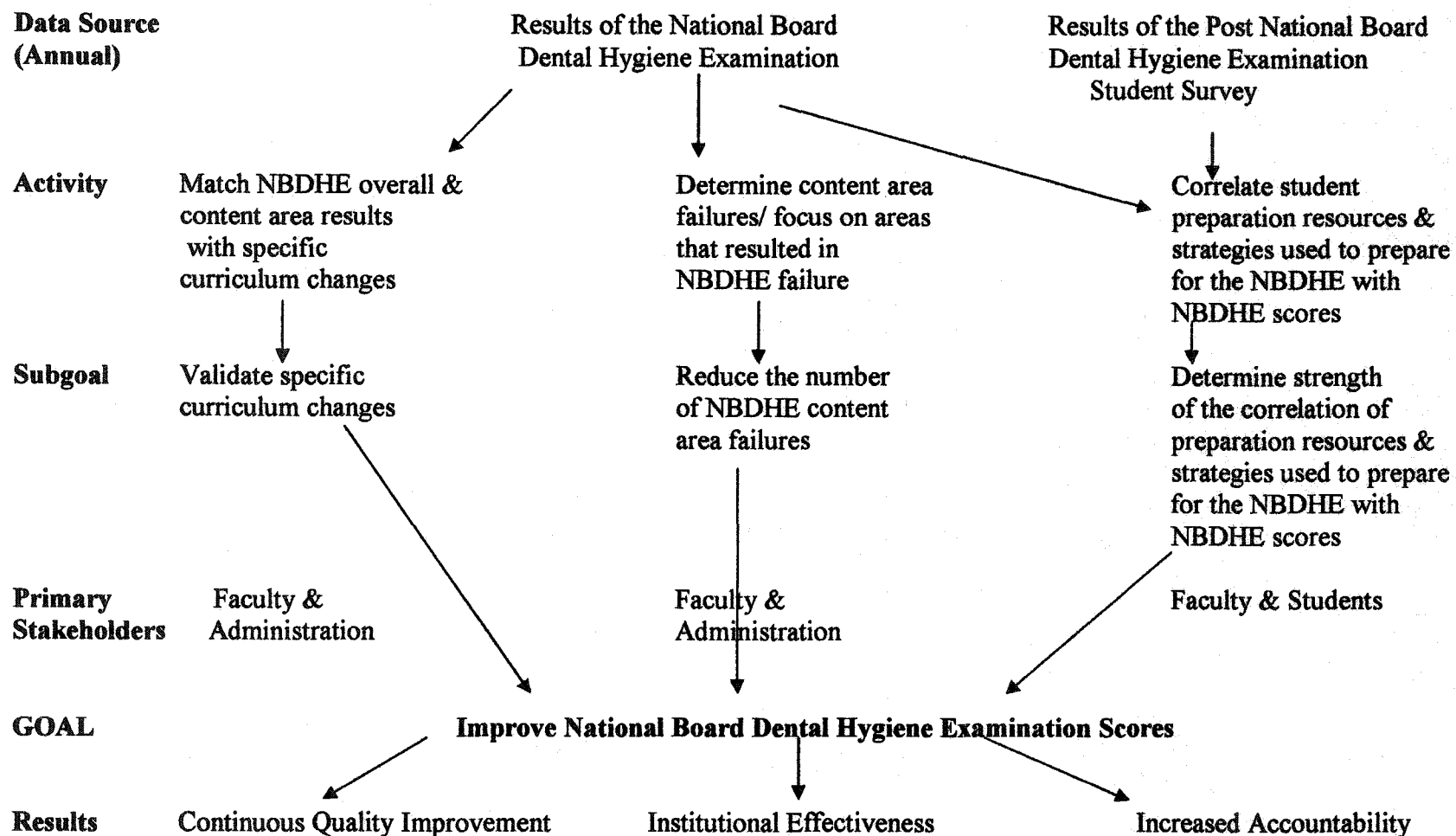
Timeline of the Background for This Study

Date	Event
1994	The dental hygiene curriculum revision process began.
1996	Implementation of a new dental hygiene curriculum; Concurrently wrote the accreditation self-study.
1997	American Dental Association (ADA) site visit resulting in several curriculum recommendations.
1997	Grand Rapids Community College Dental Hygiene faculty still writing and implementing the second year of the Dental Hygiene curriculum.
1997	New Format for the National Board Dental Hygiene Examination from: 400 stand alone multiple choice questions; to 200 stand alone multiple choice questions; and, 150 multiple choice questions based on a variety of case studies.
1998	GRCC Dental Hygiene faculty wrote the required ADA site visit response, which included a plan for implementation of the recommended curriculum changes.
1998	Dental Hygiene Program received full accreditation status.
1998	2nd Anatomy and Physiology Course added to the Dental Hygiene Curriculum
1998–1999	Dental Hygiene students took the NBDHE based on the 1996 curriculum changes
2000	Dental Hygiene diagnosis and case-study work added to the 2 nd year of the Dental Hygiene curriculum
2001	New curriculum fully implemented based on the ADA recommendations: Nutrition and Preventive Dentistry in as separate courses; and, dental patients were seen 4 months (earlier in the program) to increase clinical and case study expectations
2003	First Dental Hygiene class to take the NBDHE under the new 2001 curriculum

Appendix B

Using Data-Driven Decision-Making in the Annual Outcomes Assessment Plan for Grand Rapids Community College's Dental Hygiene Program

Using Data-Driven Decision-Making in the Annual Outcomes Assessment Plan for Grand Rapids Community College's Dental Hygiene Program



Appendix C

Grand Rapids Community College 2003 Feedback Survey for the National Board Dental Hygiene Examination (NBDHE)

**GRAND RAPIDS COMMUNITY COLLEGE
2003 FEEDBACK SURVEY FOR
THE DENTAL HYGIENE NATIONAL BOARD (NBDHE)**

Code _____

In an ongoing effort to assist the faculty in the preparation of classes for the NBDHE, please share your opinions regarding the following questions. Your input is greatly appreciated.

1. Please rate each of the following categories of the NBDHE, according to how well prepared you felt. Check the appropriate box, using a scale of 1 to 3 as follows: 1= very prepared, 2= somewhat prepared, 3= not prepared.

	1	2	3
Anatomic Sciences			
Physiology-Biochem-Nutrition			
Microbiology			
Pathology			
Pharmacology			
Patient Assessment			
Radiology			
Management of D.H. Care			
Periodontology			
Preventive Agents			
Supportive Treatment			
Community Health			
Case-Based			

2. How much time did you spend preparing for the board? Please select from the following and record approximately how many hours per week. If more than 1 scenario fits you please record accordingly.

_____ I started preparing for the boards last summer. _____ hours per week.

_____ I started preparing for the boards during Christmas (break). _____ hours per week.

_____ I started preparing for the boards in January. _____ hours per week.

_____ I started preparing for the boards after the Chicago review. _____ hours per week.

_____ I started preparing for the boards during spring break. _____ hours per week.

_____ Other please specify _____

3. Please rate each of the following preparation resources according to how beneficial you felt each one to be: 1= extremely beneficial; 2=very beneficial; 3= somewhat beneficial; 4= not beneficial; 5= did not use.

	1	2	3	4	5
ADA's pilot case based exam					
Dental Decks					
Dental Hygiene Seminar- review book					
Mosby's review book					
Saunders's review book					
Wilkin's " Clinical Dental Hygiene"					
Dental Hygiene Text: Please specify					
Notes from a course(s): Please specify					
Review session at GRCC: Please specify					
Web Source: Please specify					
Other: Please specify					

4. Please rate each of the following preparation strategies according to how beneficial you felt each one to be: 1= extremely beneficial; 2=very beneficial; 3= somewhat beneficial; 4= not beneficial; 5= did not use.

	1	2	3	4	5
Attend the Chicago Dental Hygiene Review					
Start studying in the fall semester					
Get into a study group					
Have an accountability partner.					
Study alone					
Read Wilkins in the summer					
Other: Please specify					

5. Please write any comments you feel would be beneficial to future Dental Hygiene classes in preparing for the NBDHE.

Thank you for completing this survey.

Appendix D
Student Survey Consent Form

WESTERN MICHIGAN UNIVERSITY
H. S. I. R. B.
Approved for use for one year from this date:

MAY 27 2003

x *Mary Lagacy*
HSIRB Chair

Western Michigan University Department of Educational Leadership
Principle Investigator: Carl Woloszyk, Ph.D.
Student Investigator: Debra Schultz
Using the Dental Hygiene National Board Results as a Method of Outcomes Assessment

Student Consent Form

May 27, 2003

Dear GRCC 2003 Dental Hygiene Graduate:

On April 3, 2003, after you completed the DHNB, you were invited to participate in a Dental Hygiene National Board (DHNB) Feedback Survey. Dr. Carl Woloszyk, professor in the Department of Teaching, Learning & Leadership at Western Michigan University (WMU) and I, Deb Schultz, GRCC Dental Hygiene instructor and doctoral student at WMU, conducted the survey to determine the relationship between student perception of success on the DHNB and actual success on the DHNB. This information will be used for program evaluation purposes and to provide preparation information to future classes. In addition, I would like to use the data in my dissertation research.

In order for me to use of your survey information and the results of the DHNB, for the listed purposes I need to obtain your consent. If you are willing to allow me to use your feedback survey and the results of your DHNB, please sign and date the attached consent form and return it in the self-addressed, stamped envelope as soon as possible. Your timely cooperation is greatly appreciated.

The coded surveys have remained sealed waiting for the results of the DHNB to be received by GRCC. If you agree to have your data used in this research project, the results of the survey and the DHNB will remain totally confidential and will be reported only in aggregate form. It will not be possible to identify an individual participant from reading the report.

If you have any questions regarding the survey, please contact Dr. Woloszyk at 616-771-9140 or Deb Schultz at 616-234-4239. You can also contact the Chair of Human Subjects Institutional Review Board (HSIRB) at 269-387-8293 or the Vice President for Research at 269-387-8298, if questions or problems arise during the course of the study.

This consent document has been approved for use for one year by the Human Subjects Institutional Review Board (HSIRB) as indicated by the stamped date and signature of the board chair in the upper right corner. Do not participate in this study if the stamped date is older than one year.

WESTERN MICHIGAN UNIVERSITY
H. S. I. R. B.
Approved for use for one year from this date:

MAY 27 2003

x May Zagay
HSIRB Chair

Carl Woloszyk, Ph.D.
Professor, WMU- Teaching, Learning & Leadership Dept.

Deb Schultz, RDH, MS
GRCC Dental Hygiene Faculty

Thank you for responding to this consent form. Once completed, please return by June 7, 2003 in the enclosed, stamped, self-addressed envelope.

I, _____, give Deb Schultz, dental hygiene faculty member
(print your name)

at Grand Rapids Community College, my informed consent to confidentially use the results of my: Dental Hygiene National Board Feedback Survey and Dental Hygiene National Board exam for the completion of her dissertation work.

(signature)

(date)

Appendix E
Human Subjects Institutional Review Board
Letter of Approval

WESTERN MICHIGAN UNIVERSITY



Human Subjects Institutional Review Board

Date: May 27, 2003

To: Carl Woloszyk, Principal Investigator
Debra Schultz, Student Investigator for dissertation

From: Mary Lagerwey, Chair

A handwritten signature in cursive script, appearing to read "Mary Lagerwey".

Re: HSIRB Project Number: 03-05-11

This letter will serve as confirmation that your research project entitled "Using the Dental Hygiene National Board Results as a Method of Outcomes Assessment" has been approved under the expedited category of review by the Human Subjects Institutional Review Board. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the application.

Please note that you may only conduct this research exactly in the form it was approved. You must seek specific board approval for any changes in this project. You must also seek reapproval if the project extends beyond the termination date noted below. In addition if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: May 27, 2004

Appendix F

Supporting Statistics for Research Question 1

Supporting Statistics for Research Question 1 (page 1)

Performance of GRCC vs. the National Average from 1998 to 2003

	Year	1998	1999	2000	2001	2002	2003
Overall	GRCC	200.6	205.1	207.4	213.1	235.5	230.8
	National	220.9	218.6	207.4	215.5	236.1	226.7
	Difference	-20.3	-13.5	0.0	-2.4	-0.6	4.1
	Calculated z	-4.716	-3.258	0.00	-0.559	-0.133	0.910
AS	GRCC	10.1	10.2	10.3	13.7	12.4	11.5
	National	10.5	10.5	10.5	13.3	13.3	11.9
	Difference	-0.4	-0.3	-0.2	0.4	-0.9	-0.4
	Calculated z	-0.972	-0.663	-0.392	0.825	-1.761	-0.780
PBN	GRCC	6.3	6.4	7.8	6.9	7.1	7.2
	National	6.9	6.5	7.9	6.5	6.8	6.5
	Difference	-0.6	-0.1	-0.1	0.4	0.3	0.7
	Calculated z	-1.666	-0.319	-0.294	1.310	0.865	2.084
MI	GRCC	6.6	6.6	6.1	4.8	7.1	5.2
	National	7.1	7.0	6.8	4.8	7.6	5.5
	Difference	-0.5	-0.4	-0.7	0.0	-0.5	-0.3
	Calculated z	-1.388	-1.277	-2.315	0.000	-1.611	-0.998
PATH	GRCC	7.9	8.6	8.4	9.7	11.0	8.7
	National	9.3	9.0	8.0	9.5	10.8	8.6
	Difference	-1.4	-0.4	0.4	0.2	0.2	0.1
	Calculated z	-4.082	-1.352	1.411	0.530	0.498	0.269
PHAR	GRCC	8.0	8.6	7.0	8.0	6.8	6.7
	National	8.6	9.6	7.7	7.9	6.9	6.4
	Difference	-0.6	-1.0	-0.7	0.1	-0.1	0.3
	Calculated z	-1.841	-2.611	-1.950	0.328	-0.342	0.893
PA	GRCC	36.4	37.8	46.8	43.9	49.4	51.2
	National	39.5	40.0	45.5	44.7	49.1	49.3
	Difference	-3.1	-2.2	1.3	-0.8	0.3	1.9
	Calculated z	-3.544	-2.633	1.323	-0.891	0.293	1.791

Supporting Statistics for Research Question 1 (page 2)

Performance of GRCC vs. the National Average from 1998 to 2003

	Year	1998	1999	2000	2001	2002	2003
RAD	GRCC	28.8	25.4	29.0	27.9	29.8	28.1
	National	31.3	27.1	28.4	29.9	31.1	27.8
	Difference	-2.5	-1.7	0.6	-2.0	-1.3	0.3
	Calculated z	-3.940	-2.382	0.774	-2.421	-1.483	0.361
MGT	GRCC	36.3	32.4	34.6	39.6	40.6	44.5
	National	38.7	36.3	33.6	40.1	40.0	43.4
	Difference	-2.4	-3.9	1.0	-0.5	0.6	1.1
	Calculated z	-2.915	-4.979	1.150	-0.535	0.714	1.092
PER	GRCC	27.5	36.6	25.9	26.8	34.5	31.8
	National	33.4	36.8	28.0	26.6	32.9	31.7
	Difference	-5.9	-0.2	-2.1	0.2	1.6	0.1
	Calculated z	-5.931	-0.230	-2.525	0.286	1.992	0.145
PREV	GRCC	15.4	10.9	9.8	12.5	15.4	12.8
	National	17.0	12.4	9.7	12.5	15.9	12.8
	Difference	-1.6	-1.5	0.1	0.0	-0.5	0.0
	Calculated z	-3.887	-3.590	0.241	0.000	-1.304	0.000
ST	GRCC	8.8	10.8	9.9	8.1	8.3	10.6
	National	9.7	11.2	9.1	8.1	8.7	10.6
	Difference	-0.9	-0.4	0.8	0.0	-0.4	0.0
	Calculated z	-2.282	-1.044	2.016	0.000	-1.153	0.000
CH	GRCC	8.3	10.8	11.7	11.2	13.2	12.5
	National	8.8	12.2	12.1	11.5	13.1	12.2
	Difference	-0.5	-1.4	-0.4	-0.3	0.1	0.3
	Calculated z	-1.080	-2.979	-0.784	-0.668	0.219	0.771
CB	GRCC	88.6	85.7	83.1	86.2	98.8	100.2
	National	97.1	91.2	83.2	89.0	99.2	99.3
	Difference	-8.5	-5.5	-0.1	-2.8	-0.4	0.9
	Calculated z	-5.163	-3.326	-0.065	-1.607	-0.217	0.494

Appendix G
Supporting Statistics for Research Question 2

Supporting Statistics for Research Question 2
Oneway Groups of Two; Split at Score of 75; 1=PASS 2=FAIL Across All Yrs
(1998-2003)

Descriptives

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
DHNBscore 1.00	167	82.5150	4.76161	.36846	81.7875	83.2425	75.00	96.00
2.00	21	71.3810	2.51945	.54979	70.2341	72.5278	64.00	74.00
Total	188	81.2713	5.75951	.42006	80.4426	82.0999	64.00	96.00
CORRAS 1.00	167	11.5749	2.65803	.20568	11.1688	11.9809	5.00	18.00
2.00	21	9.5238	2.15914	.47116	8.5410	10.5066	5.00	13.00
Total	188	11.3457	2.68141	.19556	10.9600	11.7315	5.00	18.00
CORRPBN 1.00	167	7.1198	1.70683	.13208	6.8590	7.3805	2.00	11.00
2.00	21	5.1905	1.88730	.41184	4.3314	6.0496	2.00	8.00
Total	188	6.9043	1.82712	.13326	6.6414	7.1671	2.00	11.00
CORRMI 1.00	167	6.2216	1.87051	.14474	5.9358	6.5073	1.00	10.00
2.00	21	4.7143	2.02837	.44263	3.7910	5.6376	2.00	8.00
Total	188	6.0532	1.94231	.14166	5.7737	6.3326	1.00	10.00
CORRPATH 1.00	167	9.3533	2.04785	.15847	9.0404	9.6662	5.00	15.00
2.00	21	6.5238	1.63153	.35603	5.7811	7.2665	4.00	10.00
Total	188	9.0372	2.19228	.15989	8.7218	9.3527	4.00	15.00
CORRPHAR 1.00	167	7.7485	1.84234	.14256	7.4670	8.0300	4.00	12.00
2.00	21	5.9524	1.43095	.31226	5.3010	6.6037	3.00	8.00
Total	188	7.5479	1.88516	.13749	7.2766	7.8191	3.00	12.00
CORRPA 1.00	167	45.5509	7.15294	.55351	44.4581	46.6437	30.00	61.00
2.00	21	31.9524	5.85215	1.27704	29.2885	34.6162	22.00	46.00
Total	188	44.0319	8.21757	.59933	42.8496	45.2142	22.00	61.00
CORRRAD 1.00	167	28.8922	4.17253	.32288	28.2547	29.5297	18.00	38.00
2.00	21	22.1905	3.68265	.80362	20.5142	23.8668	14.00	29.00
Total	188	28.1436	4.62447	.33727	27.4783	28.8090	14.00	38.00
CORRMGT 1.00	167	38.9581	5.89910	.45649	38.0568	39.8594	24.00	58.00
2.00	21	30.2381	5.25266	1.14623	27.8471	32.6291	20.00	40.00
Total	188	37.9840	6.43642	.46942	37.0580	38.9101	20.00	58.00
CORRPER 1.00	167	31.2874	5.69411	.44062	30.4175	32.1574	17.00	45.00
2.00	21	24.9524	5.65222	1.23342	22.3795	27.5252	16.00	35.00
Total	188	30.5798	6.01682	.43882	29.7141	31.4455	16.00	45.00
CORRPREV 1.00	167	13.0838	2.96041	.22908	12.6315	13.5361	6.00	20.00
2.00	21	11.0000	2.84605	.62106	9.7045	12.2955	7.00	16.00
Total	188	12.8511	3.01319	.21976	12.4175	13.2846	6.00	20.00
CORRST 1.00	167	9.6287	2.02541	.15673	9.3193	9.9382	3.00	15.00
2.00	21	7.6190	2.65474	.57931	6.4106	8.8275	3.00	12.00
Total	188	9.4043	2.19050	.15976	9.0891	9.7194	3.00	15.00
CORRHC 1.00	167	11.7305	2.77996	.21512	11.3058	12.1553	4.00	18.00
2.00	21	7.6190	2.20173	.48046	6.6168	8.6213	3.00	13.00
Total	188	11.2713	3.01082	.21959	10.8381	11.7045	3.00	18.00
CORRCB 1.00	167	92.7665	10.70241	.82818	91.1313	94.4016	69.00	126.00
2.00	21	72.3333	7.84432	1.71177	68.7626	75.9040	54.00	84.00
Total	188	90.4840	12.24373	.89297	88.7225	92.2456	54.00	126.00

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
DHNBScore	Between Groups	2312.500	1	2312.500	110.553	.000
	Within Groups	3890.665	186	20.918		
	Total	6203.165	187			
CORRAS	Between Groups	78.474	1	78.474	11.529	.001
	Within Groups	1266.052	186	6.807		
	Total	1344.527	187			
CORRPBN	Between Groups	69.434	1	69.434	23.276	.000
	Within Groups	554.843	186	2.983		
	Total	624.277	187			
CORRMI	Between Groups	42.380	1	42.380	11.888	.001
	Within Groups	663.088	186	3.565		
	Total	705.468	187			
CORRPATH	Between Groups	149.346	1	149.346	37.068	.000
	Within Groups	749.394	186	4.029		
	Total	898.739	187			
CORRPHAR	Between Groups	60.180	1	60.180	18.520	.000
	Within Groups	604.390	186	3.249		
	Total	664.569	187			
CORRPA	Between Groups	3449.539	1	3449.539	69.906	.000
	Within Groups	9178.270	186	49.346		
	Total	12627.809	187			
CORRRAD	Between Groups	837.824	1	837.824	49.295	.000
	Within Groups	3161.298	186	16.996		
	Total	3999.122	187			
CORRMGT	Between Groups	1418.436	1	1418.436	41.689	.000
	Within Groups	6328.516	186	34.024		
	Total	7746.952	187			
CORRPER	Between Groups	748.647	1	748.647	23.127	.000
	Within Groups	6021.156	186	32.372		
	Total	6769.803	187			
CORRPREV	Between Groups	81.003	1	81.003	9.319	.003
	Within Groups	1616.826	186	8.693		
	Total	1697.830	187			
CORRST	Between Groups	75.342	1	75.342	17.050	.000
	Within Groups	821.934	186	4.419		
	Total	897.277	187			
CORRHC	Between Groups	315.338	1	315.338	42.507	.000
	Within Groups	1379.827	186	7.418		
	Total	1695.165	187			
CORRCB	Between Groups	7788.393	1	7788.393	71.557	.000
	Within Groups	20244.559	186	108.842		
	Total	28032.952	187			

Supporting Statistics for Research Question 2
Oneway Year = 1998

Descriptives

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
DHNBscore 1.00	26	79.9231	3.87735	.76041	78.3570	81.4892	75.00	89.00
2.00	8	71.0000	2.07020	.73193	69.2693	72.7307	68.00	73.00
Total	34	77.8235	5.20181	.89210	76.0085	79.6385	68.00	89.00
CORRAS 1.00	26	10.3846	2.02142	.39643	9.5681	11.2011	6.00	14.00
2.00	8	9.1250	1.88509	.66648	7.5490	10.7010	6.00	12.00
Total	34	10.0882	2.03556	.34910	9.3780	10.7985	6.00	14.00
CORRPBN 1.00	26	6.6154	1.81278	.35551	5.8832	7.3476	2.00	10.00
2.00	8	5.2500	2.12132	.75000	3.4765	7.0235	2.00	8.00
Total	34	6.2941	1.94671	.33386	5.6149	6.9734	2.00	10.00
CORRMI 1.00	26	6.8846	1.81828	.35659	6.1502	7.6190	3.00	10.00
2.00	8	5.1250	2.16712	.76619	3.3132	6.9368	2.00	8.00
Total	34	6.4706	2.01863	.34619	5.7663	7.1749	2.00	10.00
CORRPATH 1.00	26	8.5000	2.12132	.41603	7.6432	9.3568	5.00	13.00
2.00	8	6.1250	1.35620	.47949	4.9912	7.2588	4.00	8.00
Total	34	7.9412	2.20112	.37749	7.1732	8.7092	4.00	13.00
CORRPHAR 1.00	26	8.8077	1.23351	.24191	8.3095	9.3059	6.00	11.00
2.00	8	5.5000	1.60357	.56695	4.1594	6.8406	3.00	7.00
Total	34	8.0294	1.93038	.33106	7.3559	8.7030	3.00	11.00
CORRPA 1.00	26	38.4231	4.09070	.80225	36.7708	40.0753	30.00	44.00
2.00	8	29.8750	4.85320	1.71587	25.8176	33.9324	24.00	36.00
Total	34	36.4118	5.58742	.95823	34.4622	38.3613	24.00	44.00
CORRRAD 1.00	26	29.9615	3.52682	.69167	28.5370	31.3861	22.00	36.00
2.00	8	25.0000	2.44949	.86603	22.9522	27.0478	21.00	29.00
Total	34	28.7941	3.90632	.66993	27.4311	30.1571	21.00	36.00
CORRMGT 1.00	26	37.8077	4.08920	.80196	36.1560	39.4594	27.00	44.00
2.00	8	31.3750	3.54310	1.25268	28.4129	34.3371	26.00	38.00
Total	34	36.2941	4.79602	.82251	34.6207	37.9675	26.00	44.00
CORRPER 1.00	26	28.9231	4.85735	.95260	26.9612	30.8850	20.00	41.00
2.00	8	22.7500	4.23421	1.49702	19.2101	26.2899	16.00	31.00
Total	34	27.4706	5.36111	.91942	25.6000	29.3412	16.00	41.00
CORRPREV 1.00	26	16.0769	2.26138	.44349	15.1635	16.9903	12.00	20.00
2.00	8	13.0000	2.39046	.84515	11.0015	14.9985	10.00	16.00
Total	34	15.3529	2.61560	.44857	14.4403	16.2656	10.00	20.00
CORRST 1.00	26	9.5385	2.21325	.43405	8.6445	10.4324	5.00	14.00
2.00	8	6.2500	2.05287	.72580	4.5338	7.9662	4.00	10.00
Total	34	8.7647	2.57092	.44091	7.8677	9.6617	4.00	14.00
CORRHC 1.00	26	9.3077	3.27132	.64156	7.9864	10.6290	4.00	18.00
2.00	8	6.5000	2.00000	.70711	4.8280	8.1720	3.00	9.00
Total	34	8.6471	3.22756	.55352	7.5209	9.7732	3.00	18.00
CORRCB 1.00	26	93.0000	7.30479	1.43259	90.0495	95.9505	76.00	107.00
2.00	8	74.2500	5.39179	1.90629	69.7423	78.7577	67.00	83.00
Total	34	88.5882	10.57188	1.81306	84.8995	92.2769	67.00	107.00

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
DHNBScore	Between Groups	487.095	1	487.095	38.406	.000
	Within Groups	405.846	32	12.683		
	Total	892.941	33			
CORRAS	Between Groups	9.706	1	9.706	2.445	.128
	Within Groups	127.029	32	3.970		
	Total	136.735	33			
CORRPBN	Between Groups	11.405	1	11.405	3.211	.083
	Within Groups	113.654	32	3.552		
	Total	125.059	33			
CORRMI	Between Groups	18.942	1	18.942	5.247	.029
	Within Groups	115.529	32	3.610		
	Total	134.471	33			
CORRPATH	Between Groups	34.507	1	34.507	8.807	.006
	Within Groups	125.375	32	3.918		
	Total	159.882	33			
CORRPHAR	Between Groups	66.932	1	66.932	38.221	.000
	Within Groups	56.038	32	1.751		
	Total	122.971	33			
CORRPA	Between Groups	447.014	1	447.014	24.527	.000
	Within Groups	583.221	32	18.226		
	Total	1030.235	33			
CORRRAD	Between Groups	150.597	1	150.597	13.653	.001
	Within Groups	352.962	32	11.030		
	Total	503.559	33			
CORRMGT	Between Groups	253.145	1	253.145	16.012	.000
	Within Groups	505.913	32	15.810		
	Total	759.059	33			
CORRPER	Between Groups	233.124	1	233.124	10.428	.003
	Within Groups	715.346	32	22.355		
	Total	948.471	33			
CORRPREV	Between Groups	57.919	1	57.919	11.042	.002
	Within Groups	167.846	32	5.245		
	Total	225.765	33			
CORRST	Between Groups	66.156	1	66.156	13.931	.001
	Within Groups	151.962	32	4.749		
	Total	218.118	33			
CORRHC	Between Groups	48.226	1	48.226	5.222	.029
	Within Groups	295.538	32	9.236		
	Total	343.765	33			
CORRCB	Between Groups	2150.735	1	2150.735	44.763	.000
	Within Groups	1537.500	32	48.047		
	Total	3688.235	33			

Supporting Statistics for Research Question 2
Oneway Year = 1999

Descriptives

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
DHNBScore	1.00	26	80.9231	4.56003	.89429	79.0812	82.7649	75.00	92.00
	2.00	7	70.5714	3.45722	1.30671	67.3740	73.7688	64.00	74.00
	Total	33	78.7273	6.07903	1.05822	76.5717	80.8828	64.00	92.00
CORRAS	1.00	26	10.3462	2.36546	.46390	9.3907	11.3016	5.00	14.00
	2.00	7	9.8571	1.95180	.73771	8.0520	11.6623	7.00	12.00
	Total	33	10.2424	2.26426	.39416	9.4396	11.0453	5.00	14.00
CORRPBN	1.00	26	6.8077	1.87658	.36803	6.0497	7.5657	3.00	10.00
	2.00	7	4.7143	1.79947	.68014	3.0501	6.3785	2.00	7.00
	Total	33	6.3636	2.02821	.35307	5.6445	7.0828	2.00	10.00
CORRMI	1.00	26	6.9615	1.66086	.32572	6.2907	7.6324	3.00	10.00
	2.00	7	5.1429	2.11570	.79966	3.1862	7.0996	3.00	8.00
	Total	33	6.5758	1.88796	.32865	5.9063	7.2452	3.00	10.00
CORRPATH	1.00	26	9.3462	1.87494	.36771	8.5889	10.1035	5.00	12.00
	2.00	7	5.7143	1.38013	.52164	4.4379	6.9907	4.00	7.00
	Total	33	8.5758	2.31881	.40365	7.7535	9.3980	4.00	12.00
CORRPHAR	1.00	26	9.2308	1.81786	.35651	8.4965	9.9650	6.00	12.00
	2.00	7	6.2857	1.49603	.56544	4.9021	7.6693	4.00	8.00
	Total	33	8.6061	2.12043	.36912	7.8542	9.3579	4.00	12.00
CORRPA	1.00	26	39.8462	4.54042	.89045	38.0122	41.6801	31.00	48.00
	2.00	7	30.2857	4.42396	1.67210	26.1942	34.3772	22.00	34.00
	Total	33	37.8182	5.96057	1.03760	35.7047	39.9317	22.00	48.00
CORRRAD	1.00	26	26.5385	3.64671	.71518	25.0655	28.0114	20.00	34.00
	2.00	7	21.2857	2.69037	1.01686	18.7975	23.7739	18.00	26.00
	Total	33	25.4242	4.06225	.70715	23.9838	26.8647	18.00	34.00
CORRMGT	1.00	26	34.2308	4.96635	.97398	32.2248	36.2367	24.00	43.00
	2.00	7	25.7143	3.63842	1.37519	22.3493	29.0793	20.00	30.00
	Total	33	32.4242	5.85251	1.01879	30.3490	34.4995	20.00	43.00
CORRPER	1.00	26	38.5769	3.06167	.60044	37.3403	39.8136	33.00	45.00
	2.00	7	29.2857	5.67786	2.14603	24.0346	34.5369	18.00	35.00
	Total	33	36.6061	5.31472	.92517	34.7215	38.4906	18.00	45.00
CORRPREV	1.00	26	11.5769	2.28338	.44781	10.6546	12.4992	8.00	18.00
	2.00	7	8.2857	.95119	.35952	7.4060	9.1654	7.00	10.00
	Total	33	10.8788	2.47181	.43029	10.0023	11.7553	7.00	18.00
CORRST	1.00	26	11.0385	1.90748	.37409	10.2680	11.8089	8.00	15.00
	2.00	7	10.0000	1.15470	.43644	8.9321	11.0679	9.00	12.00
	Total	33	10.8182	1.81064	.31519	10.1762	11.4602	8.00	15.00
CORRHC	1.00	26	11.6923	2.34554	.46000	10.7449	12.6397	6.00	17.00
	2.00	7	7.4286	1.81265	.68512	5.7521	9.1050	5.00	10.00
	Total	33	10.7879	2.83678	.49382	9.7820	11.7938	5.00	17.00
CORRCB	1.00	26	89.9231	9.33348	1.83045	86.1532	93.6930	71.00	113.00
	2.00	7	70.0000	8.94427	3.38062	61.7279	78.2721	54.00	83.00
	Total	33	85.6970	12.30723	2.14241	81.3330	90.0609	54.00	113.00

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
DHNBScore	Between Groups	590.985	1	590.985	30.970	.000
	Within Groups	591.560	31	19.083		
	Total	1182.545	32			
CORRAS	Between Groups	1.319	1	1.319	.251	.620
	Within Groups	162.742	31	5.250		
	Total	164.061	32			
CORRPBN	Between Groups	24.169	1	24.169	6.972	.013
	Within Groups	107.467	31	3.467		
	Total	131.636	32			
CORRMI	Between Groups	18.242	1	18.242	5.902	.021
	Within Groups	95.819	31	3.091		
	Total	114.061	32			
CORRPATH	Between Groups	72.747	1	72.747	22.708	.000
	Within Groups	99.313	31	3.204		
	Total	172.061	32			
CORRPBAR	Between Groups	47.835	1	47.835	15.440	.000
	Within Groups	96.044	31	3.098		
	Total	143.879	32			
CORRPA	Between Groups	504.096	1	504.096	24.694	.000
	Within Groups	632.813	31	20.413		
	Total	1136.909	32			
CORRRAD	Between Groups	152.170	1	152.170	12.550	.001
	Within Groups	375.890	31	12.125		
	Total	528.061	32			
CORRMGT	Between Groups	400.017	1	400.017	17.816	.000
	Within Groups	696.044	31	22.453		
	Total	1096.061	32			
CORRPER	Between Groups	476.104	1	476.104	34.502	.000
	Within Groups	427.775	31	13.799		
	Total	903.879	32			
CORRPREV	Between Groups	59.740	1	59.740	13.640	.001
	Within Groups	135.775	31	4.380		
	Total	195.515	32			
CORRST	Between Groups	5.948	1	5.948	1.863	.182
	Within Groups	98.962	31	3.192		
	Total	104.909	32			
CORRHC	Between Groups	100.262	1	100.262	19.765	.000
	Within Groups	157.253	31	5.073		
	Total	257.515	32			
CORRCB	Between Groups	2189.124	1	2189.124	25.533	.000
	Within Groups	2657.846	31	85.737		
	Total	4846.970	32			

Supporting Statistics for Research Question 2
Oneway Year = 2000

Descriptives

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
DHNBScore	1.00	27	82.6296	3.73289	.71840	81.1529	84.1063	75.00	91.00
	2.00	1	73.0000	.	.	.	.	73.00	73.00
	Total	28	82.2857	4.09025	.77298	80.6997	83.8717	73.00	91.00
CORRAS	1.00	27	10.3333	2.57204	.49499	9.3159	11.3508	5.00	15.00
	2.00	1	9.0000	.	.	.	.	9.00	9.00
	Total	28	10.2857	2.53651	.47935	9.3022	11.2693	5.00	15.00
CORRPBN	1.00	27	7.8148	1.46857	.28263	7.2339	8.3958	4.00	10.00
	2.00	1	8.0000	.	.	.	.	8.00	8.00
	Total	28	7.8214	1.44154	.27243	7.2625	8.3804	4.00	10.00
CORRMI	1.00	27	6.1852	1.49453	.28762	5.5940	6.7764	3.00	9.00
	2.00	1	5.0000	.	.	.	.	5.00	5.00
	Total	28	6.1429	1.48360	.28037	5.5676	6.7181	3.00	9.00
CORRPATH	1.00	27	8.3704	.92604	.17822	8.0040	8.7367	6.00	10.00
	2.00	1	9.0000	.	.	.	.	9.00	9.00
	Total	28	8.3929	.91649	.17320	8.0375	8.7482	6.00	10.00
CORRPBAR	1.00	27	7.1111	1.33973	.25783	6.5811	7.6411	4.00	10.00
	2.00	1	5.0000	.	.	.	.	5.00	5.00
	Total	28	7.0357	1.37389	.25964	6.5030	7.5685	4.00	10.00
CORRPA	1.00	27	47.2222	4.51777	.86945	45.4351	49.0094	37.00	54.00
	2.00	1	36.0000	.	.	.	.	36.00	36.00
	Total	28	46.8214	4.91448	.92875	44.9158	48.7271	36.00	54.00
CORRRAD	1.00	27	29.2222	3.65148	.70273	27.7777	30.6667	22.00	36.00
	2.00	1	24.0000	.	.	.	.	24.00	24.00
	Total	28	29.0357	3.71665	.70238	27.5945	30.4769	22.00	36.00
CORRMGT	1.00	27	34.9259	3.54016	.68130	33.5255	36.3264	28.00	42.00
	2.00	1	26.0000	.	.	.	.	26.00	26.00
	Total	28	34.6071	3.86187	.72982	33.1097	36.1046	26.00	42.00
CORRPER	1.00	27	26.1852	4.39438	.84570	24.4468	27.9235	17.00	32.00
	2.00	1	18.0000	.	.	.	.	18.00	18.00
	Total	28	25.8929	4.58128	.86578	24.1164	27.6693	17.00	32.00
CORRPREV	1.00	27	9.8148	1.86129	.35820	9.0785	10.5511	6.00	14.00
	2.00	1	8.0000	.	.	.	.	8.00	8.00
	Total	28	9.7500	1.85841	.35121	9.0294	10.4706	6.00	14.00
CORRST	1.00	27	10.1111	1.47631	.28412	9.5271	10.6951	7.00	13.00
	2.00	1	3.0000	.	.	.	.	3.00	3.00
	Total	28	9.8571	1.97605	.37344	9.0909	10.6234	3.00	13.00
CORRHC	1.00	27	11.6667	2.71746	.52298	10.5917	12.7417	7.00	18.00
	2.00	1	13.0000	.	.	.	.	13.00	13.00
	Total	28	11.7143	2.67854	.50620	10.6757	12.7529	7.00	18.00
CORRCB	1.00	27	83.7778	5.73339	1.10339	81.5097	86.0458	72.00	93.00
	2.00	1	64.0000	.	.	.	.	64.00	64.00
	Total	28	83.0714	6.75458	1.27650	80.4523	85.6906	64.00	93.00

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
DHNBScore	Between Groups	89.418	1	89.418	6.417	.018
	Within Groups	362.296	26	13.934		
	Total	451.714	27			
CORRAS	Between Groups	1.714	1	1.714	.259	.615
	Within Groups	172.000	26	6.615		
	Total	173.714	27			
CORRPBN	Between Groups	.033	1	.033	.015	.902
	Within Groups	56.074	26	2.157		
	Total	56.107	27			
CORRMI	Between Groups	1.354	1	1.354	.606	.443
	Within Groups	58.074	26	2.234		
	Total	59.429	27			
CORRPATH	Between Groups	.382	1	.382	.446	.510
	Within Groups	22.296	26	.858		
	Total	22.679	27			
CORRPHAR	Between Groups	4.298	1	4.298	2.394	.134
	Within Groups	46.667	26	1.795		
	Total	50.964	27			
CORRPA	Between Groups	121.440	1	121.440	5.950	.022
	Within Groups	530.667	26	20.410		
	Total	652.107	27			
CORRRAD	Between Groups	26.298	1	26.298	1.972	.172
	Within Groups	346.667	26	13.333		
	Total	372.964	27			
CORRMGT	Between Groups	76.827	1	76.827	6.130	.020
	Within Groups	325.852	26	12.533		
	Total	402.679	27			
CORRPER	Between Groups	64.604	1	64.604	3.346	.079
	Within Groups	502.074	26	19.311		
	Total	566.679	27			
CORRPREV	Between Groups	3.176	1	3.176	.917	.347
	Within Groups	90.074	26	3.464		
	Total	93.250	27			
CORRST	Between Groups	48.762	1	48.762	22.373	.000
	Within Groups	56.667	26	2.179		
	Total	105.429	27			
CORRHHC	Between Groups	1.714	1	1.714	.232	.634
	Within Groups	192.000	26	7.385		
	Total	193.714	27			
CORRCB	Between Groups	377.190	1	377.190	11.475	.002
	Within Groups	854.667	26	32.872		
	Total	1231.857	27			

Supporting Statistics for Research Question 2
Oneway Year = 2001

Descriptives

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
DHNBScore	1.00	29	82.7586	5.04023	.93595	80.8414	84.6758	77.00	96.00
	2.00	2	71.5000	.70711	.50000	65.1469	77.8531	71.00	72.00
	Total	31	82.0323	5.62426	1.01015	79.9693	84.0953	71.00	96.00
CORRAS	1.00	29	14.0000	2.47848	.46024	13.0572	14.9428	9.00	18.00
	2.00	2	9.0000	5.65685	4.00000	-41.8248	59.8248	5.00	13.00
	Total	31	13.6774	2.89122	.51928	12.6169	14.7379	5.00	18.00
CORRPBN	1.00	29	7.0345	1.42635	.26487	6.4919	7.5770	3.00	10.00
	2.00	2	5.0000	2.82843	2.00000	-20.4124	30.4124	3.00	7.00
	Total	31	6.9032	1.55681	.27961	6.3322	7.4743	3.00	10.00
CORRMI	1.00	29	4.9655	1.54649	.28718	4.3773	5.5538	1.00	7.00
	2.00	2	2.5000	.70711	.50000	-3.8531	8.8531	2.00	3.00
	Total	31	4.8065	1.62110	.29116	4.2118	5.4011	1.00	7.00
CORRPAT	1.00	29	9.8621	1.97709	.36714	9.1100	10.6141	6.00	13.00
	2.00	2	7.5000	.70711	.50000	1.1469	13.8531	7.00	8.00
	Total	31	9.7097	2.00322	.35979	8.9749	10.4445	6.00	13.00
CORRPHA	1.00	29	8.0690	1.13172	.21015	7.6385	8.4994	6.00	10.00
	2.00	2	6.5000	.70711	.50000	.1469	12.8531	6.00	7.00
	Total	31	7.9677	1.16859	.20988	7.5391	8.3964	6.00	10.00
CORRPA	1.00	29	44.8621	6.81765	1.26601	42.2688	47.4554	33.00	61.00
	2.00	2	30.5000	2.12132	1.50000	11.4407	49.5593	29.00	32.00
	Total	31	43.9355	7.50971	1.34878	41.1809	46.6901	29.00	61.00
CORRRAD	1.00	29	28.5862	4.23014	.78552	26.9771	30.1953	18.00	35.00
	2.00	2	18.5000	6.36396	4.50000	-38.6779	75.6779	14.00	23.00
	Total	31	27.9355	4.93920	.88711	26.1238	29.7472	14.00	35.00
CORRMGT	1.00	29	39.7586	4.94726	.91868	37.8768	41.6405	33.00	52.00
	2.00	2	37.0000	4.24264	3.00000	-1.1186	75.1186	34.00	40.00
	Total	31	39.5806	4.89063	.87838	37.7867	41.3745	33.00	52.00
CORRPER	1.00	29	27.3103	3.53658	.65673	25.9651	28.6556	22.00	34.00
	2.00	2	19.5000	.70711	.50000	13.1469	25.8531	19.00	20.00
	Total	31	26.8065	3.93632	.70698	25.3626	28.2503	19.00	34.00
CORRPRE	1.00	29	12.7241	2.16954	.40287	11.8989	13.5494	6.00	16.00
	2.00	2	10.0000	.00000	.00000	10.0000	10.0000	10.00	10.00
	Total	31	12.5484	2.20361	.39578	11.7401	13.3567	6.00	16.00
CORRST	1.00	29	8.2069	1.76026	.32687	7.5373	8.8765	3.00	12.00
	2.00	2	6.5000	.70711	.50000	.1469	12.8531	6.00	7.00
	Total	31	8.0968	1.75793	.31573	7.4520	8.7416	3.00	12.00
CORRHC	1.00	29	11.3448	2.46802	.45830	10.4060	12.2836	7.00	16.00
	2.00	2	8.5000	.70711	.50000	2.1469	14.8531	8.00	9.00
	Total	31	11.1613	2.49128	.44745	10.2475	12.0751	7.00	16.00
CORRCB	1.00	29	87.7241	10.23962	1.90145	83.8292	91.6191	69.00	110.00
	2.00	2	64.5000	7.77817	5.50000	-5.3841	134.3841	59.00	70.00
	Total	31	86.2258	11.55482	2.07531	81.9875	90.4642	59.00	110.00

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
DHNBScore	Between Groups	237.157	1	237.157	9.662	.004
	Within Groups	711.810	29	24.545		
	Total	948.968	30			
CORRAS	Between Groups	46.774	1	46.774	6.649	.015
	Within Groups	204.000	29	7.034		
	Total	250.774	30			
CORRPBN	Between Groups	7.744	1	7.744	3.457	.073
	Within Groups	64.966	29	2.240		
	Total	72.710	30			
CORRMI	Between Groups	11.373	1	11.373	4.889	.035
	Within Groups	67.466	29	2.326		
	Total	78.839	30			
CORRPATH	Between Groups	10.439	1	10.439	2.753	.108
	Within Groups	109.948	29	3.791		
	Total	120.387	30			
CORRPHAR	Between Groups	4.606	1	4.606	3.673	.065
	Within Groups	36.362	29	1.254		
	Total	40.968	30			
CORRPA	Between Groups	385.923	1	385.923	8.570	.007
	Within Groups	1305.948	29	45.033		
	Total	1691.871	30			
CORRRAD	Between Groups	190.336	1	190.336	10.193	.003
	Within Groups	541.534	29	18.674		
	Total	731.871	30			
CORRMGT	Between Groups	14.238	1	14.238	.587	.450
	Within Groups	703.310	29	24.252		
	Total	717.548	30			
CORRPER	Between Groups	114.132	1	114.132	9.438	.005
	Within Groups	350.707	29	12.093		
	Total	464.839	30			
CORRPREV	Between Groups	13.884	1	13.884	3.055	.091
	Within Groups	131.793	29	4.545		
	Total	145.677	30			
CORRST	Between Groups	5.451	1	5.451	1.812	.189
	Within Groups	87.259	29	3.009		
	Total	92.710	30			
CORRHC	Between Groups	15.142	1	15.142	2.567	.120
	Within Groups	171.052	29	5.898		
	Total	186.194	30			
CORRCB	Between Groups	1009.126	1	1009.126	9.767	.004
	Within Groups	2996.293	29	103.320		
	Total	4005.419	30			

Supporting Statistics for Research Question 2
Oneway Year = 2002

Descriptives

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
DHNBscore 1.00	28	83.5000	5.28800	.99934	81.4495	85.5505	75.00	94.00
2.00	2	74.0000	.00000	.00000	74.0000	74.0000	74.00	74.00
Total	30	82.8667	5.64302	1.03027	80.7595	84.9738	74.00	94.00
CORRAS 1.00	28	12.4643	2.26866	.42874	11.5846	13.3440	7.00	16.00
2.00	2	11.5000	.70711	.50000	5.1469	17.8531	11.00	12.00
Total	30	12.4000	2.20657	.40286	11.5761	13.2239	7.00	16.00
CORRPBN 1.00	28	7.2143	1.64107	.31013	6.5779	7.8506	4.00	11.00
2.00	2	5.0000	1.41421	1.00000	-7.7062	17.7062	4.00	6.00
Total	30	7.0667	1.70057	.31048	6.4317	7.7017	4.00	11.00
CORRMI 1.00	28	7.2500	1.53055	.28925	6.6565	7.8435	4.00	10.00
2.00	2	5.0000	1.41421	1.00000	-7.7062	17.7062	4.00	6.00
Total	30	7.1000	1.60495	.29302	6.5007	7.6993	4.00	10.00
CORRPATH 1.00	28	11.1786	2.09149	.39525	10.3676	11.9896	7.00	15.00
2.00	2	9.0000	1.41421	1.00000	-3.7062	21.7062	8.00	10.00
Total	30	11.0333	2.10882	.38502	10.2459	11.8208	7.00	15.00
CORRPHAR 1.00	28	6.8214	1.49204	.28197	6.2429	7.4000	4.00	9.00
2.00	2	6.5000	2.12132	1.50000	-12.5593	25.5593	5.00	8.00
Total	30	6.8000	1.49482	.27292	6.2418	7.3582	4.00	9.00
CORRPA 1.00	28	49.7500	5.97913	1.12995	47.4315	52.0685	35.00	60.00
2.00	2	44.5000	2.12132	1.50000	25.4407	63.5593	43.00	46.00
Total	30	49.4000	5.93412	1.08342	47.1842	51.6158	35.00	60.00
CORRRAD 1.00	28	30.5714	5.28049	.99792	28.5239	32.6190	21.00	38.00
2.00	2	19.5000	2.12132	1.50000	.4407	38.5593	18.00	21.00
Total	30	29.8333	5.83144	1.06467	27.6558	32.0108	18.00	38.00
CORRMGT 1.00	28	40.9286	4.14486	.78331	39.3214	42.5358	33.00	50.00
2.00	2	35.5000	6.36396	4.50000	-21.6779	92.6779	31.00	40.00
Total	30	40.5667	4.39187	.80184	38.9267	42.2066	31.00	50.00
CORRPER 1.00	28	35.0000	3.90631	.73822	33.4853	36.5147	28.00	41.00
2.00	2	27.0000	5.65685	4.00000	-23.8248	77.8248	23.00	31.00
Total	30	34.4667	4.40793	.80478	32.8207	36.1126	23.00	41.00
CORRPREV 1.00	28	15.5357	1.93376	.36545	14.7859	16.2855	13.00	19.00
2.00	2	13.5000	.70711	.50000	7.1469	19.8531	13.00	14.00
Total	30	15.4000	1.94049	.35428	14.6754	16.1246	13.00	19.00
CORRST 1.00	28	8.4286	1.95180	.36886	7.6717	9.1854	5.00	11.00
2.00	2	6.0000	.00000	.00000	6.0000	6.0000	6.00	6.00
Total	30	8.2667	1.98152	.36178	7.5268	9.0066	5.00	11.00
CORRHC 1.00	28	13.4286	2.21825	.41921	12.5684	14.2887	9.00	17.00
2.00	2	9.5000	.70711	.50000	3.1469	15.8531	9.00	10.00
Total	30	13.1667	2.36473	.43174	12.2837	14.0497	9.00	17.00
CORRCB 1.00	28	100.0357	9.80734	1.85341	96.2328	103.8386	80.00	120.00
2.00	2	82.0000	2.82843	2.00000	56.5876	107.4124	80.00	84.00
Total	30	98.8333	10.52447	1.92150	94.9034	102.7632	80.00	120.00

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
DHNBScore	Between Groups	168.467	1	168.467	6.248	.019
	Within Groups	755.000	28	26.964		
	Total	923.467	29			
CORRAS	Between Groups	1.736	1	1.736	.348	.560
	Within Groups	139.464	28	4.981		
	Total	141.200	29			
CORRPBN	Between Groups	9.152	1	9.152	3.430	.075
	Within Groups	74.714	28	2.668		
	Total	83.867	29			
CORRMI	Between Groups	9.450	1	9.450	4.055	.054
	Within Groups	65.250	28	2.330		
	Total	74.700	29			
CORRPATH	Between Groups	8.860	1	8.860	2.065	.162
	Within Groups	120.107	28	4.290		
	Total	128.967	29			
CORRPHAR	Between Groups	.193	1	.193	.084	.775
	Within Groups	64.607	28	2.307		
	Total	64.800	29			
CORRPA	Between Groups	51.450	1	51.450	1.486	.233
	Within Groups	969.750	28	34.634		
	Total	1021.200	29			
CORRRAD	Between Groups	228.810	1	228.810	8.459	.007
	Within Groups	757.357	28	27.048		
	Total	986.167	29			
CORRMGT	Between Groups	55.010	1	55.010	3.054	.092
	Within Groups	504.357	28	18.013		
	Total	559.367	29			
CORRPER	Between Groups	119.467	1	119.467	7.534	.010
	Within Groups	444.000	28	15.857		
	Total	563.467	29			
CORRPREV	Between Groups	7.736	1	7.736	2.135	.155
	Within Groups	101.464	28	3.624		
	Total	109.200	29			
CORRST	Between Groups	11.010	1	11.010	2.997	.094
	Within Groups	102.857	28	3.673		
	Total	113.867	29			
CORRHC	Between Groups	28.810	1	28.810	6.049	.020
	Within Groups	133.357	28	4.763		
	Total	162.167	29			
CORRCB	Between Groups	607.202	1	607.202	6.527	.016
	Within Groups	2604.964	28	93.034		
	Total	3212.167	29			

Supporting Statistics for Research Question 2
Oneway Year = 2003

Descriptives

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
DHNBScore	1.00	31	84.8065	4.49755	.80778	83.1567	86.4562	76.00	95.00
	2.00	1	73.0000	.	.	.	.	73.00	73.00
	Total	32	84.4375	4.89198	.86479	82.6738	86.2012	73.00	95.00
CORRAS	1.00	31	11.6129	2.13974	.38431	10.8280	12.3978	7.00	16.00
	2.00	1	8.0000	.	.	.	.	8.00	8.00
	Total	32	11.5000	2.19971	.38886	10.7069	12.2931	7.00	16.00
CORRPBN	1.00	31	7.1935	1.86939	.33575	6.5079	7.8792	2.00	10.00
	2.00	1	6.0000	.	.	.	.	6.00	6.00
	Total	32	7.1563	1.85106	.32722	6.4889	7.8236	2.00	10.00
CORRMI	1.00	31	5.3226	1.95597	.35130	4.6051	6.0400	2.00	9.00
	2.00	1	2.0000	.	.	.	.	2.00	2.00
	Total	32	5.2188	2.01181	.35564	4.4934	5.9441	2.00	9.00
CORRPATH	1.00	31	8.8065	1.74010	.31253	8.1682	9.4447	5.00	11.00
	2.00	1	6.0000	.	.	.	.	6.00	6.00
	Total	32	8.7188	1.78225	.31506	8.0762	9.3613	5.00	11.00
CORRPHAR	1.00	31	6.7097	2.17859	.39129	5.9106	7.5088	4.00	10.00
	2.00	1	6.0000	.	.	.	.	6.00	6.00
	Total	32	6.6875	2.14683	.37951	5.9135	7.4615	4.00	10.00
CORRPA	1.00	31	51.7097	5.28011	.94834	49.7729	53.6464	38.00	61.00
	2.00	1	34.0000	.	.	.	.	34.00	34.00
	Total	32	51.1563	6.06475	1.07211	48.9697	53.3428	34.00	61.00
CORRRAD	1.00	31	28.4516	3.56687	.64063	27.1433	29.7600	22.00	38.00
	2.00	1	17.0000	.	.	.	.	17.00	17.00
	Total	32	28.0938	4.05096	.71612	26.6332	29.5543	17.00	38.00
CORRMGT	1.00	31	44.8710	5.77778	1.03772	42.7517	46.9903	32.00	58.00
	2.00	1	33.0000	.	.	.	.	33.00	33.00
	Total	32	44.5000	6.05885	1.07106	42.3156	46.6844	32.00	58.00
CORRPER	1.00	31	31.9677	2.61386	.46946	31.0090	32.9265	27.00	37.00
	2.00	1	26.0000	.	.	.	.	26.00	26.00
	Total	32	31.7813	2.77935	.49132	30.7792	32.7833	26.00	37.00
CORRPREV	1.00	31	12.8065	1.99030	.35747	12.0764	13.5365	9.00	16.00
	2.00	1	14.0000	.	.	.	.	14.00	14.00
	Total	32	12.8438	1.96927	.34812	12.1338	13.5537	9.00	16.00
CORRST	1.00	31	10.5161	1.15097	.20672	10.0939	10.9383	8.00	13.00
	2.00	1	12.0000	.	.	.	.	12.00	12.00
	Total	32	10.5625	1.16224	.20546	10.1435	10.9815	8.00	13.00
CORRHC	1.00	31	12.6774	1.97294	.35435	11.9537	13.4011	8.00	17.00
	2.00	1	7.0000	.	.	.	.	7.00	7.00
	Total	32	12.5000	2.18499	.38626	11.7122	13.2878	7.00	17.00
CORRCB	1.00	31	100.9355	9.01087	1.61840	97.6303	104.2407	85.00	126.00
	2.00	1	78.0000	.	.	.	.	78.00	78.00
	Total	32	100.2188	9.74757	1.72314	96.7044	103.7331	78.00	126.00

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
DHNBScore	Between Groups	135.036	1	135.036	6.676	.015
	Within Groups	606.839	30	20.228		
	Total	741.875	31			
CORRAS	Between Groups	12.645	1	12.645	2.762	.107
	Within Groups	137.355	30	4.578		
	Total	150.000	31			
CORRPBN	Between Groups	1.380	1	1.380	.395	.534
	Within Groups	104.839	30	3.495		
	Total	106.219	31			
CORRMI	Between Groups	10.695	1	10.695	2.795	.105
	Within Groups	114.774	30	3.826		
	Total	125.469	31			
CORRPATH	Between Groups	7.630	1	7.630	2.520	.123
	Within Groups	90.839	30	3.028		
	Total	98.469	31			
CORRPHAR	Between Groups	.488	1	.488	.103	.751
	Within Groups	142.387	30	4.746		
	Total	142.875	31			
CORRPA	Between Groups	303.832	1	303.832	10.898	.002
	Within Groups	836.387	30	27.880		
	Total	1140.219	31			
CORRRAD	Between Groups	127.041	1	127.041	9.986	.004
	Within Groups	381.677	30	12.723		
	Total	508.719	31			
CORRMGT	Between Groups	136.516	1	136.516	4.089	.052
	Within Groups	1001.484	30	33.383		
	Total	1138.000	31			
CORRPER	Between Groups	34.501	1	34.501	5.050	.032
	Within Groups	204.968	30	6.832		
	Total	239.469	31			
CORRPREV	Between Groups	1.380	1	1.380	.348	.559
	Within Groups	118.839	30	3.961		
	Total	120.219	31			
CORRST	Between Groups	2.133	1	2.133	1.610	.214
	Within Groups	39.742	30	1.325		
	Total	41.875	31			
CORRHHC	Between Groups	31.226	1	31.226	8.022	.008
	Within Groups	116.774	30	3.892		
	Total	148.000	31			
CORRCB	Between Groups	509.598	1	509.598	6.276	.018
	Within Groups	2435.871	30	81.196		
	Total	2945.469	31			

Appendix H
Supporting Statistics for Research Question 3

Supporting Statistics for Research Question 3 (a)
Oneway On Split 1 = Years 1998-1999;
2 =Years 2000-2003 [Hyp 3A]

Descriptives

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
DHNBScore	1.00	67	78.2687	5.62619	.68735	76.8963	79.6410	64.00	92.00
	2.00	121	82.9339	5.14415	.46765	82.0080	83.8598	71.00	96.00
	Total	188	81.2713	5.75951	.42006	80.4426	82.0999	64.00	96.00
CORRAS	1.00	67	10.1642	2.13625	.26098	9.6431	10.6853	5.00	14.00
	2.00	121	12.0000	2.73557	.24869	11.5076	12.4924	5.00	18.00
	Total	188	11.3457	2.68141	.19556	10.9600	11.7315	5.00	18.00
CORRPBN	1.00	67	6.3284	1.97245	.24097	5.8472	6.8095	2.00	10.00
	2.00	121	7.2231	1.66577	.15143	6.9233	7.5230	2.00	11.00
	Total	188	6.9043	1.82712	.13326	6.6414	7.1671	2.00	11.00
CORRMI	1.00	67	6.5224	1.94124	.23716	6.0489	6.9959	2.00	10.00
	2.00	121	5.7934	1.90139	.17285	5.4512	6.1356	1.00	10.00
	Total	188	6.0532	1.94231	.14166	5.7737	6.3326	1.00	10.00
CORRPATH	1.00	67	8.2537	2.26531	.27675	7.7012	8.8063	4.00	13.00
	2.00	121	9.4711	2.03336	.18485	9.1051	9.8371	5.00	15.00
	Total	188	9.0372	2.19228	.15989	8.7218	9.3527	4.00	15.00
CORRPHAR	1.00	67	8.3134	2.03164	.24820	7.8179	8.8090	3.00	12.00
	2.00	121	7.1240	1.66118	.15102	6.8250	7.4230	4.00	10.00
	Total	188	7.5479	1.88516	.13749	7.2766	7.8191	3.00	12.00
CORRPA	1.00	67	37.1045	5.77386	.70539	35.6961	38.5128	22.00	48.00
	2.00	121	47.8678	6.72798	.61163	46.6568	49.0788	29.00	61.00
	Total	188	44.0319	8.21757	.59933	42.8496	45.2142	22.00	61.00
CORRRAD	1.00	67	27.1343	4.30256	.52564	26.0849	28.1838	18.00	36.00
	2.00	121	28.7025	4.71813	.42892	27.8532	29.5517	14.00	38.00
	Total	188	28.1436	4.62447	.33727	27.4783	28.8090	14.00	38.00
CORRMGT	1.00	67	34.3881	5.64869	.69010	33.0102	35.7659	20.00	44.00
	2.00	121	39.9752	5.98256	.54387	38.8984	41.0520	26.00	58.00
	Total	188	37.9840	6.43642	.46942	37.0580	38.9101	20.00	58.00
CORRPER	1.00	67	31.9701	7.01723	.85729	30.2585	33.6818	16.00	45.00
	2.00	121	29.8099	5.25882	.47807	28.8634	30.7565	17.00	41.00
	Total	188	30.5798	6.01682	.43882	29.7141	31.4455	16.00	45.00
CORRPREV	1.00	67	13.1493	3.38559	.41362	12.3234	13.9751	7.00	20.00
	2.00	121	12.6860	2.78697	.25336	12.1843	13.1876	6.00	19.00
	Total	188	12.8511	3.01319	.21976	12.4175	13.2846	6.00	20.00
CORRST	1.00	67	9.7761	2.44219	.29836	9.1804	10.3718	4.00	15.00
	2.00	121	9.1983	2.01916	.18356	8.8349	9.5618	3.00	13.00
	Total	188	9.4043	2.19050	.15976	9.0891	9.7194	3.00	15.00
CORRHC	1.00	67	9.7015	3.20518	.39158	8.9197	10.4833	3.00	18.00
	2.00	121	12.1405	2.51762	.22887	11.6873	12.5937	7.00	18.00
	Total	188	11.2713	3.01082	.21959	10.8381	11.7045	3.00	18.00
CORRCB	1.00	67	87.1642	11.46483	1.40065	84.3677	89.9607	54.00	113.00
	2.00	121	92.3223	12.31883	1.11989	90.1050	94.5396	59.00	126.00
	Total	188	90.4840	12.24373	.89297	88.7225	92.2456	54.00	126.00

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
DHNBScore	Between Groups	938.530	1	938.530	33.158	.000
	Within Groups	5264.635	186	28.304		
	Total	6203.165	187			
CORRAS	Between Groups	145.333	1	145.333	22.542	.000
	Within Groups	1199.194	186	6.447		
	Total	1344.527	187			
CORRPBN	Between Groups	34.525	1	34.525	10.889	.001
	Within Groups	589.751	186	3.171		
	Total	624.277	187			
CORRMI	Between Groups	22.917	1	22.917	6.245	.013
	Within Groups	682.551	186	3.670		
	Total	705.468	187			
CORRPATH	Between Groups	63.904	1	63.904	14.238	.000
	Within Groups	834.835	186	4.488		
	Total	898.739	187			
CORRPHAR	Between Groups	61.011	1	61.011	18.802	.000
	Within Groups	603.558	186	3.245		
	Total	664.569	187			
CORRPA	Between Groups	4995.656	1	4995.656	121.747	.000
	Within Groups	7632.153	186	41.033		
	Total	12627.809	187			
CORRRAD	Between Groups	106.042	1	106.042	5.066	.026
	Within Groups	3893.080	186	20.931		
	Total	3999.122	187			
CORRMGT	Between Groups	1346.116	1	1346.116	39.116	.000
	Within Groups	6400.836	186	34.413		
	Total	7746.952	187			
CORRPER	Between Groups	201.235	1	201.235	5.698	.018
	Within Groups	6568.568	186	35.315		
	Total	6769.803	187			
CORRPREV	Between Groups	9.256	1	9.256	1.020	.314
	Within Groups	1688.574	186	9.078		
	Total	1697.830	187			
CORRST	Between Groups	14.395	1	14.395	3.033	.083
	Within Groups	882.881	186	4.747		
	Total	897.277	187			
CORRHC	Between Groups	256.523	1	256.523	33.166	.000
	Within Groups	1438.641	186	7.735		
	Total	1695.165	187			
CORRCB	Between Groups	1147.328	1	1147.328	7.937	.005
	Within Groups	26885.624	186	144.546		
	Total	28032.952	187			

Supporting Statistics for Research Question 3 (b)

Oneway On Split 1 = Years 1998-2000;

2 = Years 2001-2003 [Hyp 3B]

Descriptives

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
DHNBscore 1.00	95	79.4526	5.51549	.56588	78.3291	80.5762	64.00	92.00
2.00	93	83.1290	5.42584	.56263	82.0116	84.2465	71.00	96.00
Total	188	81.2713	5.75951	.42006	80.4426	82.0999	64.00	96.00
CORRAS 1.00	95	10.2000	2.24840	.23068	9.7420	10.6580	5.00	15.00
2.00	93	12.5161	2.59017	.26859	11.9827	13.0496	5.00	18.00
Total	188	11.3457	2.68141	.19556	10.9600	11.7315	5.00	18.00
CORRPBN 1.00	95	6.7684	1.94855	.19992	6.3715	7.1654	2.00	10.00
2.00	93	7.0430	1.69343	.17560	6.6943	7.3918	2.00	11.00
Total	188	6.9043	1.82712	.13326	6.6414	7.1671	2.00	11.00
CORRMI 1.00	95	6.4105	1.81890	.18662	6.0400	6.7811	2.00	10.00
2.00	93	5.6882	2.00531	.20794	5.2752	6.1012	1.00	10.00
Total	188	6.0532	1.94231	.14166	5.7737	6.3326	1.00	10.00
CORRPATH 1.00	95	8.2947	1.96173	.20127	7.8951	8.6944	4.00	13.00
2.00	93	9.7957	2.16473	.22447	9.3499	10.2415	5.00	15.00
Total	188	9.0372	2.19228	.15989	8.7218	9.3527	4.00	15.00
CORRPHAR 1.00	95	7.9368	1.94505	.19956	7.5406	8.3331	3.00	12.00
2.00	93	7.1505	1.74422	.18087	6.7913	7.5098	4.00	10.00
Total	188	7.5479	1.88516	.13749	7.2766	7.8191	3.00	12.00
CORRPA 1.00	95	39.9684	7.08377	.72678	38.5254	41.4115	22.00	54.00
2.00	93	48.1828	7.17778	.74430	46.7045	49.6610	29.00	61.00
Total	188	44.0319	8.21757	.59933	42.8496	45.2142	22.00	61.00
CORRRAD 1.00	95	27.6947	4.21010	.43195	26.8371	28.5524	18.00	36.00
2.00	93	28.6022	4.99378	.51783	27.5737	29.6306	14.00	38.00
Total	188	28.1436	4.62447	.33727	27.4783	28.8090	14.00	38.00
CORRMGT 1.00	95	34.4526	5.16693	.53012	33.4001	35.5052	20.00	44.00
2.00	93	41.5914	5.55846	.57639	40.4466	42.7361	31.00	58.00
Total	188	37.9840	6.43642	.46942	37.0580	38.9101	20.00	58.00
CORRPER 1.00	95	30.1789	6.95423	.71349	28.7623	31.5956	16.00	45.00
2.00	93	30.9892	4.88230	.50627	29.9837	31.9947	19.00	41.00
Total	188	30.5798	6.01682	.43882	29.7141	31.4455	16.00	45.00
CORRPREV 1.00	95	12.1474	3.38636	.34743	11.4575	12.8372	6.00	20.00
2.00	93	13.5699	2.38837	.24766	13.0780	14.0618	6.00	19.00
Total	188	12.8511	3.01319	.21976	12.4175	13.2846	6.00	20.00
CORRST 1.00	95	9.8000	2.30448	.23643	9.3306	10.2694	3.00	15.00
2.00	93	9.0000	2.00000	.20739	8.5881	9.4119	3.00	13.00
Total	188	9.4043	2.19050	.15976	9.0891	9.7194	3.00	15.00
CORRHC 1.00	95	10.2947	3.18198	.32646	9.6465	10.9429	3.00	18.00
2.00	93	12.2688	2.46779	.25590	11.7606	12.7771	7.00	17.00
Total	188	11.2713	3.01082	.21959	10.8381	11.7045	3.00	18.00
CORRCB 1.00	95	85.9579	10.43614	1.07073	83.8319	88.0838	54.00	113.00
2.00	93	95.1075	12.27445	1.27280	92.5796	97.6354	59.00	126.00
Total	188	90.4840	12.24373	.89297	88.7225	92.2456	54.00	126.00

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
DHNBScore	Between Groups	635.176	1	635.176	21.218	.000
	Within Groups	5567.988	186	29.935		
	Total	6203.165	187			
CORRAS	Between Groups	252.101	1	252.101	42.924	.000
	Within Groups	1092.426	186	5.873		
	Total	1344.527	187			
CORRPBN	Between Groups	3.543	1	3.543	1.062	.304
	Within Groups	620.733	186	3.337		
	Total	624.277	187			
CORRMI	Between Groups	24.522	1	24.522	6.698	.010
	Within Groups	680.946	186	3.661		
	Total	705.468	187			
CORRPATH	Between Groups	105.874	1	105.874	24.837	.000
	Within Groups	792.866	186	4.263		
	Total	898.739	187			
CORRPHAR	Between Groups	29.056	1	29.056	8.504	.004
	Within Groups	635.514	186	3.417		
	Total	664.569	187			
CORRPA	Between Groups	3171.011	1	3171.011	62.369	.000
	Within Groups	9456.798	186	50.843		
	Total	12627.809	187			
CORRRAD	Between Groups	38.695	1	38.695	1.817	.179
	Within Groups	3960.427	186	21.293		
	Total	3999.122	187			
CORRMGT	Between Groups	2394.942	1	2394.942	83.232	.000
	Within Groups	5352.010	186	28.774		
	Total	7746.952	187			
CORRPER	Between Groups	30.856	1	30.856	.852	.357
	Within Groups	6738.947	186	36.231		
	Total	6769.803	187			
CORRPREV	Between Groups	95.097	1	95.097	11.036	.001
	Within Groups	1602.733	186	8.617		
	Total	1697.830	187			
CORRST	Between Groups	30.077	1	30.077	6.451	.012
	Within Groups	867.200	186	4.662		
	Total	897.277	187			
CORRHC	Between Groups	183.138	1	183.138	22.528	.000
	Within Groups	1512.027	186	8.129		
	Total	1695.165	187			
CORRCB	Between Groups	3934.196	1	3934.196	30.365	.000
	Within Groups	24098.756	186	129.563		
	Total	28032.952	187			

Supporting Statistics for Research Question 3 (c)
Oneway On Split 1 =Years 1998-2002;
2 = Year 2003 [Hyp 3C]

Descriptives

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
DHNBScore	1.00	156	80.6218	5.72188	.45812	79.7168	81.5268	64.00	96.00
	2.00	32	84.4375	4.89198	.86479	82.6738	86.2012	73.00	95.00
	Total	188	81.2713	5.75951	.42006	80.4426	82.0999	64.00	96.00
CORRAS	1.00	156	11.3141	2.77501	.22218	10.8752	11.7530	5.00	18.00
	2.00	32	11.5000	2.19971	.38886	10.7069	12.2931	7.00	16.00
	Total	188	11.3457	2.68141	.19556	10.9600	11.7315	5.00	18.00
CORRPBN	1.00	156	6.8526	1.82387	.14603	6.5641	7.1410	2.00	11.00
	2.00	32	7.1563	1.85106	.32722	6.4889	7.8236	2.00	10.00
	Total	188	6.9043	1.82712	.13326	6.6414	7.1671	2.00	11.00
CORRMI	1.00	156	6.2244	1.88910	.15125	5.9256	6.5231	1.00	10.00
	2.00	32	5.2188	2.01181	.35564	4.4934	5.9441	2.00	9.00
	Total	188	6.0532	1.94231	.14166	5.7737	6.3326	1.00	10.00
CORRPATH	1.00	156	9.1026	2.26667	.18148	8.7441	9.4611	4.00	15.00
	2.00	32	8.7188	1.78225	.31506	8.0762	9.3613	5.00	11.00
	Total	188	9.0372	2.19228	.15989	8.7218	9.3527	4.00	15.00
CORRPHAR	1.00	156	7.7244	1.78370	.14281	7.4423	8.0065	3.00	12.00
	2.00	32	6.6875	2.14683	.37951	5.9135	7.4615	4.00	10.00
	Total	188	7.5479	1.88516	.13749	7.2766	7.8191	3.00	12.00
CORRPA	1.00	156	42.5705	7.84126	.62780	41.3304	43.8107	22.00	61.00
	2.00	32	51.1563	6.06475	1.07211	48.9697	53.3428	34.00	61.00
	Total	188	44.0319	8.21757	.59933	42.8496	45.2142	22.00	61.00
CORRRAD	1.00	156	28.1538	4.74533	.37993	27.4033	28.9044	14.00	38.00
	2.00	32	28.0938	4.05096	.71612	26.6332	29.5543	17.00	38.00
	Total	188	28.1436	4.62447	.33727	27.4783	28.8090	14.00	38.00
CORRMGT	1.00	156	36.6474	5.66347	.45344	35.7517	37.5432	20.00	52.00
	2.00	32	44.5000	6.05885	1.07106	42.3156	46.6844	32.00	58.00
	Total	188	37.9840	6.43642	.46942	37.0580	38.9101	20.00	58.00
CORRPER	1.00	156	30.3333	6.46313	.51746	29.3111	31.3555	16.00	45.00
	2.00	32	31.7813	2.77935	.49132	30.7792	32.7833	26.00	37.00
	Total	188	30.5798	6.01682	.43882	29.7141	31.4455	16.00	45.00
CORRPREV	1.00	156	12.8526	3.19032	.25543	12.3480	13.3571	6.00	20.00
	2.00	32	12.8438	1.96927	.34812	12.1338	13.5537	9.00	16.00
	Total	188	12.8511	3.01319	.21976	12.4175	13.2846	6.00	20.00
CORRST	1.00	156	9.1667	2.27705	.18231	8.8065	9.5268	3.00	15.00
	2.00	32	10.5625	1.16224	.20546	10.1435	10.9815	8.00	13.00
	Total	188	9.4043	2.19050	.15976	9.0891	9.7194	3.00	15.00
CORRHC	1.00	156	11.0192	3.09937	.24815	10.5290	11.5094	3.00	18.00
	2.00	32	12.5000	2.18499	.38626	11.7122	13.2878	7.00	17.00
	Total	188	11.2713	3.01082	.21959	10.8381	11.7045	3.00	18.00
CORRCB	1.00	156	88.4872	11.75913	.94148	86.6274	90.3470	54.00	120.00
	2.00	32	100.2188	9.74757	1.72314	96.7044	103.7331	78.00	126.00
	Total	188	90.4840	12.24373	.89297	88.7225	92.2456	54.00	126.00

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
DHNBScore	Between Groups	386.604	1	386.604	12.363	.001
	Within Groups	5816.561	186	31.272		
	Total	6203.165	187			
CORRAS	Between Groups	.918	1	.918	.127	.722
	Within Groups	1343.609	186	7.224		
	Total	1344.527	187			
CORRPBN	Between Groups	2.449	1	2.449	.733	.393
	Within Groups	621.828	186	3.343		
	Total	624.277	187			
CORRMI	Between Groups	26.852	1	26.852	7.360	.007
	Within Groups	678.616	186	3.648		
	Total	705.468	187			
CORRPATH	Between Groups	3.912	1	3.912	.813	.368
	Within Groups	894.828	186	4.811		
	Total	898.739	187			
CORRPHAR	Between Groups	28.547	1	28.547	8.348	.004
	Within Groups	636.022	186	3.419		
	Total	664.569	187			
CORRPA	Between Groups	1957.365	1	1957.365	34.119	.000
	Within Groups	10670.443	186	57.368		
	Total	12627.809	187			
CORRRAD	Between Groups	.096	1	.096	.004	.947
	Within Groups	3999.026	186	21.500		
	Total	3999.122	187			
CORRMGT	Between Groups	1637.343	1	1637.343	49.847	.000
	Within Groups	6109.609	186	32.847		
	Total	7746.952	187			
CORRPER	Between Groups	55.668	1	55.668	1.542	.216
	Within Groups	6714.135	186	36.098		
	Total	6769.803	187			
CORRPREV	Between Groups	.002	1	.002	.000	.988
	Within Groups	1697.828	186	9.128		
	Total	1697.830	187			
CORRST	Between Groups	51.735	1	51.735	11.381	.001
	Within Groups	845.542	186	4.546		
	Total	897.277	187			
CORRHC	Between Groups	58.223	1	58.223	6.616	.011
	Within Groups	1636.942	186	8.801		
	Total	1695.165	187			
CORRCB	Between Groups	3654.509	1	3654.509	27.883	.000
	Within Groups	24378.443	186	131.067		
	Total	28032.952	187			

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