

2002

Implementation Of The Scholarly Activity Standard In Diagnostic Radiology Residency Programs

Judith E. Malinowski
Seton Hall University

Follow this and additional works at: <https://scholarship.shu.edu/dissertations>

 Part of the [Higher Education Commons](#), and the [Radiology Commons](#)

Recommended Citation

Malinowski, Judith E., "Implementation Of The Scholarly Activity Standard In Diagnostic Radiology Residency Programs" (2002).
Seton Hall University Dissertations and Theses (ETDs). 467.
<https://scholarship.shu.edu/dissertations/467>

IMPLEMENTATION OF THE SCHOLARLY ACTIVITY STANDARD IN DIAGNOSTIC
RADIOLOGY RESIDENCY PROGRAMS

By

Judith E. Malinowski, Ph.D.

Dissertation Committee:

- Sheama Krishnagiri, Ph.D., OTR/L, Chair
- Margaret Briggs, Ph.D., CCC-SLP
- Jonathan Engel, Ph.D.
- John W. Sensakovic, M.D., Ph.D.

Approved by the Dissertation Committee:

Sheama Krishnagiri Date 4/1/02

Margaret Briggs Date 4/1/02

J. Engel Date 4/1/02

John W. Sensakovic M.D. Ph.D. Date 4/1/02

Submitted in partial fulfillment of the requirements for the degree of
 Doctor of Philosophy in Health Sciences
 Seton Hall University
 2002

Copyright © Judith Elaine Malinowski 2002

DEDICATION

Two very special men have significantly influenced my doctoral journey and, in many ways, are responsible for my finally arriving at this point. The first is my boss and friend, Mark J. Rametta, D.O. If it had not been for Dr. Rametta I may have spent the rest of my life *talking* about getting my Ph.D. He gave me the gentle push I needed, when I was most receptive. In the years that followed he encouraged me and praised me. Without his support, the journey would have been much tougher.

The second is Jonathan Engel, Ph.D. I first met Dr. Engel, when he taught Philosophy of Science. My initial panic, at the thought of reading nine books in fourteen weeks – and living up to his expectations, soon turned to awe. Each week was more interesting than the next. During the subsequent years – and courses – that admiration has grown. He is brilliant, kind, professional, and a truly wonderful role model. He has a talent for inspiring and pushing, while making you feel as if you are the one, who has something interesting to contribute.

For their roles in helping me to become Judith Malinowski, Ph.D., I dedicate this study to Dr. Mark J. Rametta and Dr. Jonathan Engel.

ACKNOWLEDGEMENTS

A professional journey, as with life's many personal journeys, requires the assistance and support of many people. First, I would like to thank the many faculty and medical professionals, who have helped me and stimulated me throughout the years. In particular, I must mention three, who were instrumental at the beginning of my educational pursuits in the doctoral program. They are Mark J. Rametta, D.O., John Mitchell, Ph. D., and Jonathan Engel, Ph.D. Each was crucial to my choosing to matriculate into this program.

Second, I thank, Jonathan Sunshine, Ph.D., Yasmin Cypel, Ph.D., and Bruce Hillman, M.D. of the American College of Radiology for their endorsement of the study and their many efforts on my behalf; Jay Harolds, M.D. of the Association of Program Directors in Radiology; the program directors, who participated in the pilot study; and all the program directors, who took the time to respond to my survey, especially those, who wrote comments, notes, and letters. They were much appreciated – and very useful.

In addition, (in no particular order) I thank my fellow students; Doreen Benedetto and the medical education department at Saint Michael's Medical Center (for cheering me on, giving me a shoulder to cry on, feeding me, but most of all, for being my friends); Elaine Walker, Ph.D., Catherine Beneteau, Ph.D., and Jeanne Czajka, Ph.D. (statistical advice); George Cardinale, Ph.D. (weekly words of encouragement); Erik in Technical Support (thank you for fixing my SPSS); Barbara Ward and her staff at the SHU library (thank you for getting all those articles!); my long-neglected friends, especially Rob Strauch (who always spoke of my efforts in superlatives), Ellen Sears (for letting me vent), and Richard Drezen (because he always seemed to send me a note just when I needed it most); and to my internal medicine residents (because they bring such joy to my life).

Lastly, but definitely not least, I thank my committee, Jonathan Engel, Ph.D., John W. Sensakovic, M.D., Ph.D., Margaret Briggs, Ph.D. and most importantly, Sheama Krishnagiri, Ph.D., who sacrificed countless hours and numerous weekends editing this document and helping me move forward.

TABLE OF CONTENTS

Copyright.....	2
Dedication.....	3
Acknowledgements.....	4
List of Tables.....	7
Abstract.....	8
I. INTRODUCTION.....	10
Background of Problem.....	10
Statement of Problem.....	14
Purpose of Study.....	15
Hypotheses.....	15
Rationale for Study.....	16
Definition of Terms.....	17
II. REVIEW OF LITERATURE.....	19
Theoretical Framework.....	19
Typical Residency Research Programs.....	25
Components of Research and Scholarly Activity Programs	33
Research Limitations.....	38
Summary.....	42
III. METHODS.....	44
Type of Study.....	44
Instrumentation.....	44
Pilot Study.....	46
Subjects.....	46
Procedures.....	47
Data Analysis.....	48
Assumptions.....	49
Limitations.....	49

IV. RESULTS.....	51
Response Rate.....	51
Program Demographics.....	52
Curriculum.....	57
Research Activities.....	61
Leadership Skills.....	67
The Role and Importance of Scholarly Activities.....	76
Compliance.....	78
Summary.....	83
V. DISCUSSION.....	85
How the Standard is Being Met.....	86
Program Directors' Self-Identified Skill Level.....	93
The Importance of a Research Curriculum.....	95
Perception of Skill Level and Perception of Skill Importance...	97
Perception of Skill Level in Research Methodologies and Perception of the Importance of a Research Experience.....	100
Associations with Excellence.....	102
Summary.....	111
VI. CONCLUSIONS.....	113
Curriculum.....	113
Clarification of the Standard.....	116
Recommendations	118
Strengths and Limitations.....	120
Recommendations for Further Study.....	122
REFERENCES.....	123
APPENDICES.....	127
A. Research and scholarly activity standard (allopathic).....	127
B. Research and scholarly activity standard (osteopathic).....	130
C. Program review documents (ACGME)	135
D. Seton Hall University Institutional Review Board Documents.....	138
E. Survey.....	141
F. Tables.....	148

LIST OF TABLES

1.	Response rates by program characteristics.....	149
2.	Comparison of population and survey respondents.....	52
3.	Number of residents and faculty in radiology residency programs in the 2000-2001 academic year.....	53
4.	Research director degree and position characterization.....	150
5.	Administrative affiliations of radiology residency programs.....	151
6.	Administrative affiliation and research director characterization.....	152
7.	Administrative affiliation and degree of research director.....	153
8.	Relationship between grants and research director position.....	154
9.	Research skill level of radiology program leadership, as reported by the program director.....	68
10.	Program director agreement with opinion statements.....	77

Abstract

Medical residency programs are required to have a research and scholarly activity component. To date, there has been no study published describing how the requirement is being met in diagnostic radiology programs. A survey was mailed to the program directors of the 203 diagnostic radiology programs in the United States, asking them to: a) describe the program's research curriculum and scholarly activities, b) give their opinions regarding the role and importance of a number of related skills and activities, and c) identify how successful they were in complying with the research standard. A total of 96 programs (47.3%) responded to the survey. The research curriculum is composed of individual lectures. Critical analysis of the literature was the most common content area. Most programs do not require a research project. Only 11% of the programs rated their efforts in meeting the standard as superior, which was defined as the top 25% of all radiology residency programs. There is a relationship between program director self-reported skill level and the director's perception of the skill and its place in residency education. However, these perceptions are not associated with program curricula. It appears that

curriculum decisions are based on something other than pedagogical influences. Programs, that believe they are successful in meeting the research standard, tend to be larger, university-administered programs, receiving grant funding, have a competent, official research director, and have ongoing support in ancillary areas, such as statistics and presentation assistance.

Chapter I

INTRODUCTION

Background of Problem

History and Development of the Standard

Historical Development of Research in American Higher Education

Research, as a component of graduate education, developed slowly. Service to the community was the primary focus of the early American universities (Beattie, 2000; Boyer, 1990). A focus on research developed gradually, beginning in the nineteenth century, when American scholars began to emulate the German model, which had a research orientation. However, research did not become important in American university life until the mid twentieth century (Beattie, 2000; O'Neil, 1998).

The focus on research in medical schools followed a more accelerated path. Scientific thought and inquiry was a part of the medical school curriculum in the early twentieth century. Its inclusion is believed to be in response to a recommendation in the Flexnor Report that the medical faculty should engage in research (Barzansky & Gevitz, 1992; Flexnor, 1910) . The report was sponsored and published

by the Carnegie Foundation. Although scholars believe that medical education reform had begun before Flexnor, it continues to be considered by many medical educators as the most influential publication leading to the reform of the medical education curriculum in the United States (Barzansky & Gevitz, 1992).

In the 1940s and 1950s three governmental initiatives emerged that had an impact on the scientific community: the Manhattan project, the space race, and the growth of the National Institutes of Health (NIH). It was the development and expansion of the NIH, however, and its role in funding medical research, that was integral to the growth of research in medical schools and academic medical centers (AMC) during the last half of the century (Barchi & Lowery, 2000; O'Neil, 1998).

Accreditation Council for Graduate Medical Education

The Accreditation Council for Graduate Medical Education (ACGME) is responsible for the accreditation of all allopathic graduate medical education programs (GME), i.e. internships and residencies (American Medical Association, 2001). They publish the Program Requirements for Residency Education, formerly called the Essentials of Accredited Residencies. The Requirements for each residency are

published in the Directory of Residency Training Programs, known as The Green Book. The requirements and their individual components are commonly referred to as the standards. Each residency (e.g. diagnostic radiology, internal medicine, surgery) has its own standards (American Medical Association, 2001).

The standards are written in partnership with the respective professional communities. Although there are many common areas, the language and specific requirements are different for each type of residency. The research and scholarly activity standard is not uniform for all residencies. Some residencies have definite requirements, as indicated by the use of the words shall and will. The diagnostic radiology standard, although explicit, is more flexible. Should, rather than shall, is used throughout the standard.

In the early eighties, the research standard for Diagnostic Radiology was one sentence, "The program should encourage residents to participate in research" (American Medical Association, 1981, p. 52). Today, the research and scholarly activity standard is more extensive and describes many activities in which the resident and faculty should participate (Appendix A).

The current Executive Director for Diagnostic Radiology at the ACGME, states that a scholarly environment is difficult to ascertain

during an accreditation site visit. Therefore, the number of faculty publications is typically used as evidence of ongoing scholarly activity (J. Armbruster, personal conversation, April 2001).

American Osteopathic Association

The American Osteopathic Association (AOA) is responsible for the accreditation of all osteopathic graduate medical education programs (Ward, 1997). The official title of their accreditation standards is the Basic Standards for Residency Training. Similar to the AMA process, the standards for each residency are written in partnership with the respective professional groups.

Research and scholarly activity are included in three sections of the diagnostic radiology standards (Appendix B). One point to be noted is that the osteopathic radiology resident must perform research and exhibit a poster at the American College of Osteopathic Radiology conference before completing the residency. The ACGME does not have a comparable requirement for radiology residents in allopathic programs.

Statement of the Problem

As previously stated, Dr. Armbruster of the ACGME believes it is difficult to evaluate how well the standard is being applied and met in individual residency programs. The ACGME does not have an evaluation tool, other than counting the number of faculty and resident publications. A count does not encompass the breadth and depth of the research and scholarly activity standard. A publication count does not address quality of education issues, such as curriculum or faculty mentorship.

As the literature reviewed in the next chapter will show, it is not known how the diagnostic radiology residency directors are interpreting the research and scholarly activity standard. It is not known how the standard is influencing the residency curriculum. Nor is it known if the program leadership and faculty are prepared by academic training or experience to mentor the residents in research design and evaluation. To date, no one has addressed these questions in the literature.

Purpose of Study

The purpose of this study is to describe:

1. how the accreditation standard is being met in diagnostic radiology residency programs in the United States today;
2. program directors' self-identified skill level in six basic research skills and content areas;
3. program directors' perceptions of the importance of common components of a research curriculum in residency education.

Hypotheses

Hypothesis 1

There is an association between a program director's self-identified skill level in a given research topic or skill and the program director's perception of its importance in the residency curriculum.

Hypothesis 2

There is an association between a program director's self-identified skill level in research methodology and the director's perception regarding the need for a research experience during residency education.

Hypothesis 3

There are similar program characteristics (e.g. curriculum, faculty experiences, presence of a research director), amongst programs describing their research and scholarly activity curriculum as excellent or superior.

Rationale for the Study

Although the research and scholarly activity standard has been in place for twenty years, no one has published a study describing how the standard is being met by diagnostic radiology programs in the United States, or how prepared (academically or experientially) the faculty are to teach or mentor the residents in this curricular area. There is anecdotal evidence suggesting that there is resistance among the diagnostic radiology program directors and faculty of allopathic programs to expanding the scope of their standard or to changing sections of the standard from recommended to mandatory.

The professional organizations, through their leaders, have a voice in accepting or rejecting new standards. However, the standard has been evolving without data from the programs to determine if they have the human or institutional resources to grow and evolve as the standard changes and becomes more demanding.

If the elements of a successful research curriculum and environment in residency education can be identified, a leadership program can be designed to assist the program directors, who are struggling with this issue.

Definition of Terms

Allopathic is a term commonly used to describe traditional medicine or a traditional physician, i.e. M.D.

Osteopathic medicine is a branch of medicine that employs the methods of traditional medicine and the methods and principles of osteopathy. Osteopathy believes in a holistic approach to disease. The medical school curriculum includes all components of the allopathic medical school curriculum and the principles and practices of osteopathic manipulative medicine (OMM), which employs physical manipulations of the muscle and spinal column. The degree granted to a graduate of an osteopathic college of medicine is a D.O. (Ward, 1997)

The program director is the official responsible for maintaining the quality of a graduate medical education (GME) program, so that it meets accreditation standards. (Glossary, www.acgme.org)

A resident is a physician at any level of graduate medical education in a an accredited program (American Medical Association, 2001).

A standard is a degree or level of requirement, excellence, or attainment. (American Heritage Dictionary, 1996) In this study, standards are the residency accreditation requirements, which are published by the Accreditation Council for Graduate Medical Education (ACGME) or the American Osteopathic Association (AOA).

Chapter II

REVIEW OF LITERATURE

This literature review will present topics relevant to the interpretations and opinions of the research and scholarly activity standard, which is a module of both the allopathic and osteopathic accreditation requirements for graduate medical education. The chapter will begin with a brief description of the Dreyfus Model as it relates to learning and skill acquisition. Next, a review of the standard and how it is being met in graduate medical education in general is given, along with information on radiology residency programs in particular. This will be followed by a discussion of the published opinions of the necessary components of a research and scholarly activity program, such as curricular priorities and the role of program leadership. The review will conclude with an evaluation of the methodology, problems, and gaps found in prior studies.

Theoretical Framework

As with many learners, medical residents are taught an extensive number of subjects and are given a vast amount of

information. The level of comprehension and expertise required is not the same for all topics. Learners do not achieve expertise in each skill they learn. The literature was reviewed to identify a learning theory, which encompassed all the components of learning a skill and applying the knowledge.

There are many theories describing how students learn. The theories relate to cognition, learning styles, retention, or to the influence of motivation, the learning environment, and teaching methodologies (Brookfield, 1986; Jarvis, 1992; Kolb, 1984; Sousa, 1995). Only one could be identified, which encompassed the progression of skill and cognitive development, the decision-making process utilized once a skill has been learned, and the experience necessary to maintain the final level of expertise that the learner achieved. This is the Dreyfus model of skill acquisition.

Hubert and Stuart Dreyfus have been studying skill acquisition for many years. Their work with airline pilots, chess players, automobile drivers, and adult learners of a second language revealed a common pattern of skill development. As the level of comprehension and skill capability progressed, learners in each of the named activities progressed through the same stages of skill development and decision-making processes. Dreyfus and Dreyfus (1986) called the five

stages novice, advanced beginner, competent, proficient, and expert. The progression is complex. More than one category of change occurs at each level. For example, as skill improves, there are changes to the learner's perceptions of his task and/or his mode of decision-making. Their theory was initially circulated in government and corporate research documents. Using the original United States Air Force report, Benner (1984) applied the Dreyfus Model to the acquisition of nursing clinical skills. The Accreditation Council for Graduate Medical Education has proposed incorporating the Dreyfus Model into its new competency initiative (Leach, 2002; S. Dreyfus, personal correspondence, February 2002). The model is applicable to learning research skills, as well.

The Five Stages of the Dreyfus Model

During the initial stage, the novice learner recognizes objective facts and acquires rules. This level corresponds to the teaching and learning of all basic theory, such as the language and concepts of research methodology. The learner is given the information and may be able to recall facts, but he cannot process the information within specific contexts.

Dreyfus and Dreyfus call the second stage advanced beginner. During this stage the learner gains practical experience and is able to apply the information in limited situations. This stage corresponds to the resident, who is learning to evaluate medical literature, or one, who is assisting a mentor in a research project. During the first two stages, the learner employs no judgment.

The third stage is called competence. At this stage the learner is able to prioritize importance. Dreyfus and Dreyfus state that the competent performer must be able to choose an organizing plan, and will feel responsible for his choice. This level corresponds to the resident or faculty, who has the skills necessary to assume the role of principle investigator in a research study. Another example is a physician, who is able to read a published research study and make an informed decision about how the results of the study will influence his clinical practice. The first three levels of skill require reasoned thought in the problem-solving process. The two highest levels are more intuitive.

The proficient performer, the fourth level, seems to know the answer, has an opinion, or make a decision, without having a conscious awareness of how he came to the conclusion or decision. This level of performance requires a great deal of practical

experience. A busy resident or member of the clinical faculty may not have sufficient time involved in research to achieve this level.

The final level, expertise, requires frequent, ongoing experience, both to achieve and to maintain expertise. At this stage, the expert's skill has become natural. His deliberations or thought process is critically reflective, rather than calculative problem solving. One would have to be engaged in research on a daily basis to achieve and maintain the expert levels.

The levels are not discrete, but are a continuum. A learner may sometimes perform at a higher level than he has achieved, but it will not be a fluid process. Although the model identifies five stages, according to the authors, four would be appropriate and acceptable for the purpose of this study (S. Dreyfus, personal correspondence, April 23, 2001).

The Dreyfus Model, a Research Curriculum, and The Study

It would seem that the basic theory taught in a typical research methods course or critical evaluation of medical literature course would fulfill the requirements for the novice level. Early reading of the medical literature and discussions of hypothetical situations are part of the advanced beginner stage. In this study, the advanced beginner

stage will be referred to as working knowledge (S. Dreyfus, personal correspondence, April 23, 2001). This study will attempt to identify a minimum stage that a physician should achieve in the skill of reading and evaluating published medical literature. The study will seek to ascertain if program leaders believe that a physician can achieve competency without participating in an actual research study. In other words, is a learner able to understand the subtleties and nuances of research studies by repeated evaluation of the literature alone. Unless conducting research is an integral part of their professional life, it would seem difficult for most clinicians or academics to reach and sustain the proficiency level. According to the Dreyfus model, expertise is lost through inactivity, even if the expert is engaged in a cognitive sense. Frequent, ongoing practice is required to maintain expertise.

The standards require scholarly activity in each residency, but they do not set a minimum level of achievement regarding skill or quality. This is determined by the program leadership.

Typical Residency Research Programs

The Standards

The Accreditation Council for Graduate Medical Education sets general standards for all residency programs. However, the exact wording of the standard is different for each type of residency. For some residencies, the standard is explicit. For example, the ACGME states that the collective activity of the internal medicine faculty "must include all of the following" and lists a series of activities and requirements. Residents "must demonstrate acceptable scholarly activity, such as original research, comprehensive case reports, or review of assigned clinical and research topics" (American Medical Association, 2001, p. 104).

By contrast, the diagnostic radiology and obstetric and gynecology standards each state that the residents should "be encouraged" to participate in research. In addition, each provides a list of scholarly activities in which the faculty "should" participate. The diagnostic radiology standard does not discuss documentation, however, documentation submitted to the ACGME at the time of program review must include a research section, describing research facilities and listing research projects and publications (Appendix C).

Implementation of the Standard In Non-radiology Residencies

A review of the published literature indicates that little consensus exists either among or within disciplines. In internal medicine residency programs, critical appraisal skills was the only required topic taught by a majority of the programs (Alguire, Anderson, Albrecht, & Poland 1996). Only twenty percent of the programs listed research methods as a required topic, even though the ACGME mandated evidence of scholarly activity by internal medicine residents and defined scholarly activity as original research, comprehensive case reports, or review of assigned research topics.

In rehabilitation medicine, Buschbacher and Braddom (1995) reported some disagreement between residents and their program directors, regarding adequacy of research training. A majority of the program directors felt that the residents received adequate training in reviewing the literature, reading papers, research design, research methodology, and writing papers. However, reviewing the literature and reading papers were the only content areas that a majority of the residents reported receiving adequate training. The study did not address the reasons for discrepancy. The differences might be explained by subjective interpretations, such as differing expectation levels and the use of the word "adequate".

DeHaven, Wilson, Murphree, and Grundig (1997) studied the research curriculum offered by family medicine residency programs. They asked factual questions about curriculum content and opinion questions about the knowledge and skill levels achieved by their residents in several content areas. How to read and evaluate medical literature was the one course taught in almost every family medicine residency program. When comparing the objective answers with the subjective ones, there were three areas of apparent disagreement between courses or topics taught and opinion about skills learned. First, although three-quarters of the programs taught their residents study design, just more than a third of the programs said their graduates knew how to design a project. Second, the interpretation of elementary statistics, such as chi-square and t tests, were taught by a majority of the programs, but only 17% of the programs said their graduates were able to perform an analysis using them. Third, a majority of programs reported teaching a range of subjects and courses, such as understanding the medical literature (91.3%), research design (76.9%) or statistics (57.9%), but only half the programs believed their curriculum was organized. The authors offer no explanation for these discrepancies.

Almost all the emergency medicine residencies have formal presentations on research design. However, there is a wide range of course timeframes. Courses were as short as one hour and as long as thirty hours, with a mean of just over eight hours (Levitt, Terregino, Lopez, & Celi, 1999a). No attempt was made in this study to compare content between very brief courses and longer ones.

A majority of pediatric emergency medicine programs do not offer formal coursework within their departments, but half of those without internal coursework do offer training outside their departments (Mason, Biehler, Linares, & Greenberg, 1999). Unfortunately, the authors do not describe the format or locale of these outside courses.

In addition to composite studies of given disciplines, some programs have published articles describing their specific approach to meeting the standards. For example, the Merida Huron Hospital in Cleveland, Ohio, a community hospital that does not have the resources to develop and teach formal research courses, integrated clinical research into its basic surgery clinical curriculum (Chung, Diaz, & Li, 1999). Most of the teaching is performed by mentors on an individual basis, but the program does have mini-workshops on scientific writing for team members and program-wide conferences on data interpretation.

Another example, the emergency medicine department of the University of Illinois in Chicago, requires their first year residents to attend a forty-hour course, which meets five days over a one-month period (Fraker et al., 1996). The organization of the lecture topics follows the chronological development of a research project. The course is taught by a broad range of faculty and administrators, who use examples of their own research in the lectures. The afternoon workshops, which complement the morning theoretical sessions, include diverse topics, such as computerized literature searches and slide-making techniques.

Recognizing that individual programs and hospitals may not be able to give faculty significant release time to teach formal courses or that a single program may not have the expertise to offer a wide range of topics, some programs have formed consortia. The Oakland Health Education Program Center for Medical Education (OHEP) in southwest Michigan was incorporated in 1974. The consortium currently includes one medical school, seven medical centers affiliated with the medical school, and six community hospitals (Neale, Pieper, & Hammel, 2000). One service of the consortium is an annual research workshop series. The workshop, which is not mandatory for membership residents, consists of four half-day sessions. The sessions,

which can be taken at any time during the residency training, prepare the residents for their hospital's research day. The top-performing residents at each research day, compete at the OHEP research forum each spring. The first three workshops in the series are open, either as individual sessions or as a complete course, to residents from non-member institutions for a small fee.

In addition to describing formal coursework, the literature also discusses the practical aspects of research and scholarly activity. There appears to be no consensus regarding expectations for participating in research or for the type of research that is acceptable. For example, in the Alguire et al. study (1996), there was no consistency among the internal medicine programs regarding minimum research expectations. Completion of a single case report was the only project or study identified by half the programs as meeting the minimum research expectations.

A majority of obstetrics and gynecology residency programs required a research project, but the results of the study may have been influenced by responder bias (Sulak, Croop, Hillis, & Kuehl, 1992). A follow-up telephone survey of a sample of non-responders found a significant difference in the percentage of programs requiring a project or study (68% of responders v. 26% of non-responders).

In another study, slightly more than a quarter of the pediatric residency programs had a research requirement. Brouhard, Doyle, Aceves, and McHugh (1996) defined research projects broadly, i.e. retrospective chart reviews, prospective human studies, patient reports, literature reviews, and basic laboratory reports. Of the programs that did have a requirement, a majority were small programs, having 10 or fewer residents: A majority of programs requiring research accepted the variety listed in the study survey.

Although three-quarters of the family medicine program directors said that involving residents in research was a goal of their program, less than a third of them require a research project (DeHaven et al., 1997). More than half the physical medicine and rehabilitation residency programs require a research project (Blake, Lezotte, Yablon, & Rondinelli, 1994).

The literature reviewed has included curricular content, skills taught, strategies for providing courses, and types of research required in a number of residency programs. Other than teaching residents to read and evaluate medical literature, there appears to be very little agreement about what is taught, what should be taught, how it is taught, and how well it is taught.

Research and Radiology Residencies

Very few studies have been published about the current state of research and scholarly activities in diagnostic radiology residency programs. The first of two is by Gay and Hillman (2000), who surveyed University of Virginia residents, who participated in a one-month, mandatory research rotation. The stated purpose was two-fold: to examine their research productivity and to see if they developed an interest in research. The very basic one-page survey did not ask any questions about an interest in research, although this was half the stated purpose. Eight of the ten questions were factual; the two opinion-type questions asked if the experience was worthwhile and if they learned anything in research methods, statistical methods, or manuscript preparation. The study did not do a pre-test, nor did they have a control group, who had not taken part in the rotation.

A second study by McGuire and Herberman (1998) attempted to identify the types of research done in radiology residency programs, in order to determine how the ACGME standards were being met, and to see if there were differences between university-based residencies and those in private institutions. Their survey consisted of only six questions and contained no curriculum questions. The original survey was mailed to program directors. In reaction to a

very low mail response rate, the authors changed the methods. They conducted in-person interviews with several chief residents from programs, which had not sent a response. The total response rate was 45%. No meaningful results were found.

In summary, how to read and evaluate the medical literature is the course most commonly taught in residency programs, although the method ranges from formal (e.g. lectures and workshops) to informal (e.g. journal club and individual mentoring) formats. This is the only requirement about which there is consensus. Some programs require research, but may not require didactic preparation to participate in research studies. In the limited literature published, research and scholarly activity have not been uniformly defined, adding to the lack of consistency in the application of the standard.

Components of Research and Scholarly Activity Programs

Curricular Priorities

Physicians must be active consumers of published research throughout their careers. Therefore, it is not surprising that the two skills, most commonly identified in the literature as required or mandatory, are critical appraisal of the literature and statistics (Alguire et al., 1996; Buschbacher & Braddom, 1995; DeHaven et al., 1997; Supino &

Richardson, 1999). The actual courses offered are determined by a number of factors, such as interpretation of the requirements, available faculty to teach the course, and institutional influences. Two studies attempted to identify content priorities, regardless of these other influences.

Alguire et al. (1996) examined internal medicine program directors' perceptions about the importance of research skills, performance skills and content knowledge. When given a list of seven research skills, there was almost unanimous agreement that critical reading of the literature is either very or somewhat important. The most disagreement involved two skills, i.e. population description and hypothesis-driven research skills. The group responses were almost evenly divided between the two positive responses, i.e. very/somewhat important, and the two negative responses, i.e. somewhat unimportant/not important.

Neinstein and MacKenzie (1989) surveyed 482 first authors of research articles in major peer-reviewed journals in four disciplines, i.e. internal medicine, obstetrics-gynecology, pediatrics, and surgery. The authors gave a list of seven content areas and asked for recommendations. Each subject area received a strong recommendation. The areas and the percent identifying it as a

recommended course are: introductory biostatistics (99.6%), computer use (95%), experimental design (90%), advanced biostatistics (85.5%), epidemiology (71%), sampling techniques (71%), and health statistics (65.7%). Critical appraisal of the literature was not on the survey list.

The professionals, who are successful researchers and authors, view academic preparation as more important than the program leaders do. The next section will examine the research experiences of the program leaders, who are responsible for curricular choices.

Leadership Research Skills

Program Director

Although the program directors are responsible for meeting the accreditation standards for the program, very little has been published about their academic and experiential preparation for the position. Supino and Richardson (1999) surveyed a broad range of emergency medicine faculty, including the academic chair, residency director, and research director. Almost all the residency directors (89%) have a clinical doctorate only. Although 70% of the residency directors are currently mentoring residents, only forty percent of the residency directors have had a research mentor themselves. The participants were asked to identify their knowledge

level in twelve research content areas. Almost all the information in the study is reported as aggregate ratings. No attempt was made to find associations between or within groups. By reporting the scores in this manner, it is difficult to get accurate information about the qualifications and experiences of each category of leader or faculty.

Research Director

The emergency medicine residency is the only residency that is required to have a research director (Summers, Fish, Blanda & Terndrup, 1999). Some studies of other residencies have sought to ascertain how many programs employed a research director, and if they did, what qualifications did they have.

DeHaven et al. (1997) in a study of family medicine residency programs report that a third have a full time research director. In their follow-up study they found that all programs described as having successful research programs had a research director (DeHaven, Wilson, & O'Connor-Kettlestrings, 1998). The qualifications and productivity of the research director were not explored in this study, however, it was noted that most of the research directors were not physicians.

Schulz (1996) argues that a dedicated director of resident research is essential for a successful research curriculum and

experience. However, only slightly more than a third of the internal medicine residency programs had a research director, and none spends more than half their time teaching, coordinating, or directing resident research. The majority of research directors are medical doctors without another advanced degree (Alguire et al., 1996).

The qualifications of the emergency medicine research directors have been described in three studies. The first, a study by Supino and Richardson (1999) was previously described in the Program Director subsection. As noted, the aggregate manner in which the results were reported makes it difficult to assess the research director's responses as well.

Blanda, Gerson, and Dunn (1999) attempted to characterize the research directors by examining faculty status, perceived preparation for the position, presence of a research degree, and publication history. Half described themselves as junior faculty (clinical instructor or assistant professor). Only 28% has a research degree. A quarter said they had no formal preparation for the position. In the study, formal preparation was defined as coursework only, a research fellowship, or a research degree, although type of degree was not mentioned. The only associations reported were for research productivity. Senior rank, presence of a research assistant, and

Herberman, 1998), and project (Blake et al., 1994). Some of the surveys themselves were short and nonspecific. They asked if there was a requirement, and if so, each asked a few follow up questions (Brouhard et al., 1996; McGuire & Herberman, 1998; Sulak et al., 1992). It appears that some of the studies may have been short because their intent was to examine one feature of their program to compare it other programs. Even so, the information received was so general and vague, that its usefulness is questionable.

Some results may have been influenced by the collection method. Two examples are studies involving resident or fellow surveys, which were mailed to and distributed by the program directors (Mason et al., 1999; Terregino, Levitt, Lopez, Eskra & Arnold, 1999). The impact of program director involvement is not known. A third example employed two different collection methods and surveyed two very different populations. McGuire and Herberman (1998) reported a 45% response rate, but only 32% (n = 65) of the program directors returned a written survey. In order to increase the response rate, the authors conducted in person interviews with chief residents from 27 nonresponding programs at an educational conference and asked them the 6 questions on the survey. Their responses were combined with those submitted in writing by the program directors even though

chief residents and program directors may have different perspectives. The different collection methodology, i.e. mail survey versus in person interviews, could also influence the responses.

The pervasive problem, however, involves the lack of complexity, breadth, and depth in the survey and/or analysis of the results. Some did not examine possible confounders. For example, Terregino et al. (1999) studied the residents' research experiences, but didn't ask about key areas, such as protected time to do research or training in specific research methodologies. Experience in both areas could have influenced responses on the survey. Blake et al. (1994) examined level of research productivity, but didn't ask if the program required a minimum number of projects. Therefore, they were not able to evaluate the influence that having, or not having, a requirement had on productivity.

Gay and Hillman (2000) evaluated the impact of their one-month research rotation. They asked three types of questions: factual, opinion, and quantitative (i.e. number of projects completed during residency). They did not do a pre-test to examine existing opinions or skills level, nor did they compare the number of projects completed by residents before the rotation with the number of projects completed by those taking the rotation.

DeHaven et al. (1997) reported results that raise other questions, some of which could have been answered with more analysis. For example, 53% said they had a research curriculum and 77% of the programs reported teaching their residents study design. However, only 35% said their graduates knew how to design a research project, and 34% had a full-time research director. They did not examine the relationships between these four variables. It would be interesting to note which had the greater influence on research design knowledge, taking the course or the presence of a research director. Also, there were no follow-up questions on this phone survey, so we do not know why so many programs reported teaching design, but relatively few believed their graduates had the knowledge.

Failure to examine relationships between individual responses was a common problem. The aggregate reporting of results in the Supino and Robinson (1999) study was described earlier. In examining research productivity, Blake et al., (1994) placed all respondents into one of two extreme categories. They created a dividing line of 1 project during a four year rehabilitation residency or 0.25 projects per resident per residency year. Everyone reporting an average of less than one was labeled as having low productivity; all others were described as having high productivity. This artificial line, with no one

described as moderate, created analysis problems. It was difficult to find significant differences between the two groups. They reviewed the number of completed projects, not type of projects, without regard for complexity or quality. This, too, may have had an impact on their results. For example, working with a mentor had a negative influence on quantity. Did qualified mentors require more complex projects or did they have more stringent, i.e. time consuming, standards?

Summary

There is a lack of consensus and consistency in the literature regarding research and scholarly activities in residency programs. The subject has been examined from a few perspectives. Some authors attempted to identify courses taught or skills learned. How to read and evaluate the medical literature was the only course consistently identified. Two tried to identify topics that should be taught in a successful research curriculum. The differing results reported in the two studies suggest that professional training and experience may influence one's perception of a topic's importance.

Although few authors have attempted to describe the current state of research programs in their discipline, no one has published a

national study describing diagnostic radiology residency programs. In the studies that have been published in other disciplines, no one has studied the relationship between individual program characteristics, leadership characteristics or opinions, and research curriculum. Most of the analysis that has been done has been aggregate comparisons.

Given the need for evaluating how the scholarly activity standard is being met and the lack of published data on this topic at the national level with the necessary depth and breadth, this study examines how the research and scholarly activity standard is being met in diagnostic radiology residency programs nationwide. Furthermore, it examines the relationship between program leaderships' research qualifications, both academic and experiential, and the method in which the standard is interpreted in their programs.

Chapter III

METHODS

Type of Study

This is a non-experimental, descriptive, survey study (Portney & Watkins, 1993). It is non-experimental because there is no control group, no randomization, and an independent variable is not being manipulated. It is descriptive because it describes the characteristics of diagnostic radiology residency program and the program leadership. The respondents were asked to describe the components of their program for the 2000 – 2001 academic year. The study has been approved by the Seton Hall University Institutional Review Board (Appendix D).

Instrumentation

The survey (Appendix E) designed by the researcher has five sections. The curriculum and program leadership sections were based on prior studies and commentaries in the review of literature as well as on discussions with the radiology executive director of the ACGME. The opinion statements were based on the review of literature and on

focus group and private discussions with residents and radiology residency faculty.

Section A asked basic program and faculty information related to size, accreditation, leadership experience, and auxiliary staffing in research areas. Section B requests specific questions about research curriculum content and scholarly activities of both the faculty and residents. In addition to identifying courses taught, the residency directors were asked for their professional opinion about the importance of research content topics. These particular questions were asked from three perspectives: necessity of skill or knowledge, relative importance of the knowledge or experience, and minimum skill level required. Section C asked the program director to rate his or her knowledge level and the knowledge level of the research director or research leader in specific research content areas. The knowledge levels are the modified levels described in the Dreyfus Model in the literature review. Section D is an opinion section, containing a variety of statements about the value of research, the role research plays in the program, and the nature of scholarship. The final section asked the program director to rate the program's success in complying with the research and scholarly activity standard.

No validity studies were performed. The survey was reviewed by Yasmin Cypel, Ph.D., the senior researcher at the American College of Radiology. She approved of the content, terminology, and focus. Dr. Cypel suggested no substantive changes, but she did offer minor changes related to presentation and style. All, but one, of her suggestions were adopted. Financial limitations prohibited the primary investigator from creating a professional booklet.

Pilot Study

The survey was piloted for clarity of content and time required to complete. It was completed by a convenience sample of four program directors from disciplines other than diagnostic radiology, so as not to bias the study population. The disciplines represented in the pilot study were internal medicine, emergency medicine, and family medicine. The program directors were from two hospitals in northern New Jersey. Neither hospital has a diagnostic radiology residency program.

Subjects

There are currently 192 ACGME-accredited diagnostic radiology programs and eleven AOA-accredited diagnostic radiology

programs. All program directors of accredited diagnostic residency programs in the United States were sent a survey. Inclusion criteria for programs included all the following: 1) ACGME-accreditation or AOA-accreditation of program; 2) located in one of the fifty United States or District of Columbia; 3) program was active during the 2000-2001 academic year. Accredited programs, located outside the continental United States, Alaska, or Hawaii, were excluded.

Procedures

The names and addresses for each program were obtained from the ACGME and AOA web sites. This information is available in the non-secure sections of each web site.

Each survey was coded, using a four digit number, chosen from a table of random numbers. Osteopathic programs were given a prefix of 0. A confidential list of the programs and their codes was kept by the primary investigator.

A cover letter, letter from the American College of Radiology endorsing the study, the survey, and a self-addressed, stamped envelope were mailed to each program director in early November 2001. Approximately two weeks later, a reminder e-mail was sent to all directors. Approximately three weeks after the first reminder was sent,

protected research time were most highly associated with research productivity. A third reported no publications of any kind.

Lastly, Levitt, Terregino, Lopez, and Celi (1999b) report fewer directors with research degrees than the prior study, i.e. 27% for Blanda et al. and 20.6% for Levitt et al., among the same population. The response rate to both studies was similar, but Blanda's information was collected approximately two years prior to Levitt's. Another difference was the wording of the advance degree choices. Blanda's survey said research degree, without defining it; the Levitt survey listed specific degrees, e.g. Ph.D., Pharm.D.

In summary, the research and scholarly history, both academic and experiential, for program directors and research directors has not been thoroughly studied. The research leadership qualifications in diagnostic radiology programs have not been examined or reported.

Research Limitations

One of the problems with the studies reported in the literature is the language used to collect the information. Several studies used general or vague terms without defining them. A few examples are: active in research (Blanda et al., 1999), formal research program (Sulak et al., 1992), publication or presentation (McGuire &

each program director, who had not responded, was sent a cover letter, new copy of the survey, and a self-addressed, stamped envelope. A response was requested in ten days, but the program directors were told that late responses would be accepted. The last completed survey was received approximately five weeks after the final due date and has been included in the data analysis.

Data Analysis

As data came in, they were entered into a SPSS data base. Data analysis began with descriptive statistics calculated on all variables. Following this, inferential statistics, such as Fisher's Exact Test, chi square, ANOVA, parametric and nonparametric correlations were performed as appropriate. Alpha level was set at .05.

The initial focus of the data analysis concentrated on two distinct areas of comparison. The first focus used chi square, nonparametric correlations, and ANOVA to compare the program directors' self-identified competency levels in a given research topic or skill with the research curriculum in their program, and with their opinion of the importance of the research and individual research topics.

The second focus used chi square, parametric and nonparametric correlations, and logistic regression to compare the program directors' self-identified success in meeting the accreditation standard for research and scholarly activity with the content of their curriculum, and the research productivity of the faculty and residents.

Assumptions

1. All respondents will answer truthfully to the best of their recollection.
2. An anonymous survey is the best method to assess attitudes, values, and modes of general practice (Portney & Watkins, 1993).

Limitations

1. Response rate is 47.3%. Small programs, i.e. those with ten or fewer residents are underrepresented in the response population.
2. A mail survey does not permit the respondent to ask questions.
3. A survey does not permit follow-up questions for clarification.
4. There may have been responder bias. Program directors, who believe they have a strong research curriculum, may

have been more likely to respond. Conversely, program directors, who do not support the research standard, may have been more likely to respond in an attempt to demonstrate that the standard is not supported by the professional community.

5. A few respondents did not answer every question.
6. The survey was written by the author for the purpose of this study. No reliability and validity studies have been conducted on this instrument. The survey was reviewed by researchers with experience in radiology research and accreditation research.
7. Program director skill level was self report. The respondents may not be aware of their limitations and strengths in the research skills included in the study.

Chapter IV

RESULTS

This chapter reports the results of the survey. It begins with the response rate. Following this, the program demographics are reported. Subsequently, results regarding the curriculum, research activities, leadership skills, the role and importance of scholarly activities, and compliance are described.

Response Rate

The survey was sent to the 203 diagnostic radiology residency program directors in the United States. Ninety-six (47.3%) were returned. Ninety-one (47.4%) of the 192 allopathic programs returned a completed survey and five (45.45%) of the eleven osteopathic programs returned a completed survey. Not all respondents answered every question on the survey. There were two primary reasons. First, some respondents did not answer entire pages. Second, a few questions were follow-up questions, therefore, not all respondents were required to answer.

Table 1 (Appendix F) lists the response rates by accreditation organization, gender of the program director, program size, and

geography. Table 2 compares the composition of the original population, i.e. all diagnostic radiology program directors, and the composition of the response population.

Table 2. Comparison of Population and Survey Respondents

Characteristic	% of Population	% of Respondents
Gender of Director ¹		
Female	21.67	21.88
Male	78.33	78.13
Program Size ²		
10 or fewer residents	13.54	6.60
11 – 30 residents	74.48	75.80
31 – 50 residents	10.42	10.99
51 or more residents	1.56	2.20
Geographical Region		
New England	10.34	5.21
Mid Atlantic	29.56	23.96
South East	9.85	7.29
Mid West	24.63	29.17
South Central	12.32	17.71
Rockies and West	13.30	16.67

¹ Gender estimated by first name of program director; directors having unisex names (4) were included in the male group.

² ACGME programs only; size groupings according to ACGME.

Program Demographics

The program directors were asked to supply factual information for the 2000-2001 academic year. This included information related to program size, program director length of experience, presence and academic preparation of a research director, availability of research

assistance, program affiliation, and the importance of grants in the radiology department budget.

The smallest program had five residents; the largest program had sixty-five residents ($M = 20.75$, $SD = \pm 10.77$, mode = 16). The number of residents per post-graduate year and the number of faculty are reported in Table 3. The resident to full-time faculty ratio ranged from 1: 0.36 to 1: 2.89 ($M = 1: 1.35$, $SD = \pm 0.51$). The ratios were calculated using the entry for full-time, physician faculty only; they do not include full-time equivalent faculty. Information regarding FTE status of part-time, physician faculty was not sought.

Table 3. Number of Residents and Faculty in Radiology Residency Programs in the 2000-2001 academic year.

	Range	Mean	Std Dev
Residents ¹			
PGY 2	1 - 17	5.53	± 2.86
PGY 3	2 - 17	5.27	± 2.79
PGY 4	0 - 15	5.16	± 2.75
PGY 5	0 - 16	4.75	± 2.82
Faculty			
Physicians (full time) ²	5 - 100	26.90	±16.90
Physicians (part time) ²	0 - 21	3.72	± 3.99
Non-physicians (full time) ⁴	0 - 20	3.66	± 4.51
Non-physicians (part time) ³	0 - 4	0.27	± .71

¹ N = 95 ² n = 89, ³ n = 88, ⁴ n = 87

The program directors reported having held their current position from one to thirty-three years ($M = 6.47$, $SD = \pm 6.48$, $n = 89$). The total number of years as a program director ranged from one to thirty-three years ($M = 7.44$, $SD = \pm 6.83$, $n = 90$). Responses of less than one year, e.g. 6 months, were entered as one year. Eighty-three respondents gave valid answers to both questions. Seventy-three (87.95%) indicated that they have been the program director at one program only, i.e. years in current program director position equaled total number of years as program director at all institutions.

Almost half the programs (47.4%) reported that no one served – officially or unofficially – as a research director or research leader. Only ten programs (10.5%) had a full time research director. The majority of the fifty research directors – official or unofficial – were physicians. Seven (7.4%) did not have a medical degree. Eleven (11.6%) had a research doctorate. There is a statistically significant association between the employment status and the degree(s) of the research director [$\chi^2(12, N = 50) = 37.876$, $p < .001$], however, the strength of the association is not significant ($\lambda = .105$, $p = .093$). The crosstabulation is reported in Appendix F in Table 4.

In addition to research leadership, the availability of research assistance was assessed. The most common types of research

assistance available to the faculty and residents are clerical (66 programs, 68.8%) and audiovisual (79 programs, 82.3%), such as making slides or posters. Thirty-one programs (32.3%) have statistical assistance available on site; forty-nine programs (51%) had statistical assistance available at an affiliated institution. One program director commented that the help was available for a fee. Twenty-four programs (25%) said they had access to a research assistant, who could help with data collection, research design, or other types of non-clinical assistance.

As the presence or absence of a university relationship may influence several aspects of the study, such as a publish-or-perish climate or the availability of qualified faculty to teach research courses, the directors were asked to classify their administrative affiliation. The majority (55.2%) of the programs, who responded, are university administered. In order to determine the type of university relationship, the university-administered programs were asked to categorize their teaching and curriculum relationship with the university as either close and active or minimal. Eighty-seven percent of the programs described their relationship as a close, active teaching relationship. The administrative affiliation categorization is reported in Table 5 (Appendix F).

The relationship between administrative affiliation and the presence or absence of a research director was not statistically significant. However, there was a statistically significant association found when university-administered programs were compared to non-university-administered programs [$\chi^2 (1, N = 95) = 5.982, p = .014$, Fisher's $p = .02$]. University programs were more likely to have an official research director. There was no association between administrative affiliation and the degree held by the research director. The crosstabulations are reported in Tables 6 and 7 in Appendix F.

Lastly, twenty-six program directors (27.08%) indicated that grants are an important part of the radiology department budget at their institution. Five program directors did not answer this question. The relationship between grants and the position of research director was examined. A statistically significant relationship was found between the importance of grants to the budget and the presence of an official research director [$\chi^2 (1, N = 90) = 4.769, p = .029$, Fisher's $p = .035$] and to the status of the research director, i.e. full time, part time, or unofficial [$\chi^2 (2, N = 90) = 8.419, p = .015$]. If grants were an important part of the departmental budget, the department was more likely to have a full time research director. The crosstabulation is reported in Table 8 in Appendix F.

Curriculum

The program directors were asked to give their opinions regarding the importance and necessity of research-related skills and experiences for radiology residents. In addition, they were asked to identify required courses within their residency curriculum. This section discusses the descriptive statistics for critical analysis of the medical literature, research ethics, statistics, research methods and related skills and experiences, presentation skills, and scientific writing.

Critical Analysis of Medical Literature

First, the directors were asked to rate the importance of critical analysis of the medical literature. Ninety program directors (95.7%) identified it as a necessary skill for graduating residents. Twenty-four (25.5%) rated it as more important than traditional residency curriculum subjects; forty-eight (51.5%) rated it as equal to traditional residency curriculum subjects. Of the eighty-one program directors, who ranked the minimum skill level a new radiologist should have in this subject, twenty-seven (32.9%) said they should achieve at least a working knowledge; fifty-four (65.9%) said they should achieve competency.

After reviewing necessity, relative importance, and recommended minimum skill level for graduating residents, the directors were asked how they prepared the residents to learn this skill. Thirty-five programs (36.5%) require their residents to take a course with the same title, i.e. how to read and evaluate medical literature. For 76.6% of the programs identifying the course as either required or recommended, the total length of the course was five hours or less. See Tables 9 - 13 in the Appendix F for all responses.

Research Ethics

Thirty-two program directors (34.0%) stated that knowledge of research ethics was necessary; approximately half that number (n = 15, 15.6%) provided a mandatory course in research ethics. Of the programs identifying the course as required, all but one program, offered a course that was five hours or less in length. Skill level was not addressed.

Statistics

Forty-one program directors (43.6%) believe that knowledge of basic statistics is a necessary skill. A majority of the directors (62.8%) said that interpretation of elementary statistics was at least as

important as other academic courses in the curriculum. However, only ten programs (10.4%) require their residents to take a course in entry-level statistics. Eight of those courses are five hours or less in length. Two program directors (2.1%) believe that knowledge of intermediate statistics is a necessary skill. No programs required their residents to take a course in intermediate statistics.

Research Methods

The program directors were asked about research design and sampling techniques, two components of research methods. Twenty-one (22.3%) said that knowledge of research design was necessary; nine (9.6%) believed that knowledge of sampling methods was necessary. When asked to rate the minimum skill level a graduating resident should have in each, a majority (65.4%) said the graduating residents should have a working knowledge in research design, and more than half (55.6%) said they should have a working knowledge of sampling methods. Almost half (46.8%) said that research methods was at least as important as required academic courses.

Regarding practical research experiences, i.e. application of research methodology, thirty-six (38.3%) said that participating in the faculty's research was at least as important as traditional academic

courses. A majority (51.6%) said that performing their own research with a faculty mentor was at least as important as traditional academic subjects in the residency curriculum.

The directors were given three course names, which could encompass the topics of design, sampling, and prerequisite skills one should have in order to participate in a research study. These were research methods, a combined research methods/statistics course, and a general overview of research course. Seven directors said that research methods was a required course; seven directors said that a combined research methods and statistics course was required. These two sets of responses do not represent fourteen programs, because six directors marked both courses as required. Therefore, it appears that eight programs, not fourteen, require a course in either research methods or research methods with statistics. Twenty-one directors (21.9%) said their residents are required to take a multi-subject research course that includes topics such as ethics, methods, statistics, and performing a literature search; 70% of those courses are five or fewer hours in length.

Presentation Skills

Sixteen programs (16.7%) mandate a course in presentation skills and technology. Of those programs mandating or recommending this course, 89.5% offer five hours or less of instruction during the four year residency.

Scientific Writing

One program (1.0%) requires a course in scientific writing. The course is less than five hours long.

Research Activities

Research activities are defined rather broadly. They encompass research projects, publications and poster presentations by both faculty and residents, factors associated with fostering a positive research climate, factors considered to be barriers to research or research productivity, and finally, the quality of research in radiology. Relationships between variables will be discussed, when significant.

Research Projects and Research Models

The majority of programs (59.8%) do not require the residents to perform a research project or study, however, only three programs (3.9%) said that none of the residents participated in a research

project during the 2000-2001 academic year. Twenty program directors did not answer this question.

Directors were asked to identify the resident research model used in their program. Of the eighty-two, who answered this question, 39% said their model closely resembles an apprenticeship model, which was defined as residents working on faculty projects or studies; 43.9% said they permitted both apprenticeship and independence models. The independence model was defined as a project in which the resident develops the research idea and the faculty member mentors the project.

The types of projects, identified by the directors as acceptable for resident participation, are: retrospective studies and chart reviews (96.3%); prospective studies (87.8%); case studies (87.8%); diagnostic value of a procedure (72%); literature reviews (66.1%); effect of test on patient:management (63.4%); categorization of findings (46.3%); determination of values, i.e. diseased/normal (46.3%).

Publications and Poster Presentations

Faculty

Faculty publication rates were examined by two approaches, i.e. number of articles and percentage of faculty, who publish.

Directors were asked how many articles, authored by faculty, were accepted for publication in a peer-reviewed journal during the past three years. The correlation between number of faculty in a program and the number of articles published was statistically significant ($r = .693, p < .001$). They were also asked to report the percent of their faculty, who had authored articles published in a peer-reviewed journal during the past three years. The correlation between the percent of faculty, who publish, and the number of full time faculty in a program was statistically significant ($r = .647, p < .001$). When a partial correlation was performed controlling for the number of faculty articles, the correlation between the number of full time faculty and the percent of faculty who publish was no longer statistically significant ($r = .237, p = .064$). When a partial correlation was performed controlling for the number of full time faculty, the correlation between the percent of faculty who publish and the number of faculty articles published remained statistically significant ($r = .529, p < .001$). As compared to small programs, a greater percentage of the faculty in the larger programs are publishing studies in peer-reviewed journals.

Directors were next asked to report the number of faculty posters that had been exhibited at national or international meetings

during the past three years. The correlation between number of faculty publications and number of faculty posters was statistically significant ($r = .552, p < .001$). The number of articles was greater than or equal to the number of posters in 89.1% of the programs. When performing a partial correlation by controlling for the number of full time faculty, the correlation between the number of faculty posters and the number of faculty publications remained statistically significant ($r = .409, p = .001$). The correlation between the number of posters exhibited and the number of full time faculty in a program was statistically significant ($r = .498, p < .001$). However, when controlling for the number of faculty articles, the correlation between the number of posters and the number of faculty was no longer significant ($r = .187, p = .156$).

Residents

The AOA accreditation standards require every resident to exhibit a research poster at the annual meeting of the American Osteopathic College of Radiology (AOCR) prior to graduation. The ACGME does not have a similar requirement. Therefore, the results in this section are reported separately.

Residents at all five responding AOA-accredited programs exhibited posters, however, in the sample no resident in an AOA-

accredited program published an article in a peer-reviewed journal. Of the ACGME-accredited programs completing this section, 86.8% had at least one resident, who exhibited posters, and 90.3% had at least one resident, who had published an article in a peer-reviewed journal during the past three years. Twenty-three ACGME programs did not answer the poster question and twenty did not answer the article question.

Cultivation of and Impediments to Research

Programs participated in the following auxiliary research activities and procedures that promote or encourage research: a departmental or institutional research day (38.5%); awards or prizes for research (35.9%); active, regularly-scheduled departmental or graduate medical education research committee meetings (25.6%); formal communication about ongoing or completed studies, such as a newsletter or research bulletin board (20.5%); research traditions or rituals (2.6%).

Perceived barriers to resident research were: an increase in faculty patient-care time because of financial constraints (80.8%); no research-dedicated release time for faculty (73.1%); no research-dedicated release time for residents (66.7%); lack of faculty skills

(61.5%); lack of faculty interest (60.3%); and no active research director guiding the residents (50%). A statistically significant association was noted between the employment status of the research director and the response to the absence of a research director as a barrier to research question. Ninety percent of the programs with an official, in-department research director answered that it was not a barrier [$\lambda = .308, p = .03$]. Almost 90% of the programs (89.7%) that did not have an official research director answered that lack of a research director was a barrier [$\lambda = .415, p = .007$].

Research Quality in Diagnostic Radiology

Half the program directors (50.6%) thought the general quality of resident research, i.e. at all programs in the United States, was inconsistent. More than a quarter (27.3%) rated it as good. The programs active in research thought the quality of research was higher than those who were not as active. There was a statistically significant relationship between the quality of resident research and the percent of faculty who publish [$\tau = -.394, p < .001$], the number of faculty posters exhibited in the past three years [$\tau = -.231, p = .01$], the number of resident posters exhibited in the last three years [$\tau = -.327, p$

< .001], the number of faculty articles [$\tau = -.308$, $p = .001$], and the number of resident articles [τ was $-.285$, $p < .001$].

When asked about the quality of radiology research in the United States, 52.6% thought it was inconsistent and 28.9% thought it was good. There were no significant relationships between a director's opinion of the quality of radiology research and the quantity of faculty research in the director's program.

Leadership Skills

In order to examine the relationship between the program directors' skill levels and the directors' responses to topics related to that skill, the program directors were asked to rate their skill level in six research-related topics, using the modified Dreyfus Model. Using the same model, they were asked to rate the skills of the research director or the faculty member, who serves unofficially as the research coordinator or leader. The results are reported in Table 9.

Relationship between Program Director Skill and Curriculum

The program directors' self-reported skill level in critical analysis of the medical literature, interpretation of statistics, research design, and research methods in general were examined with their responses

to the necessity, relative importance, minimum skill level for a graduating resident in similar or related topics and to the presence or absence of a corresponding course.

Table 9. Research Skill Level of Radiology Program Leadership, as Reported by the Program Director. (% = % of n)

Skill	n	Novice	Wkg Knldg	Competent	Expert
Program Director					
Analysis of med literature	93	7.5	36.6	44.1	11.8
Interpreting statistics	93	37.6	37.6	23.7	1.1
Research design	93	39.8	31.2	24.7	4.3
Scientific writing	91	23.1	25.3	41.8	9.9
Grant writing	93	73.1	17.2	8.6	1.1
Research methods	93	38.5	39.6	19.8	2.2
Research Director ¹					
Analysis of med literature	45	0	6.7	51.1	42.2
Interpreting statistics	45	2.2	20.0	44.4	33.3
Research design	45	0	15.6	37.8	46.7
Scientific writing	45	0	17.8	33.3	48.9
Grant writing	43	11.6	16.3	30.2	41.9
Research methods	42	2.4	21.4	42.9	33.3

¹ A total of 50 programs reported having an official RD or unofficial research leader.

Critical Analysis of the Medical Literature

There was a statistically significant relationship between the directors' opinion of their skills in evaluating medical literature and the

skill level they recommended for a graduating resident [$\tau = .190$, $p = .023$]. As skill level increased a higher percentage of the directors responded that the new graduate should achieve competency. No additional paired associations were found to be statistically significant.

The necessity, relative importance, minimum skill level, and course variables for medical literature were indexed in order to perform an ANOVA. The index mean increased as skill level increased, but the relationship was not significant [$F(3, 73) = 1.988$, $p = .123$]. As statistics are an integral part of scientific literature, basic statistics as a necessary skill was added to the index. Again, the mean increased with increasing skill level, but the relationship was not significant [$F(3, 73) = 1.833$, $p = .149$].

Interpretation of Statistics

Three statistically significant associations were discovered. As program director skill increased, a greater percentage of directors believed that elementary statistics is at least as important as other subjects in the academic curriculum [$\tau = -.201$, $p = .015$]. Less than half of the directors, who identified their skill level as novice, believed basic statistics was at least as important, but greater than 80% of the directors, who identified their skill level as competent, said it was at least as important.

Statistically significant associations were found between the program directors skill level in interpretation of statistics and the status of courses in elementary and intermediate statistics [$\tau = -.197, p = .013, \tau = -.225, p = .007$]. Program directors, who rated themselves as competent, were likely to require a course in elementary statistics and to recommend a course in intermediate statistics.

Responses to the necessity of basic statistics, the relative importance of elementary statistics, and the status of a course in elementary statistics were indexed in order to perform an ANOVA. The mean response increased with increasing skill level, but the relationship was not significant [$F(3, 86) = 1.899, p = .136$].

Research Design

Two significant associations were found. As the directors skill level in design increased, the percent, who believed research design is a necessary skill for graduating residents, increased [$\tau = -.320, p = .001$]. At each director skill level, the percent of directors, recommending a minimum skill level of working knowledge in design for new graduates, increased [$\tau = .285, p < .001$]. Half the directors rating themselves a novice recommended a working knowledge level and all the directors rating themselves as expert recommended the working knowledge level. The association between program director

skills in research design and the status of a course in research methods was not significant.

Four indices were created for research design. Index 1 included the necessity and minimum skill level for research design, and the relative importance and status of a course in research methods. The relationship with program director skills in research design was significant [$F(3, 72) = 3.956, p = .011$]. As director skill level increased the mean of the indexed variables increased.

Index 2 included all the variables in index 1 plus the relative importance of a resident performing his/her own research. The relationship with program director skill in research design was significant [$F(3, 72) = 3.733, p = .015$]. As program director skill level increased, the mean for the indexed variables increased.

Index 3 included all of index 1 plus the relative importance of participating in a faculty member's research. The relationship with director skill in research design was significant [$F(3, 72) = 3.824, p = .013$]. As director skill level increased the mean of the indexed variables increased.

Index 4 included all variables in index 2 and 3. The relationship was significant [$F(3, 72) = 3.518, p = .019$]. As director skill level in

research design increased the mean of the indexed variables increased.

Research Methods

The program directors' self-reported skill level in research methods was examined with their responses to questions about research design, sampling techniques, research methods skills, and research experiences. The results will be discussed in three sections, i.e. design, sampling, and research methods and experiences.

Program directors' skill in research methods and responses to research design.

A statistically significant association was found between the director's skill in research methods and their response to research design as a necessary skill. As skill level of the director increased, a greater percentage responded yes [$\tau = -.247$, $p = .008$]. There was also a statistically significant association between director skill level and the recommended minimum skill level in research design for a graduating resident. As skill level increased, a greater percentage of the directors recommended a minimum of working knowledge in design [$\tau = .270$, $p = .001$].

Program directors' skill in research methods and responses to sampling techniques and related experiences.

As program directors' self-reported skill in research methods increased, the more likely the director responded yes, when asked if sampling techniques were a necessary skill [$\tau = -.208, p = .004$]. The absolute number responding yes was small in each category. As program directors' skill level increased, the more likely the director was to recommend a minimum skill level of working knowledge in sampling techniques for a new graduate [$\tau = .222, p = .012$].

Four indices were created for sampling. Index 1 included the necessity and minimum skill variables for sampling, and the relative importance and course variable for research methods. Index 2 included all of index 1 plus the relative importance of a resident performing his/her own research. Index 3 included all of index 1 plus the relative importance of a resident participating in a faculty member's research. Index 4 included all of indices 2 and 3. In each index the mean of the index variable increased as skill level increased. However, no sampling index met the Levene's test for homogeneity of variances, therefore ANOVA results are not reported.

Program directors' skill in research methods and responses to questions about research methods and research experiences.

No statistical associations were found between program directors' self-reported skill level in research methods and relative importance of research methods, relative importance of participating in faculty research, relative importance of resident performing own research, nor the status of a course in research methods. Four indices were created for research methods and related skills. Index 1 included the necessity of research design and sampling, the minimum skill level for research design and sampling, the relative importance of research methods, and the status of a course in research methods. Index 2 included all of index 1 plus the relative importance of participating in faculty research and the relative importance of performing one's own research. Index 3 included all of index 1 and the relative importance of participating in a faculty member's research. Index 4 included all of index 1 and the relative importance of performing one's own research. In each index the mean for the index variables increased with increasing program director skill level. However, no index passed the Levene's test for homogeneity of variances, therefore, the ANOVA significance is not reported.

Residency Directors' Perceptions of a Research Degree

The program directors were asked to give their opinion about the preferred qualifications for a research leader. They were asked to compare the qualifications of a person with a research degree, i.e. Ph.D., to the qualifications of a physician to teach research skills, mentor research design, and mentor research projects. A majority (69.1%) indicated that the best combination to mentor a research project was a Ph.D.-trained person as supervising research mentor and a physician as the medical content advisor. Only 35.1% indicated that a Ph.D.-trained person was better qualified than a physician to teach research skills, and 28.7% indicated that a Ph.D.-trained person was better qualified than a physician to mentor research design. As both research design and research skills are components of being a supervising research mentor, further comparisons were made.

In the subsection, a check was recorded as agreement with the statement; a blank was recorded as disagree. The instructions said to choose "all that are appropriate", however, 63.08% chose one answer only. Of the respondents, who chose the team approach, i.e. physician and Ph.D. working together, as the best effort, 56.92% chose one answer only. Twenty respondents did not check any choices; therefore, their responses were recorded as a no or disagreement with

the statement. It was observed that 60 % (n = 12) of the directors who left all three choices blank did not have to complete the prior section about research skills of the research director. It is not known if they skipped the subsection accidentally or if they chose to leave the section blank as an indication of disagreement.

The Role and Importance of Scholarly Activities

The directors were asked to give their opinion about sixteen statements pertaining to the importance of research or research methodology and the role of scholarly activity in the residency curriculum. The percent, who agreed with each statement, is listed in Table 10.

Statements 9 and 15 express comparable beliefs and response agreement was statistically significant [$\kappa = .294, p = .001$]. It was observed, however, that 22.5% of the respondents gave a different answer to each one. If the responses of the directors, who answered "no opinion" to one or both statements, are eliminated, the concordance rate is 97.8%.

The statements in this section were examined with the variables related to relative importance of a skill or content area. The statements were entered as single variables and in combination. In

addition, some multiple-variable combinations included a related course variable. Only two statistically significant relationships were found, both were single variable comparisons. Both associations were with the statement that said research methods skills improve clinical reasoning skills. Directors who believed that research methods skills or the experience of participating in a faculty member's research project were at least as important as other academic topics, tended to agree with the statement. However, there were no apparent relationships when looking at the responses of those who thought the skills and experiences were less important than traditional academic topics.

Table 10. Program Director Agreement with Opinion Statements.

	Agree (%)
1. Basic research methods skills improve clinical reasoning skills.	57.9
2. Actively participating in research improves clinical reasoning skills.	46.8
3. Critical evaluation of the literature skills improve clinical reasoning skills.	91.6
4. The culture of a radiology residency program does little to convince residents that research is worthwhile and important.	53.7
5. Our residents have a comfortable working knowledge of research evaluation and critical analysis of the literature.	27.4
6. Medical schools are <u>not</u> doing an acceptable job of teaching basic research methods skills to students.	68.8
7. Medical schools are <u>not</u> doing an acceptable job of teaching basic medical literature analysis skills.	64.6
8. Experience is a requisite for expertise.	84.2

9. Participating in research increases a resident's ability to evaluate medial literature, just as clerkship and residency increase the resident's ability to apply the medical knowledge that he/she learned in medical school.	83.2
10. The radiology residency is unique. Unlike other residencies, we must begin with the basics, therefore, we don't have enough time to add new content. The ACGME/RRC or AOA should exempt us from the research and scholarly activity requirements.	22.3
11. One goal of a successful scholarly environment is that all faculty become competent in the skills necessary for critical evaluation of the medical literature.	67.4
12. "Scholarly Activity" in academic medicine, in general, and residency education, in particular, is well-defined.	5.3
13. For me (or my program), a universally-accepted definition of 'scholarly environment' would be helpful.	56.3
14. The purpose of a diagnostic radiology residency is to train competent clinicians. Adding scholarly activity requirements, detracts from that purpose.	11.6
15. The application of research methodology knowledge (i.e. actively participating in a research project) reinforces the concepts taught in the classroom and helps make the resident a more knowledgeable consumer of medical literature in the future.	80.0
16. A competent physician must be able to evaluate the strengths and weaknesses of studies published in medical journals.	95.8

Compliance

The final question on the survey asked program directors to rate the residency program's efforts in meeting the scholarly activity requirement in the residency accreditation standards. Eleven directors did not answer the question. Four directors marked two choices; three of those four marked needs improvement and a higher score. One

director marked two choices and wrote that in some areas they did a good job and in other areas they didn't.

Of the eighty-one valid responses, 42% chose needs improvement; 23.5% said they meet the letter of the standard, but not the spirit; 23.5% rated their efforts as good to competent; 8.6% said they were excellent, which was defined as being in the top 25% of programs, and 2.5% said they were superior, which was defined as being in the top 10% of programs. For purposes of statistical calculations, the excellent and superior categories were combined. The responses in the combined category were 11.1% of the total. Chi-square, bivariate and nonparametric correlations, and simple regression were calculated to determine statistically significant relationships with self-rated compliance of the accreditation standard.

Associations between Self-rated Compliance and Demographics

University administered programs ranked themselves as more compliant than other programs [$\tau = -.362$, $p = .001$]. It appeared that larger programs, those with more faculty and more residents, ranked themselves as more compliant (faculty: $r = .457$, $p < .001$; residents: $r = .443$, $p < .001$). The experience of the program director, both in current position and total number of years as a program director, were

statistically significant (current position: $r = .320$, $p = .005$; total years at director: $r = .276$, $p = .014$), but when partial correlations were performed, controlling for the corresponding experience variable, only the years in current position remained significant ($r = .235$, $p = .048$). The directors with more experience, rated themselves as more compliant.

Relationship Between Compliance, Curriculum, and Related Resident Achievements

The association between each of the courses listed on the survey and the directors' self-reported compliance level was examined. The only course that was associated with compliance was medical literature evaluation. Those programs with a mandatory course, rated themselves as more compliant [$\tau = -.328$, $p < .001$]. Program directors, who believe that their residents have a working knowledge of medical literature evaluation, rated their programs as more successful in meeting the standard [$\tau = -.241$, $p = .011$]. Programs that ranked themselves higher in compliance also ranked the quality of resident research higher [$\tau = -.250$, $p = .008$].

Relationships Between Program Leadership Self-report Skill Level and Self-report Compliance Level

Program directors, who rated their skills in medical literature evaluation higher, rated their programs compliance higher ($r = .202$, $p = .014$). Factors relevant to the position of research director that were associated with a lower compliance rating were director belief that lack of a research director is a barrier to research [$\chi^2 (3, N = 70) = 7.720$, $p = .052$], and the absence of an official research director, regardless of whether or not a faculty member unofficially performed the duties of leader [$\chi^2 (3, N = 80) = 13.405$, $p = .004$]. On-site statistical help was the only research assistance that was associated with compliance rank. As compliance rating increased, the ratio between having and not having on-site statistical help increased [$\chi^2 (3, N = 81) = 8.550$, $p = .036$].

Research Outcomes and Compliance

Measurable outcomes, such as number of projects, articles, and posters were positively correlated with compliance rating. The number of projects that had some degree of resident participation was statistically significant ($r = .456$, $p < .001$). This correlation remained significant, when controlling for the number of residents ($r = .321$, $p =$

.009) and for the number of senior residents ($r = .322, p = .008$). As the number of faculty-authored articles and the number of faculty posters increased, so did the compliance rating (articles: $r = .457, p < .001$; posters: $.449, p < .001$). These correlations remained significant after controlling for the number of faculty (articles: $r = .328, p = .011$; posters: $r = .401, p = .002$). As the percent of faculty who publish increased, the compliance rating increased ($r = .552, p < .001$).

As the number of resident-authored articles increased and the number of resident posters increased, the compliance rating increased (articles: $r = .492, p < .001$; posters: $r = .345, p = .005$). When controlling for the number of residents, the relationships remained significant (articles: $r = .326, p = .008$; posters: $r = .305, p = .015$).

Predictors of compliance

Simple logistic regression was used to access the statistically significant predictors of compliance rating. For these calculations the compliance variable was collapsed into two levels: excellent and all others. Three predictors were statistically significant. They are the percent of faculty, who have published in a peer-reviewed journal during the past three years [Nagelkerke $R^2 = .411, \chi^2(1, N = 64) = 12.203, p = .009$], the belief that the residents in the program have a

comfortable working knowledge of critical analysis of the medical literature [Nagelkerke $R^2 = .096$, $\chi^2(1, N = 80) = 3.959$, $p = .05$], and the presence of an official research director. The latter was significant when evaluated as a dichotomous variable, i.e. official and not official, [Nagelkerke $R^2 = .281$, $\chi^2(1, N = 80) = 12.268$, $p = .007$] and when evaluated as a three level variable, i.e. full time official, part time official, and not official [Nagelkerke $R^2 = .356$, $\chi^2(1, N = 80) = 15.871$, $p = .001$].

Direct logistic regression analysis, using several models, and stepwise logistic regression analysis were performed. Consistently, the best prediction model was a two variable model: grants are important to the department budget and presence of an official research director [Nagelkerke $R^2 = .718$, $\chi^2(2, N = 75) = 30.226$, $p < .001$].

Summary

Most diagnostic radiology residencies are midsize programs, having no official research director, and are lead by a program director, who has not been the director of any other residency. The program directors rate the research directors skills' in scholarly content areas higher than their own.

The research curriculum is composed of individual lectures, and no courses in the traditional academic sense. Critical analysis of the medical literature was the most common content area. Although almost all programs give residents the opportunity to participate in research, the majority do not require it. The program directors' opinions about the necessity and importance of given topics are not highly associated with the presence or absence of an official course or lecture on that topic.

Almost 2/3 of the programs do not think they are successful in meeting the standard. Factors associated with successfully meeting the standard are program size, university affiliation, length of service of the program director, presence of an official research director, and faculty publications.

Chapter V

DISCUSSION

This study was undertaken to 1) describe how the research and scholarly activity standard was being met in diagnostic radiology programs in the United States, 2) assess how competent the program directors believed they were in content areas related to the standard, and 3) measure the perceptions of program directors about the importance of a research curriculum. Prior to beginning the study, it was hypothesized that there were positive relationships between the program directors' perceptions of their skill level and their judgment about the importance and need for a research curriculum. It was further hypothesized that there were characteristics common to the programs that identified themselves as superior to other programs in meeting the scholarly activity standard.

Using concepts, topics, and ideas published in the literature, or stated in focus group meetings with residents and program directors, a survey was created. After review by the American College of Radiology, minor stylistic changes were made. The survey was mailed to all diagnostic radiology residency directors in the United States;

47.3% were returned. The response and study populations were compared by accrediting organization, number of residents, regional geography, and gender of program director. The response population was comparable in most characteristics. There were two regional disparities. New England had an unusually low response rate and the South Central region had an unusually high response rate. In addition, the smallest programs were underrepresented. The latter is the greater limitation. Although there may be minor regional differences or similarities of experience and opinion, characteristics relevant to implementation of curriculum, such as finances and diversity of professional staff, may be related to program size. Therefore, the conclusions of this study may not be applicable to small programs.

The chapter will discuss each of the findings as they relate to the purposes and hypotheses of this study. It will begin with the three purposes and will conclude with the three hypotheses.

How the Standard is Being Met

Academic Curriculum

There is not a typical scholarly activity curriculum in diagnostic radiology residency programs. The courses offered in the residency programs don't seem to be courses in the usual academic definition.

In continuing medical education (CME) programs, the term course may be used to describe a week-long seminar or a single lecture. The CME model, rather than a traditional college model, may be the physician-educator's frame of reference.

Course Length

Each course appears to be an individual session lasting one or two hours. Greater than seventy-five percent of the programs chose the "1 – 5 hours" response. Several directors wrote the number 1 or 2 next to their response to indicate 1 or 2 hours. One director said that his three courses were each one-hour interactive computer lessons.

Prior experience with physician-educator surveys has indicated that the confusion of an individual class session with the designation, course, might be a common misunderstanding by physician educators. For that reason, the course list on the survey included a multi-topic research course, which was called "introduction to research or research overview", and was described as having many topics in research, such as ethics, methods, literature search, and statistics. It was believed that programs having several one-hour sessions would choose this as the course they offered. That does not appear to be the case. Of the directors, who said they offer an overview course, 79.5% said its length was five hours or less.

These findings are consistent with Levitt et al. (1999), who reported that research courses in the emergency medicine residency ranged from one to 30 hours ($M = 8.18$, $SD \pm 6.3$). Their questions were limited to the content of a research design course to prepare residents to fulfill a research requirement, therefore, they did not include courses in the evaluation of medical literature or presentation skills.

Required Courses

No course was identified as required by a majority of the programs. The most common course was critical analysis of medical literature, but only 36.8% of the programs taught and required this course. The second most prevalent course was the research overview course, which was a required course in 22.1% of the programs.

These results seem to be lower than those found in other residencies, such as internal medicine, emergency medicine, obstetrics-gynecology, pediatrics, family medicine, and psychiatry (Alguire et al., 1996; Blake et al., 1994; DeHaven et al., 1997; Hayward and Taweel, 1993; Levitt et al., 1999; Mason et al., 1999; Sulak et al. 1992). The results of other studies report a range of 89.7% of the emergency medicine programs providing a formal course in research design to 48% of the obstetrics-gynecology programs providing formal instruction on how to conduct research. Alguire et al. (1996) also

report that only 38% of the internal medicine programs had a comprehensive curriculum. None of the radiology residencies had a comprehensive research curriculum.

It would seem that formal, coordinated, didactic instruction is not an integral part of any residency curriculum. However, the radiology programs appear to offer and require fewer formal classes than the other residencies.

Practical Experiences

In the sample, 96% of the programs reported that residents participated in research studies last year, however, only 59.3% said they required the residents to participate. As described by Steiner, Curtis, Lanphear, Vu, and Reid (2000) and explained in the survey, the apprenticeship model requires the residents to assist faculty members with their research studies; the independence model permits residents to perform their own research study. Of the programs that permit resident research, 43.9% let their residents use either the apprentice or independence model and 39% use the apprentice model. Only 9.8% of the programs have the independence model as the only available choice for their residents.

There is a wide range of study categories available for resident research. The categories accepted by more than half the programs (in descending order) are chart reviews and other retrospective studies, prospective studies, case studies, diagnostic value studies, literature review, and studies looking at the effect of a radiologic test on patient management.

There does not appear to be a norm for graduate medical education programs regarding a formal research study. A review of the literature indicates that other residencies require both more and less than radiology residencies. At the upper end of the range is emergency medicine. Almost all the emergency medicine residencies require a research project, but this project does not have to be a research study (Levitt et al., 1999). Psychiatry and obstetrics report similar results to radiology. Blake et al. (1994) report that 57% of the psychiatry residencies require a research project. Sulak et al. (1992) found that a majority of the obstetrics-gynecology residencies require a research study, but their results are suspect. The authors reported that a post-hoc study showed significant responder bias in favor of those programs that require research. Pediatric residencies are at the lowest end of the range. According to Brouhard et al. (1996), 73% of the pediatric residencies do not require research.

Publications and Posters

Faculty

Almost all programs (93.1%) have had at least one faculty-authored article published in a peer-reviewed journal in the past three years. All programs reporting that none of their faculty published an article were small programs, i.e. less than 10 full-time physician faculty. Almost a third of the programs (31.4%), however, indicated that less than ten percent of their faculty have been listed as an author on a research article in the same time period. These programs all had 18 or fewer full-time physician faculty. It also appears that the faculty are concentrating their efforts on publication rather than poster presentations. The number of articles was greater than or equal to the number of posters in 89.1% of the programs. As previously stated, ACGME carefully reviews the number of publications, when measuring standard compliance.

Resident/Faculty Comparisons

In each of the programs reporting no faculty-authored articles, there were no resident-authored articles as well. In fact, all programs reporting no resident publication had limited faculty publications, i.e. less than 10 in a three-year period. Five programs (7.4%) reported no resident posters and no resident articles in a three-year period.

Of the programs having both resident articles and resident posters, 75% reported that the number of articles was equal to or greater than the number of posters. Although the percent is not as high as the faculty comparison, it seems as if the residents follow the faculty's lead. If publishing is important to the faculty, it is important to the residents and vice versa. Several questions are raised, but not answered. Did the residents choose the programs based on the research emphasis or lack of emphasis? Did the residents decide to do research after working with enthusiastic faculty, or did they feel compelled to publish, even if it was not a stated program requirement?

Alguire et al. (1996) report that during one academic year, 18% of internal medicine residents in university-based programs exhibited posters at a state or national meeting, and 11% of internal medicine residents published an article in a peer-reviewed journal. Mills et al. (1995) also reported results for one academic year only. They found that 41% of the family medicine faculty did not publish any articles during the study year, and 25% had fewer than one-fourth of their faculty publish an article. Blanda et al. (1999) report that one-third of the emergency medicine research directors did not publish an article during the three year study period.

Program Directors' Self-identified Skill Level

The program directors were asked to rate themselves on a four-point scale in six topics associated with research and scholarly activity. They were critical analysis of the medical literature, interpreting biostatistics, research design, scientific writing, grant writing, and research methods. Each of the four points was labeled with a skill level taken from the modified Dreyfus Model. As the primary interest was their perception of where they are on a scale, definitions were not provided. The labels, however, were provided as guidance. The same scale and labels were used throughout the survey, whenever skill level was asked to be assessed.

Most directors feel comfortable evaluating medical literature. Almost all felt they had at least a working knowledge of this skill. This cannot be said about any of the other topics.

Most program directors do not believe that they are experts in any aspect of research. In four of the six categories, i.e. biostatistics, design, grant writing, and research methods, less than 5% of the directors thought they had achieved expertise. Ten percent believed they were experts in scientific writing and 12% believed they were experts in critical analysis of the medical literature. A large number rated themselves at the lowest level, i.e. novice, in scientific writing

(23.3%), interpretation of biostatistics (37%), research methods (38.9%), research design (40.2%), and grant writing (72.8%). The reader can refer to Table 9 in the Results chapter.

There were also a few associations between the program director's perceived skill level and the perceived skill level of the faculty. As program director self-perceived skill level increased, their perception of lack of faculty skill changed. Program directors, who rated their own skills as novice in scientific writing, research design, and research methods were more likely to see the lack of faculty skills as a barrier to resident research than program directors, who rated their own skills as competent. Interestingly, as the self-perceived skill level increased to expert, the trend did not hold. All directors, who believe they are experts in research design and research methods, and almost three-fourths of the directors, who thought they were experts in scientific writing, saw lack of faculty skills as a problem. There were no associations or trends between the program directors' perceptions of the research directors' skills and faculty skills.

Supino and Richardson (1999) reported that more than a third of emergency medicine faculty, program directors, and research directors said they had little or no knowledge of research proposal writing, statistics, and decision analysis. No subgroup analysis was

reported for program directors, however, the authors did comment that program directors' self-ratings were higher than faculty members' self-ratings. An analysis of the research director subgroup found that less than 17% said they were very knowledgeable in topics related to research methods, research design, research analysis, scientific writing, and analysis of medical literature. The classification of very knowledgeable is comparable to competent and expert in the radiology study. No other subgroup results were reported.

Physicians are experts in their medical discipline. Physician-educators are experts in their subject. One wonders how someone, who is normally considered the expert, handles professional decisions and mentoring responsibilities in an area in which he or she feels less than qualified.

The Importance of a Research Curriculum

Relationship Between Importance and Curriculum Decisions

The directors were asked to assess the necessity, relative importance, and recommended minimum skill level for a new graduate in several research knowledge areas.

When determining whether or not a course was required, recommended, or not offered there were no statistically significant

relationships between the necessity of the skill, the minimum level the director believed a new graduate should achieve, and the relative importance of the skill. There were three components of research methods in the relative importance section of the survey, i.e. research methods, participating in a faculty member's research, performing their own research. In addition, sampling and research design were both included in the minimum skill and necessity sections. Several combinations were compared to the research methods course. No combination was statistically significant. It seems that the program director's opinions about a skill or content area are not related to whether or not the program offers a course associated with that skill.

When examining the relationships between skill importance, curriculum, and the opinion statements, there were a few interesting responses. For example, half the respondents said that experience is a requisite for expertise and their residents are deficient in evaluating medical literature. Only one-fourth of that group mandated a course in medical literature evaluation. The combined responses for minimum skill in evaluation of medical literature, whether or not there was a course in medical literature evaluation, and the opinion statement regarding the knowledge level of residents in the director's program showed no logical, linear relationship or thought pattern.

Again, it seems as if there is no traditional pedagogical decision making in the radiology residency curriculum. It appears that other influences determine curriculum.

Perception of Skill Level and Perception of Skill Importance

The first hypothesis stated that there is an association between a program director's self-identified skill level in a given research topic and the program director's perception of its importance in the curriculum. To test the hypothesis, the program director's self-reported research skills were compared with their responses to the relative importance, minimum level of skill for a new graduate, and necessity of that skill.

Three individual associations were statistically significant. The first association was between the program directors' skills in research design and their responses about the necessity of research design. Of the directors, who believe that it is not a necessary skill, almost half rated themselves at the novice level. Of the directors, who said it was a necessary skill, an equal percentage rated themselves as competent in this skill.

The second and third associations were between the program directors' skills in research methods and their belief about the relative

importance of participating in faculty research and the relative importance of research methods skills and knowledge. Although both relationships were statistically significant, the actual associations are not strong and obvious.

The variables associated with hypothesis one used four different scales, therefore, it was not possible to examine their collective relationship without first creating an index. As described in chapter IV, several indices were created, using combinations of several related variables. Although all indices were not statistically significant, all indices did demonstrate the same trend. As program director skill level increased, the index's mean score increased. One related course was included in each index.

The results of the study indicate that influences other than the program director's opinion determine whether or not a course is offered or if attendance is mandated. Therefore, additional ANOVAs were calculated after removing the course variable from the index. The trend held for all indices related to program director skill in evaluation of medical literature, interpretation of statistics, research design, and three of the four research methods indices. In research methods index 2, which was the all-inclusive index, and in the four sampling indices the mean score for the directors, who rated their

research methods skills as working knowledge, and the directors, who rated their research methods skills as competent, were comparable. For all five indices, the mean for novice skill level was a point below the working knowledge/competent mean, and the mean score for the expert level was several points above the working knowledge/competent mean. Research methods is a very broad content area. It encompasses several topics, numerous skills, varied experiences. It is possible that program directors, who had a moderate skill level in some areas and not others, may not have been as secure in their choice of skill level in research methods as they were when designating their skill in the other subjects.

Individual responses did not always demonstrate evidence of a relationship between program director self-reported skill level and the director's opinions about the importance of the skill in graduate medical education. However, when examined collectively, there is clear evidence supporting the hypothesis. As program director self-reported skill level increases, the director's global view of the importance of that skill, as it relates to graduate medical education, changes.

Perception of Skill Level in Research Methodologies and Perception of the Importance of a Research Experience

Hypothesis 2 stated that there is an association between a program director's self-identified skill level in research methodologies and the director's perception regarding the need for a research experience. To test this hypothesis, the directors' skill level in research methods was compared to a) the minimum number of required projects for residents, b) to seven statements from the opinion section of the survey, and c) to a five variable index.

No statistically significant association was found between program director skill in research methods and the number of required research projects during the four-year residency. This may be due to the small range of responses. Although the directors were given a range of zero to four projects per resident over the four-year residency, almost all the directors chose zero or one. Only two directors chose two projects; none chose three or four.

The program director skill level was compared to the following statements: actively participating in research improves clinical reasoning skills; the culture of a radiology residency program does little to convince residents that research is worthwhile and important; experience is a requisite for expertise; participating in research

increases a resident's ability to evaluate medical literature; the accreditation organizations should exempt radiology residencies from the research standard; scholarly activity requirements detract from the training of clinicians; actively participating in a research project reinforces the concepts taught in the classroom. No statistically significant association was found, however, there were trends related to self-identified skill level. Every director, who indicated expertise in research methods, marked the response that agreed with the importance of the standard and the value of participating in research activities. At least 80% of the directors, indicating they were competent in research methods, tended to agree with the experts. The one noted exception was the statement that doing research improves clinical reasoning skills. Only two-thirds of the competent directors agreed. There did not seem to be a pattern to the answers given by the directors, who identified themselves as novice or having working knowledge only.

To examine variables using different reporting scales, two indices were created. Index 1 included the number of required projects per resident, the opinion statements that participating in research positively influenced critical evaluation of the medical literature, and the relative importance of participating in faculty

research and doing one's own research. A second index was similar to index 1, but did not include the number of required resident projects. This variable was removed because influences other than program director opinion may determine whether or not a project is required. Neither index was statistically significant, but there was a trend. The mean score for directors rating their research methods skills as working knowledge level or competent were almost the same. The responses for program directors rating themselves as novice or expert were at least a point lower or higher, respectively. Again, the program directors' evaluation of their skill level in research methods may not be accurate or the directors may be using differing definitions of research methods.

There are some interesting relationships noted, but there is no clear evidence supporting the hypothesis. Perhaps, the question can be reevaluated in the future by asking the directors to assess their skill level in specific topics that are included in the research methods domain.

Associations with Excellence

Hypothesis 3 stated that there would be characteristics common to the programs describing themselves as superior. Only two

programs identified themselves as superior. Therefore, the categories of superior, i.e. top 10%, and excellent, i.e. top 25%, were combined for analysis and discussion. For the purposes of this discussion, the programs will be referred to as "excellent programs" and "other programs". As hypothesized, several components were common to those programs rating themselves as excellent or superior. It is difficult to determine which, if any, are interrelated.

Significant Associations with Compliance

Interestingly, none of the nine courses listed had a statistically significant association with the directors' self-rating of how well their program met the research and scholarly activity standard. The variables that did have a significant relationship appear to be in two categories: components of a supportive of research climate and the position of research director.

Features Supporting Research

All programs rating themselves as excellent also responded that grants were important to their departmental budget. Whereas, less than 20% of the other programs stated that grants were important. One wonders if the directors believe they are more successful in meeting the standard because as more grant research is performed,

the residents are given more exposure to the practical application of research principles, or if the directors believe that the success in obtaining research grants validates their scholarly activities.

All programs rating themselves as excellent said that at least half their faculty had published an article in a peer-reviewed journal in the last three years. Only 15% of the other programs replied that more than half of their faculty had been published in the same time period. The presence of grant-funded studies in the radiology department may have influenced this result. Department-wide, grant-funded research studies probably gave the faculty more opportunities to be listed as authors, even if they weren't primary or secondary authors.

There were several aspects of research assistance that are available to faculty and residents in excellent programs. They were the availability of statistical assistance, active research committees, routine reminders of on-going departmental research, and public acknowledgement of quality research. Two-thirds of the excellent programs had access to on-site statistical assistance, but less than a quarter of the other programs did. Almost two-thirds of the excellent programs had active research committees, however, less than a quarter of the other programs did. The excellent programs were more likely (62.5%) to publicize their research internally, conversely, only a

small percentage (14.8%) of the other programs did. Almost all the excellent programs gave awards or prizes for research; less than a third of the others did. Frequent reminders of research activities, a supportive infrastructure, such as assistance with statistics, and public acknowledgement of research success contribute to an overall impression of a research-friendly environment. If doing research is not considered to be an unpleasant task or additional responsibility for the director and faculty, the director is probably more likely to view the department's accomplishments more positively.

The Impact of the Research Director

The program directors' opinions of the research directors' skill seemed to have a greater influence on their opinion of program compliance rating than their perception of their own skill level did. No significant associations were found with program director skill level.

Several statistically significant relationships were found with the research director position and skill level. All, but one, of the programs rating themselves as excellent had an official research director. Half of the research directors were full time, departmental research directors. The other half were full time faculty, who served as part time research directors. Only, thirty percent of the other programs had an official research director in the medical education or the radiology

department. In addition, half the excellent programs had a research director with a Ph.D; less than 16% of the other programs had a research director or leader with a Ph.D.

Although the program directors were asked their opinion about barriers to research in general, i.e. for all programs, their responses and accompanying comments seem to indicate that they either answered for their specific department or their personal experience influenced their responses. For example, when asked about the lack of a research director as a barrier to research, the answers were divided according to personal experiences. The programs without a research director said that not having one was a problem. Those with a research director said not having one was not a problem or a barrier to research. Either the latter group were not consciously aware of the contribution the research director made to their research efforts, or they were answering that in their program the lack of research director was not a problem.

All program directors of excellent programs rated their research directors' skill level as competent or expert in all six content areas. The association was statistically significant in research design, scientific writing, and grant writing. In each of these, all research directors in excellent programs were rated as expert.

There may be a sense of elitism involved in the relationship between research director and the program's perceived success in complying with the scholarly activity standard. The standards do not require a research director and most radiology departments do not have one. If an academic department has a research director and the program director respects the research director's professional skills, that, too, may add to a sense of superiority, when compared to the other radiology departments.

Observed Trends with Compliance

Although none of the following is statistically significant, the observed relationships and trends are interesting to note. They seem to naturally fall into three categories: features supporting research, curriculum, and program leadership, both program director and research director.

Features Supporting Research

By a ratio of 2:1, the excellent programs were more likely than not to have access to secretarial assistance with research projects and audiovisual assistance, such as power point and poster presentation assistance. Although the other programs also were more likely to have assistance in both of these areas, the ratios were not as

striking. The excellent programs were also more likely to participate in a research day. Two-thirds of excellent programs participated, but slightly less than 40% of the other programs did. As stated earlier, the supportive infrastructure in areas outside the physicians expertise contributes to a research-friendly climate.

Curriculum

Although a project or study wasn't always required at the excellent programs, all programs had a research component. In the other programs, 10% said their residents never do research. Mentoring seemed to be the primary focus at the excellent programs. None had the independence model as its only model. Approximately half the excellent programs indicated that the apprenticeship model was the only approved model; the other half permitted both the independent and apprenticeship model. By contrast, 10.9% of the other programs said the independence model was their only resident research model. At first glance, this result seems unexpected, but upon reflection it appears that, perhaps, the excellent programs mentor first and then permit their residents to work with minimal supervision if they have demonstrated a certain level of skill. None of the programs, which reported using the independence model solely, thought that the quality of resident research was excellent or very good; 75% thought

that it was inconsistent. In the programs that did not use the independence model or used it in conjunction with the apprenticeship model, only half thought resident research was inconsistent; almost 20% thought it was good or excellent. One speculates that the combination of little or no academic preparation and limited practical mentoring, associated with the independence model, may lead to inconsistent results.⁴

By a ratio of 2:1, the excellent programs were more likely than not to require instruction in the critical analysis of medical literature. Only a third of the other programs required this course. This may account for the response to the opinion statement about residents' skill in evaluating medical literature. More than twice as many excellent programs agreed, as compared to other programs (55.6% v 22.9%), to the statement that their residents had a comfortable working knowledge of this skill. Reading medical literature is the one scholarly activity all physicians have in common. Approximately 95% of the program directors said critical analysis of the medical literature was a necessary skill for a graduating resident. Not only have their own residents not mastered this skill, but they haven't even achieved working knowledge. It seems reasonable that this skill would have a

strong influence on their perception of success when evaluating their scholarly curriculum and outcomes.

Leadership

All the excellent programs had an official research director. Half those research directors had a Ph.D. as compared to 15.6% of the research directors in the other programs.

The program directors in all excellent programs believed that their research directors had achieved competency or better in interpretation of statistics and research methodology. The other program directors thought that approximately 1/3 of their directors had not achieved competency in these subjects. Again, the trend seems to be that the research directors' skill level may be influencing the program directors' perceptions regarding the success of their research curricular component and faculty scholarly activities.

Although it was not statistically significant, the program directors in the excellent programs tended to rate themselves at a higher skill level in critical analysis of the medical literature, research design, scientific writing, and research methods than the other program directors did. One of the most striking differences between the two was in scientific writing. The directors in the excellent programs were almost equally divided between novice, working knowledge, and

competent. In the other programs, 78.3% of the directors rated themselves as novice. In research methods, the percent of directors, who rated themselves as having working knowledge, was almost the same in both groups, however, the competent and novice categories seem to be reversed. More than 37% of the directors in the excellent programs rated themselves as competent, but more than 43% of the other directors rated themselves as novice.

Summary

As program directors self-report skill level increased, their perception of the skill as it relates to residency education changes. In general, they see it as more important. This perception, however, does not translate into curricular decisions. It appears that curriculum decisions are based on something other than pedagogical influences. These may be finances, availability of qualified faculty to teach the courses, or time during the day when all residents can be released to attend academic sessions.

The programs, that believe they are very successful in meeting the research and scholarly activity standard, tend to be larger, university-administered programs in radiology departments that receive grant funding. They have a supportive research environment,

which includes a competent, official research director and ongoing support in ancillary areas, such as statistics and presentation method assistance. There is clearly support for the hypothesis.

Chapter VI

CONCLUSIONS

The accrediting bodies have established standards for residency training. One particular component investigated in this study relates to research and scholarly activity. The findings of this study indicate that 1) residency training program directors are unclear about how to meet the standard and 2) programs do not offer an organized scholarly activity curriculum.

Curriculum

The data do not indicate a logical or linear relationship between the program directors' opinions about a content area and the teaching of that subject matter. This is apparent when looking at the responses to questions about necessity of skill and relative importance of the skill. It is most obvious when examining the responses the directors gave to the minimum level of competence a graduating resident should achieve in a given skill. If the directors believe a skill is necessary, the subject is important, and the graduating resident should have at least a working knowledge, or

even have achieved competency, the educational response should be to teach the course. That is not what was reported as occurring in the residency programs that responded to the survey. In addition, it does not seem reasonable to teach several, complicated topics in a total of three or four hours. Clearly, educational needs are not driving the decision-making process when deciding what courses to offer and the content of those courses in the residency programs.

The curriculum, if that term can be used, appears to be a hodge podge of lectures. The focus group discussions revealed that the curriculum is very full with basic clinical radiology, new modalities, and long-standing academic topics and that there was not enough time to teach additional subjects. However, when given an opinion statement that the radiology programs should be exempt from the standard, three-fourths did not agree. Even directors, who took the time to write notes expressing their frustration or disagreement with the standard, disagreed with the opinion statement. The reason for the apparent inconsistency is not obvious.

Why particular topics were chosen to be included or excluded from the educational sessions was not answered in the study. One can speculate that lack of faculty with skills to teach the omitted research topics may be the answer for many programs. This speculation is

based on the responses in the barriers to research section of the survey. Another possibility is the lack of trained research faculty. Almost none of the programs had a faculty member with a Ph.D. degree. One reason may be that very few program directors seemed to understand that a Ph.D. degree is a research degree. This is apparent in the responses to the three questions about the qualifications of a Ph.D.-trained faculty member to teach research design and research methods. Another reason may be the financial inability to hire an additional faculty member, if that person is perceived as not contributing to the departmental budget because he/she is not a clinician. In this study, Ph.D.-trained research directors were more likely to work in departments, where grants were perceived as playing an important role in the department's budget.

In addition to having minimal (or no) training in research, the typical physician program director does not have a background in curriculum development or instructional design. An analogy that may be useful to the physician educators is to treat the desired outcome, i.e. skill level in a content area, as if it were a diagnosis or desired patient outcome. If they were treating a patient, they would order specific tests, give proper medications, and order appropriate ancillary therapy, if needed. The tests and therapy would be

performed by professionals qualified in that skill. It is the same for educational skills. If competency in a certain skill is desired, they should examine which entry-level and intermediate skills the resident needs in order to achieve the outcome. They should also ask, "who is most qualified to teach those skills". Of course, funding may have a negative impact on the ability to hire appropriate personnel.

Clarification of the Standard

Two-thirds of the directors said that they are not meeting the spirit of the standard or that their program needs improvement. That is an unexpectedly large number. Slightly more than a tenth said their success level in meeting the scholarly activity standard placed them in the top 25% of all residency programs. Either the directors are very humble, or they are insecure when it comes to the standard. One speculates that it is the latter. When the accreditation agency was contacted, the executive director for radiology could not describe the components of a successful scholarly activity program. The only response given was that the inspectors count the number of publications. That method puts undue emphasis on one outcome and does not take into account the breadth of the standard. So, from the accrediting agency's perspective there is no clarity as to how to

evaluate the standard, and from the program directors' perspective there is little clarity in interpreting the standard.

The obvious implication of this conclusion is the need for more guidelines, and more importantly, assistance in obtaining the skills necessary to successfully meet those guidelines which would be beneficial to the faculty, residents, and program inspectors. One scholarly activity model cannot fit all programs. One director suggested a two-category model. In the model, the teaching of critical analysis of the medical literature would be required of all programs. Some programs would choose to be research-oriented programs. Residents, who have an interest in research or an academic career, could select those programs. Residents, who wish to be clinical radiologists in small hospitals, could choose to go to the residencies without a research component. However, if they wanted an introduction to research, the residents could do an elective rotation at a larger institution. The suggestion seems reasonable. A concern, however, is that the two-category approach would be viewed as a two-tier system, with the tiers being seen as two levels of quality. In spite of this concern, it is a suggestion that should be given thoughtful consideration by the accrediting bodies.

Recommendations

The accrediting bodies must review their reasons for having the scholarly activity standard. A key question that must be answered is, "Is the standard necessary?" If it is, is it necessary for all residency programs? If a broad research curriculum, i.e. beyond teaching critical analysis of the literature, is not necessary for all residency programs, the ACGME and AOA should consider two tracks: programs having a research component and program that do not have a research component.

After the accrediting bodies have reviewed the reasons for having the scholarly activity standard and have decided that it is necessary for at least some of the programs, they must communicate this information to the program directors. Part of the clarification must be to operationalize the standard, so that program directors know what is expected of them, their faculty, and their residents. As it is currently written, several options are given as possible ways of meeting the standard, but according to the executive director of diagnostic radiology for the ACGME, publication counts are the only way compliance with the standard is being assessed currently. This method does not address quality of research, nor does it evaluate the

curriculum that teaches the skills, which are prerequisites for performing research.

Once the information has been shared with the program directors, there must be a dual educational focus. First, the accreditation site visitors must be taught how to evaluate educational outcomes beyond a simple publication count. Either the accrediting organizations must send a qualified educator as a team member or the organizations must educate the physician site visitors in curriculum evaluation. Second, the program directors and faculty must be given the tools necessary to design and teach research methods. Ideally, each program would have a trained research director, but that is not always fiscally possible. To assist the programs, the professional societies can offer faculty development seminars in how to design a research curriculum and how to teach research methods.

In summary, evaluation and clarification of the standard must begin at the top, i.e. the ACGME and the AOA. Once they have come to a decision, they must develop a plan to a) communicate the reasons for the standard to the professional community, b) provide the program leadership with the tools they need to comply with the standard, and c) equip the accreditation inspectors with the methodology they need to evaluate the programs fairly.

Strengths and Limitations

This is the first study to look broadly at the research and scholarly activity standard in diagnostic radiology residency programs. The written comments and notations, such as stars and exclamation points on the returned surveys, indicate that the topic was important to the directors.

There were several limitations, which fell into two categories: response rate and design. The response rate was slightly less than 50%. Although a response rate of 60% was desired, the actual response rate was not unexpected. The survey was mailed from a New Jersey post office in the fall of 2001 at the height of the anthrax scare, which was associated with a New Jersey postmark. McGuire and Herberman (1998) sent a short, one-page survey on the research standard to all program directors of ACGME-accredited radiology residency programs. Their final response rate from the directors was 32%. As a group, physician surveys tend to have a lower response rate than other groups. Asch, Jedrzewski, and Christakis (1997) studied the response rate for mailed surveys published in medical journals. They report a mean response rate of 54% (SD \pm 17) for surveys mailed to physicians, however, anonymous surveys sent to physicians had a

response rate of 9.0 percentage points lower than non-anonymous surveys. The survey sent to the radiology program directors was anonymous. In this study, residency programs located in east coast states, especially New England, were underrepresented, but the main concern is that the smallest programs had a very low response rate. Therefore, the results of this study cannot be generalized to this population.

There were several limitations related to design. First, the skill levels were not defined, so each director was free to determine his or her own definition. Second, the meaning of the term, research methods, may not have been clear to a population that does not have academic research credentials. This might have been the reason that the directors identifying themselves as being in the two middle skill areas answered questions similarly. Third, the survey was on legal size paper and stapled in the upper right corner. As directors completed the survey, they folded it in half. As a result of not turning the entire page, some respondents did not complete the two middle sections. Lastly, except for the statement section of the survey, there were no 'no opinion' choices. In several sections and subsections, the directors were asked if they agreed with a statement. A check was recorded as a 'yes' response and a blank was recorded as a 'no'

response. If someone chose to skip a question, the response was automatically counted as a 'no', even though this may not have been the intent.

Recommendations for Further Study

Curriculum decisions are complicated. The results of this study indicate that importance of content area is not a primary influence as to what courses are taught and what defines a course. As long as the accreditation standards continue to be written in language that permits free interpretation and the accrediting body continues to limit its evaluation of compliance to article counts, additional study into the educational decision-making process in residency education is recommended. In a climate of dwindling reimbursement, the relationship between departmental grant funding and scholarly activity resources and influences should also be examined.

REFERENCES

Alguire P. C., Anderson W. A., Albrecht R. R., & Poland G. A. (1996). Resident research in internal medicine training programs. Annals of Internal Medicine, 124 (3), 321 - 328.

Accreditation Council for Graduate Medical Education (online). Available: www.acgme.org.

American Heritage Dictionary (3rd ed.). (1996) Boston: Houghton-Mifflin.

American Medical Association. (1981). '81/'82 Graduate Medical Education Directory. Chicago: Author.

American Medical Association. (2001). Graduate Medical Education Directory 2001 2002. Chicago: Author.

American Osteopathic Association. (2000). Basic Standards for Residency Training in Diagnostic Radiology. Chicago: Author.

Asch D. A., Jedziewski M. K., & Christakis N. A. (1997). Response rates to mail surveys published in medical journals. Journal of Clinical Epidemiology, 50 (10), 1129 - 1136.

Barchi R. L. & Lowery B. J. (2000). Scholarship in the medical faculty from the university perspective: Retaining academic values. Academic Medicine, 75 (9), 899 - 905.

Barzansky B. & Gevitz N. (Eds.). (1992). Beyond Flexnor. Medical Education in the Twentieth Century. Westport: Greenwood Press.

Beattie D. S. (2000). Expanding the view of Scholarship. Academic Medicine, 75 (9), 871 - 873.

Benner P. (1984). From Novice to Expert: Excellence and Power in Clinical Nursing Practice. Menlo Park: Addison-Wesley.

Blake D. J., Lezotte D. C., Yablon S., & Rondinelli R. D. (1994). Structured research training in residency training programs. The impact on the level of resident research activity. American Journal of Physical Medicine & Rehabilitation, 73 (4), 245 - 250.

Blanda M., Gerson L. W., & Dunn K. (1999). Emergency medicine resident research requirements and director characteristics. Academic Emergency Medicine, 6 (4), 286 - 291.

Boyer E. L. (1990). Scholarship Reconsidered. Priorities of the Professoriate. Princeton: Carnegie Foundation for the Advancement of Teaching.

Brookfield S. (1986). Understanding and Facilitating Adult Learning. San Francisco: Jossey-Bass.

Brouhard B. H., Doyle W., Aceves J., & McHugh M. J. (1996). Research in pediatric residency programs. Pediatrics, 97, 71 - 73.

Buschbacher R. & Braddom R. L. (1995). Resident versus program director perceptions about PM&R research training. American Journal of Physical Medicine & Rehabilitation, 74 (2) 90 -100.

Chung R., Diaz J., & Li P. (1999). A method of teaching clinical research in a community hospital residency program. The American Journal of Surgery, 177, 83 - 85.

DeHaven M. J., Wilson G. R., & O'Connor-Kettlestrings P. (1998). Creating a research culture: What we can learn from residencies that are successful in research. Family Medicine, 30 (7), 501 - 507.

DeHaven M. J., Wilson G. R., Murphree D.D., & Grundig J. P. (1997). Family practice residency program directors' views on research. Family Medicine, 29 (1), 33 - 37.

Dreyfus H. L. & Dreyfus S. E. (1986). Mind Over Machine. The Power of Human Intuition and Expertise in the Era of the Computer. New York: The Free Press.

Flexner A. (1910). Medical Education in the United States and Canada. Princeton: Carnegie Foundation for the Advancement of Teaching.

Fraker L. D., Orsay E. M., Sloan E. P., Bunney E. B., Holden J. A., & Hart R. G. (1996). A novel curriculum for teaching research methodology. The Journal of Emergency Medicine, 14 (4), 503 – 508.

Gay S. B. & Hillman B. J. (2000). Evaluation of mandatory radiology research rotation. Academic Radiology, 7 (3), 172 – 175.

Jarvis P. (1992). Paradoxes of Learning. San Francisco: Jossey-Bass.

Kolb D. A. (1984). Experiential Learning. Experience as the Source of Learning and Development. Englewood Cliffs: Prentice Hall.

Leach D. C. (2002). Competence is a habit. JAMA, 287 (2), 243 – 244.

Levitt M. A., Terregino C. A., Lopez B. L., & Celi C. (1999). A National profile of resident research programs in emergency medicine. Academic Emergency Medicine, 6 (4), 348 - 351.

Levitt M. A., Terregino C. A., Lopez B. L., & Celi C. (1999). Factors affecting research directors' and residents' research experience and productivity in emergency medicine training programs. Academic Emergency Medicine, 6 (4), 356-359.

Mason A. D., Biehler J. L., Linares M. Y. R., & Greenberg B. (1999). Perceptions of pediatric emergency medicine fellows and program directors about research education. Academic Emergency Medicine, 6 (10), 1061-1065.

McGuire C. W. & Herberman H. B. (1998). Research in radiology residency programs: a survey. Academic Radiology, 5 (10), 698 – 700.

Neale A. V., Pieper D., & Hammel E. (2000). A consortium-based research education program for residents. Academic Medicine, 75 (3), 298 – 301.

Neinstein L. S. & MackKenzie R. G. (1989). Prior training and recommendations for future training of clinical research faculty members. Academic Medicine, 64(1), 32 – 35.

O'Neil E. (1998). The transformation of academic health in the United States. Western Journal of Medicine, 168, 355 – 359.

Portney L. G. & Watkins M. P. (1993). Foundations of Clinical Research. Applications to Practice. Stamford: Appleton & Lange.

Schulz H. J. (1996). Research during internal medicine residency training: meeting the challenge of the residency review committee. Annals of Internal Medicine, 124 (3), 340 – 342.

Sousa D. A. (1995). How the Brain Learns. Reston: National Association of Secondary School Principals.

Steiner J. F., Curtis P., Lanphear B. P., Vu K. O. & Reid A. (2000). Program directors' perspectives on federally funded fellowship training in primary care research. Academic Medicine, 75 (1), 74 – 80.

Sulak P. J., Croop J. A., Hillis A., & Kuehl T. J. (1992). Resident research in obstetrics and gynecology: development of a program with comparison to a national survey of residency programs. American Journal of Obstetrics and Gynecology, 167 (2), 498 - 502.

Summers R. L., Fish S., Blanda M., & Terndrup T. (1999). Assessment of the "Scholarly Project" requirement for emergency medicine residents: report of the SAEM research directors workshop. Academic Emergency Medicine, 6 (11), 1160 – 1165.

Supino P. G. & Richardson L. D. (1999). Assessing research methodology training needs in emergency medicine. Academic Emergency Medicine, 6 (4), 280 - 285.

Terregino C. A., Levitt M. A., Lopez B. L., Eskra B. D., & Arnold G. K. (1999). A national profile of resident research experience. Academic Emergency Medicine, 6 (4), 351- 356.

Ward R. C. (Ed.) Foundations for Osteopathic Medicine. Baltimore: Williams & Wilkins.

Appendix A

Research and Scholarly Activity Standard (Allopathic)

V. The Educational Program

A. Clinical Components

The program in diagnostic radiology must provide a sufficient volume and variety of patients to ensure that residents gain experience in the full range of radiologic examinations, procedures, and interpretations. A reasonable volume is no less than 75,000 total radiologic examinations at the parent or integrated program, and no less than 7,000 radiologic examinations per year per resident. The number of examinations in each of the subspecialty areas must be of sufficient volume to ensure adequate training experience. If volume in any subspecialty area is less than acceptable, a plan must be developed to increase trainee exposure. The presence of residents and subspecialty residents from outside institutions for limited rotations should not dilute the educational experience of the core program residents.

The clinical training must provide for progressive, supervised responsibility for patient care and must ensure that the supervised resident performs those procedures commonly accepted in all aspects of diagnostic radiology. The training must include progressive study and experience in all of the diagnostic radiologic subspecialties. The training program should ensure sufficient time to gain experience in neuroradiology, musculoskeletal radiology, vascular and interventional radiology, chest radiology, breast imaging, abdominal radiology, pediatric radiology, ultrasonography (including obstetrical and vascular ultrasound), and nuclear radiology.

Additionally, each resident must have documented supervised experience in interventional procedures, for example, image-guided biopsies, drainage procedures, noncoronary angioplasty, embolization and infusion procedures, and percutaneous introduction techniques.

The program director must require that residents maintain a record (electronic or written) in which they document the performance, interpretation, and complications of vascular, interventional, and invasive procedures. The record must be reviewed by the program director or faculty designee on a yearly basis.

Training and experience are required in plain film interpretation, computed tomography, magnetic resonance imaging, ultrasonography, angiography, and nuclear radiology examinations related to cardiovascular disease. The program also must provide instruction in cardiac anatomy, physiology, and pathology, including the coronary arteries, as essential to the interpretation of cardiac imaging studies. This training must include both the adult and the pediatric age group.

Radiologic education in different organ systems must provide the opportunity for residents to develop adequate knowledge regarding normal and pathologic physiology, including the biologic and pharmacologic actions of materials administered to patients in diagnostic studies.

Each resident must have basic life-support training, and advanced cardiac life-support training is recommended.

B. Didactic Components

The education in diagnostic radiology must occur in an environment that encourages the interchange of knowledge and experience among residents in the program and with residents in other major clinical specialties located in those institutions participating in the program.

Diagnostic radiologic physics, radiation biology, radiation protection, and pathology are required elements of the curriculum. In view of the importance of understanding pathology as a basis for radiologic diagnosis, emphasis should be placed on its study. Radiologic/pathologic conferences are required for those residents who do not participate in formalized extramural pathology teaching programs.

Computer applications in radiology, practice management, and health systems and quality improvement are also required curriculum components.

Teaching files (electronic or film) of cases related to all aspects of diagnostic radiology must be available for use by residents. Aggregates of these files should contain a minimum of 1,000 cases that are actively maintained and continually enhanced with new cases. The American College of Radiology learning file or its equivalent should be available to residents; this only partially meets the teaching file requirements.

Conferences and teaching rounds must be correlated and provide for progressive resident participation. There should be intradepartmental conferences as well as interdepartmental conferences of appropriate frequency with each major clinical department in which both residents and faculty participate on a regular basis.

C. Resident Policies

1. Supervision

The responsibility or independence given to residents should depend on their knowledge, manual skill, and experience. Faculty supervision must be available at all sites of training.

The resident in the first year of training in the diagnostic radiology program must have a minimum of 6 months of training in diagnostic radiology prior to independent in-house on-call responsibilities. Residents must always have faculty backup when taking night or weekend call. All radiologic images must be reviewed and all reports must be signed by faculty.

2. Duty Hours and Conditions of Work

Duty hours and night and weekend call for residents must reflect the concept of responsibility for adequate patient care. However, residents must not be required regularly to perform excessively difficult or prolonged duties. It is recommended that residents should be allowed to spend at least 1 full day out of 7 away from the hospital and should be assigned on-call duty in the hospital no more than, on average, every third night. It is the responsibility of the program director to monitor resident assignments to ensure adherence to this recommendation.

D. Other Required Components

1. Scholarly Activity

Graduate medical education must take place in an environment of inquiry and scholarship in which residents participate in the development of new knowledge, learn to evaluate research findings, and develop habits of inquiry as a continuing professional responsibility. The responsibility for establishing and maintaining an environment of inquiry and scholarship rests with the teaching faculty. While not all members of a teaching faculty must be investigators, the faculty as a whole must demonstrate broad involvement in scholarly activity. This activity should include the following:

- a. Active participation of the teaching faculty in clinical discussions, rounds, and conferences in a manner that promotes a spirit of inquiry and scholarship. Scholarship implies an in-depth understanding of basic mechanisms of normal and abnormal states and the application of current knowledge to practice.
- b. Participation in journal clubs and research conferences
- c. Active participation in regional or national professional and scientific societies, particularly through presentations at the organizations' meetings and publication in their journals
- d. Participation in continuing medical education programs
- e. Participation in research, particularly in projects that are funded following peer review and/or result in publication or presentations at regional and national scientific meetings

1. Offering of guidance and technical support (eg, research design, statistical analysis) for residents involved in scholarly activities
2. Resident Research
During their training, all residents should be encouraged to engage in an investigative project under faculty supervision. This may take the form of laboratory research, clinical research, or the retrospective analysis of data from patients, and results of such projects shall be suitable for publication or presentation at local, regional, or national scientific meetings.

VI. Evaluation

A. Resident Evaluation

The program director is responsible for regular evaluation of residents' knowledge, skills, and overall performance, including the development of professional attitudes consistent with being a physician. Evaluations of each resident's progress and competence should be conducted preferably at the end of each rotation, but not less than four times yearly. The evaluation must concern itself with intellectual abilities, attitudes and character skills, and clinical and technical competence. The program director or the program director's designee must meet with all the residents at least semiannually to discuss these evaluations and provide feedback on performance. More frequent reviews of performance for residents experiencing difficulties or receiving unfavorable evaluations are required. There must be provision for appropriate and timely feedback of the content of all evaluations to the resident. Residents should be advanced to positions of higher responsibility only on the basis of their satisfactory progressive scholarship and professional growth. The program must maintain a permanent record of the evaluation and counseling process for each resident. Such records must be accessible to the resident and other authorized personnel.

There must be a written final evaluation for each resident who completes the program. The evaluation must include a review of the resident's performance during the final period of training and should verify that the resident has demonstrated sufficient professional ability to practice competently and independently. The final evaluation should be part of the resident's permanent record maintained by the institution.

B. Faculty and Program Evaluation

The program must provide the opportunity for residents to provide written confidential evaluation of the faculty and the program at least annually. Each faculty member must review his or her evaluations.

The educational effectiveness of a program must be evaluated in a systematic manner. In particular, the quality of the curriculum and the extent to which the educational goals have been met by residents must be assessed. Anonymous written evaluations by residents should be utilized in this process.

VII. Board Certification

The RRC will consider the performance of a program's graduates on the examinations of the American Board of Radiology as one measure of the quality of the training program. During the most recent 5-year period, at least 50% of its graduates should pass without condition the written and oral examinations on the first attempt.

Residents who plan to seek certification by the American Board of Radiology should communicate with the Executive Director of the Board to be certain of all requirements, including duration of training, for admission to the examination process.

ACGME: June 1998 Effective: July 1999

Policies and Procedures for Residency Education in the Subspecialties of Diagnostic Radiology

Subspecialty programs must be administratively linked to an accredited core residency program in diagnostic radiology. (The only exception is pediatric radiology, as discussed below.) An application for accreditation of a new subspecialty program will be considered only if the core program has full accreditation. An application will not be accepted for review if the core program in diagnostic radiology is accredited on a provisional or a probationary basis, or if it has been accredited with a warning that adverse action will be taken if it is not in substantial compliance with the *Essentials of Accredited Residencies in Graduate Medical Education* at the time of the next review.

A subspecialty program in pediatric radiology may not necessarily be administratively linked to an accredited core residency program in diagnostic radiology if the pediatric radiology program is conducted in a children's hospital. In such a case, the subspecialty program may be considered free-standing and, therefore, not required to be under the sponsorship of a diagnostic radiology residency program.

An on-site survey of the proposed program is required for the initial review by the Residency Review Committee. Accreditation will be granted on the basis of the application and the written report from the on-site survey of the proposed program. Following the initial approval, the subspecialty program will be surveyed and reviewed in conjunction with the core diagnostic radiology program.

Subspecialty programs will be designated as "accredited" or "non-accredited." No other delineation of accreditation categories will be used. The accreditation status of the subspecialty program will be directly related to that of the core diagnostic radiology program, as follows:

Subspecialty programs may be cited for deficiencies and advised that either the deficiencies must be corrected by the specified time or accreditation will be withdrawn regardless of the accreditation status of the associated diagnostic radiology program.

If the associated diagnostic radiology program is accredited on a probationary basis, or accredited with a warning that adverse action will be taken, the subspecialty program will be informed that its accreditation status is also in jeopardy. Thereafter, accreditation of the subspecialty programs will be withdrawn if the Residency Review Committee finds that the sponsoring institution(s) is (are) not making satisfactory progress in addressing the adverse accreditation status of the core diagnostic radiology program.

Withdrawal of accreditation of the core diagnostic radiology residency program will result in simultaneous withdrawal of accreditation of the subspecialty program.

In the case of withholding of accreditation or withdrawing accreditation of subspecialty programs, the *Procedures for Proposed Adverse Actions* and the *Procedures for Appeal of Adverse Actions* apply.

Appendix B

Research and Scholarly Activity Standard (Osteopathic)

6. Training in magnetic resonance imaging that includes exposure to both image acquisition and interpretation.
 7. Weekly instruction by the department of diagnostic radiology as well as integration of training with other departments, in the relationship of clinical radiology with other departments such as surgery, pathology, medicine and pediatrics. There must be a required sign-in policy for documentation of attendance and of the lecture subject.
 8. Opportunities for the resident to follow patients to surgery for the purpose of correlating radiologic findings and to follow cases to pathology to develop an understanding of the gross pathology of surgical specimens. The resident shall review gross and microscopic findings of tissue in cases of special interest to the department of diagnostic radiology, attend autopsies, especially those of interest to the department of diagnostic radiology and participate in clinicopathologic and tumor conferences.
 9. An opportunity throughout for exposure to issues which the resident will face as a practicing clinician, including health policy, managed care, health administration, medical ethics, medical liability and practice management.
 10. Research. Retrospective or prospective studies shall be performed in cooperation with the program director and where required, approved by institutional review authorities. The research project may be utilized in the required scientific exhibit.
- E. If necessary, the program must provide suitable arrangements for outside rotations to insure the complete education of the resident and for broadening the scope of training. All rotations must meet standards as formulated in the Residency Training Requirements of the AOA.
- F. Any organizational or structural change that may affect a residency training program must be approved in writing by the committee on evaluation and educational standards of the AOCR prior to implementation. Requests for changes must include the educational impact of any request and documentation that the educational process will not be compromised by said change. Changes must be approved in advance.

ARTICLE V - QUALIFICATIONS AND RESPONSIBILITIES OF THE PROGRAM DIRECTOR

- A. Qualifications:
1. The program director must be certified as a radiologist by the AOA, through the AOB.R.

- A. Residents in diagnostic radiology must:
1. Have graduated from an AOA-accredited college of osteopathic medicine.
 2. Have completed an AOA-approved internship.
 3. Be and remain members of the AOA during residency training.
 4. Be appropriately licensed in the state in which training is conducted.
 5. Be a full-time resident of the training institution; must not be engaged in any other residency training program or in any full-time or part-time medical practice; and conform to the AOCR policy for "Moonlighting".
- B. During the training program the resident must:
1. Submit an annual log to the program director. All logs shall be signed by the program director and copies sent to the DME. Logs shall include documentation of outside rotations.
 2. Submit an annual report to the AOCR and the DME. An annual report must be evaluated as a twelve (12)-month period of residency training that must be under contract with a single institution. A certificate of completion must be submitted with the final year's annual report in order to be considered for program completion approval.
 3. Present one exhibit at an annual meeting of the AOCR no later than the annual meeting of the resident's third year of training (see Appendix III).
 4. Participate in diagnostic radiology related and other conferences including journal club.
 5. All residents in a consortium or an OPTI must complete all AOCR requirements as well as any additional requirements of the consortium or OPTI each year prior to AOCR approval for that year of training and must submit verification of completion of program from the consortium or OPTI.
- C. It is recommended that the resident apply for candidate membership in the AOCR during the first year of residency training.

ARTICLE VII - POLICIES

A. Advanced Standing Policy:

To receive advanced standing in radiology, candidates must:

APPENDIX III

AOCR Guidelines for Resident Scientific Exhibits In Diagnostic Radiology and Radiation Oncology Residency Training Programs

A resident must present a scientific exhibit no later than the annual meeting of the resident's third year of training to fulfill the residency training requirement. The exhibit must be displayed and judged at an annual meeting of the college.

Exhibits will be evaluated at the meeting and must meet minimal criteria established by the committee as listed on the evaluation form. An exhibit must score a 70 or above to fulfill the residency training requirement.

Scientific exhibits will be accepted in poster form or multi-media form. For poster exhibits materials should be mounted on poster board (light cardboard) which will be mounted on a 4'H x 8'W display board.

For multi-media exhibits the following guidelines will apply:

1. The AOCR is not responsible for the exhibit or equipment in any way.
2. Security for the equipment is the responsibility of the resident.

Poster exhibits or multi-media exhibits must be fully set-up during all exhibit hours or credit will not be received.

Residents planning to submit an exhibit at an annual meeting for residency training credit must submit an application and an abstract of the exhibit to the AOCR office by June 1 of that year. Abstracts should include paragraphs beginning with the words, objective, methods, results and conclusion. All information on abstracts must be typed and double spaced. The length of the abstract should not exceed 200 words. Do not include in your abstract photographs, references or acknowledgments.

Helpful guidelines in preparing an exhibit can be found in Radiographics² and AJR³. Here is a summary of some of the suggestions:

1. Choose a topic that targets your particular audience. Keep the scope of the poster narrow enough to prevent loss of interest.
2. Keep it simple. Limit textual information and highlight the central theme.

²Franken E.A. and Photo A.V. The scientific exhibit in Radiology. Radiographics 1993;13:2-4.

³Bach D.B., et al: Producing Picture Perfect Posters. AJR 1993; 180:1303-1307

3. Keep the text at a minimum and a size that is easy to read. The reader should be able to absorb the theme of your exhibit in no more than 5 minutes.
4. Images should be pertinent to the message of your exhibit and should not be too subtle since your audience may be viewing it from a distance. The size of your images is important. You don't want them to be too small. They should be of high quality and attractively mounted.
5. A single case history is not acceptable.

Cash awards will be presented to the first, second and third place winners.

Appendix C

Program Review Documents (ACGME)

VII. RESEARCH

1. Describe briefly the research space and important special research facilities:

2. List intramural research programs (not more than ten) being conducted by members of the Department, indicating those (if any) in which residents participate. DO NOT SUBMIT COPIES OF PROTOCOLS, PAPERS OR GRANT APPLICATIONS.
1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

3. List publications by the residents for the past three years. Underline the resident's name. DO NOT INCLUDE REPRINTS.

4. List resident research projects leading to presentations.

VIII. NARRATIVE DESCRIPTION OF TRAINING PROGRAM

This is a most important part of your application. The Residency Review Committee for Radiology must determine whether a truly educational experience is offered by your program as it is presented. The Committee recognizes that many variations exist among excellent programs and it does not intend to design or dictate curricula.

In addition to the material already provided, information of significance relative to the following questions will be helpful in evaluating your program:

1. What are the principal objectives of the program?
2. Describe the organization of the teaching services.
3. Explain the provision for graduated resident responsibility.
4. Explain the availability of attending coverage and provision for resident supervision.
5. Is there a documented, supervised experience in interventional procedures as described in the diagnostic radiology special requirements?
6. Are residents present during the interpretation of adult and pediatric angiocardiograms and adult coronary angiograms?
7. How is experience in CT, Ultrasound and MRI obtained?
8. Explain the OB/Ultrasound experience.

Appendix D

Seton Hall University Institutional Review Board Documents

SETON HALL UNIVERSITY
1 8 5 6

July 3, 2001

Ms. Judith Malinowski
408 Warren Street
Harrison, NJ 07029

Dear Ms. Collins:

At its May meeting, the Seton Hall University Institutional Review Board for Human Subject Research reviewed and approved as submitted your proposal entitled "Scholarly Activity in Diagnostic Radiology Residency Programs." Enclosed please find the signed Request for Approval from for your records.

The Institutional Review Board approval of the project is valid for a one year period from the date of this letter. Any changes to the research protocol must be reviewed and approved by the committee prior to implementation. Thank your for your cooperation and best wishes for the success of your research.

Sincerely,

Mary F. Ruzicka, Ph.D.

Mary F. Ruzicka, Ph.D.
Acting Chair
Institutional Review Board

C: Sheama Krishnigari, Ph.D.

/fs

Office of Grants and Research Services
Presidents Hall
Tel: 973.275.2974 • Fax: 973.275.2978
400 South Orange Avenue • South Orange, New Jersey 07079-2641

**REQUEST FOR APPROVAL OF RESEARCH, DEMONSTRATION OR
RELATED ACTIVITIES INVOLVING HUMAN SUBJECTS**

PROJECT TITLE: Scholarly Activity in Diagnostic Radiology Residency Programs

CERTIFICATION STATEMENT:

In making this application, I(we) certify that I(we) have read and understand the University's policies and procedures governing research, development, and related activities involving human subjects, and that I(we) shall comply with the letter and spirit of those policies. I(we) further acknowledge my(our) obligation to (1) obtain written approval of significant deviations from the originally-approved protocol BEFORE making those deviations, and (2) report immediately all adverse effects of the study on the subjects to the Chairperson of the Institutional Review Board Involving Human Subjects and to the Director of the Office of Grants and Research Services, Seton Hall University, South Orange, NJ 07079.

Judith E. Malinowski
Judith E. Malinowski, Ph.D.(C)

May 15, 2001

****Please print or type out name below signature****

Sheema Krishnagiri Ph.D., OTR
Sheema Krishnagiri, Ph.D., OTR, Dissertation Chair

5/11/01
Date

****Please print or type out name below signature****

The request for approval submitted by the above researcher(s) was considered by the IRB for Research Involving Human Subjects Research May 2001 meeting.

The application was approved not approved by the Committee. Special conditions were _____ were not set by the IRB. (Any special conditions are described on the reverse side.)

Mary J. Ruzicka, Ph.D.
CHAIRPERSON, SETON HALL UNIVERSITY INSTITUTIONAL
REVIEW BOARD FOR HUMAN SUBJECTS RESEARCH

7/2/01
DATE

Appendix E

Survey

A Profile of Scholarly Activity in Academic Radiology

Unless stated otherwise, all questions refer to the last residency year (i.e. July 2000 to June 2001).

If you are unsure, leave answer blank. Comments and explanations are welcomed and gratefully encouraged.

A. General Program Information

1. Date (e.g. 1999) of last RRC or AOA inspection: _____
2. Number of residents: PGY 2 _____ PGY 3 _____ PGY 4 _____ PGY 5 _____
3. Number of faculty:
Radiologist: Full time _____ Part time _____
Non-radiologist: Full time _____ Part time _____
4. Current program director:
Years in current position _____ Total number of years as a program director _____
(i.e. this program only) (i.e. at all programs, including this one)
5. Which best describes the position of research director? (choose one answer)
 Graduate medical education employs a full-time research director.
 Our program/department has a full-time research director.
 A full time faculty member serves (officially) as the part-time research director.
 A faculty member serves unofficially as a part-time research coordinator or leader.
 We do not have an official or unofficial research director.
6. What are the degrees of the person identified in question 5? (choose one answer)
Medical degree (M.D. or D.O.) only _____ Ph.D. _____ Medical degree & Ph.D. _____
Medical degree & other doctoral degree (e.g. DPH, DSc, EdD) _____
Medical degree & M.P.H. _____ Other: _____ (identify degree) _____
7. Which of the following are available to residents & faculty? (check all that apply)
 statistician on site
 access to a statistician (at affiliate or partner institution, e.g. university, 'sister' hospital)
 a research assistant (e.g. data collection, design assistance)
 secretarial or clerical support for research projects
 a/v support (e.g. assistance with making slides, posters)
8. Which best describes your program's association / relationships? (choose one answer)
 University administered: close, active teaching and curriculum relationship.
 University administered: teaching relationship with university is minimal.
 University affiliated.
 Independent
 Military
9. Grants are an important part of the radiology department budget. Yes _____ No _____

B. Curriculum

In your residency program are any of the following courses mandatory or recommended? *Formal (scheduled) courses only. Do not include one-on-one mentorship.* (leave blank, if neither required or recommended.)

	Mandatory	Recommended
Introduction to research <i>OR</i> Research overview (many topics in research, e.g. ethics, methods, lit search, stats)	_____	_____
How to read & evaluate medical literature	_____	_____
Combined research methods & statistical methods course	_____	_____
Entry-level statistics course	_____	_____
Intermediate statistics course	_____	_____
Research methods course	_____	_____
Scientific writing course	_____	_____
Research ethics	_____	_____
Presentation skills & technology (e.g. power point)	_____	_____

2. What is the approximate length of the courses you identified as mandatory OR recommended?

	1 – 5 hours	6 – 10 hours	> 11 hours
Introduction to research / Research overview	_____	_____	_____
How to read & eval medical literature	_____	_____	_____
Combined research methods & stats	_____	_____	_____
Entry-level statistics course	_____	_____	_____
Intermediate statistics course	_____	_____	_____
Research methods course	_____	_____	_____
Scientific writing course	_____	_____	_____
Research ethics	_____	_____	_____
Presentation skills & technology	_____	_____	_____

**3. Which of the following skills / knowledge would you describe as necessary for graduating residents?
[check all that apply]**

- _____ How to read and evaluate medical literature
- _____ Research design
- _____ Sampling methods
- _____ Basic statistics
- _____ Intermediate statistics
- _____ Research ethics

4. When compared to traditional academic subjects (e.g. physics, radiation biology, practice management) in the residency curriculum, would you rate the following experiences or skills as more important, of equal importance, or less important?
 For example, a response of 'more important' would mean that the item on the list is more important than physics.

	More Impt.	Equal Impt.	Less Impt.
Research method skills/ knowledge	_____	_____	_____
Participating in faculty's research study	_____	_____	_____
Performing own study with faculty mentor	_____	_____	_____
Critical analysis of research articles	_____	_____	_____
Interpretation of elementary statistics	_____	_____	_____

5. In your opinion, what is the minimum skill level a radiologist, who has completed residency training in 2001, should have in the following content areas:

	Novice	Working Knowledge	Competent	Expert
How to read & evaluate medical literature	_____	_____	_____	_____
Research design	_____	_____	_____	_____
Sampling methods	_____	_____	_____	_____

6. During the 4 year residency, what is the minimum number of required research projects / studies? (i.e. total number per resident) Check one.

_____ 0 _____ 1 _____ 2 _____ 3 _____ 4

7. What is the actual number of projects – in progress or completed – during the 2000-2001 residency year? (i.e. total number of projects/studies in which residents actively participated)

8. Our resident research model most closely resembles:

- _____ apprenticeship model (residents work on faculty projects/studies)
- _____ independent model (resident develops research idea, faculty mentor)
- _____ either / both
- _____ neither, they don't do research

9. Which types of projects are acceptable for resident participation? (check all that apply)

- _____ retrospective studies / chart reviews
- _____ prospective study
- _____ case studies
- _____ literature review
- _____ other: describe / identify _____
- _____ categorization of findings
- _____ determination of values (diseased, normal)
- _____ diagnostic value of procedure
- _____ effect of test on patient management

10. During the past 3 years, how many resident articles were accepted for publication in a peer-reviewed journal? (i.e. number of articles)

_____ 0 _____ 1-3 _____ 4-6 _____ 7-10 _____ 11-15 _____ > 15
 _____ exact number, if known

11. During the past 3 years, how many faculty articles were accepted for publication in a peer-reviewed journal? (i.e. number of articles)

_____ 0 _____ 1-5 _____ 6-10 _____ 11-15 _____ 16-20 _____ > 20
 _____ exact number, if known

12. **During the past 3 years, what percent of your faculty have had articles published in a peer-reviewed journal?** (e.g. If you have 10 faculty and one published 5 articles, it would be 10%, BUT if five of the 10 collaborated on 1 article, that would be 50% of the faculty)

< 10% 11 - 25% 26 - 50% 51 - 75% > 75%
 exact percent, if known

13. **During the past 3 years, how many faculty posters have been exhibited at a national or international conference?** (i.e. number of posters)

0 1 - 5 6 - 10 11 - 15 16 - 20 > 20
 exact number, if known

14. **During the past 3 years, how many resident posters have been exhibited at a national or international conference?** (i.e. number of posters; do not include any posters from question 13)

0 1 - 3 4 - 6 7 - 10 11 - 15 > 15
 exact number, if known

15. In general (i.e. all programs), the quality of resident research is:

excellent very good good inconsistent poor

16. In general, the quality of radiology research in the United States is:

excellent very good good inconsistent poor

17. Does your program / institution have or participate in any of the following: (check all that apply)

- Research traditions or rituals, such as toasting the completion of a study or the publication of an article
- Research prizes or awards, such as plaques, certificates, free parking for a month
- A Research Day (departmental, GME, institution) when residents can exhibit or present
- Formal communication about ongoing or completed studies (newsletter, bulletin board)
- Regularly-scheduled research committee meetings (departmental or GME-wide) with faculty mentors and research director or program director.

18. In general, which of the following do you believe are barriers to resident research?

(check all that apply)

- Lack of faculty interest
- Lack of faculty with research skills
- No active Director of Research guiding the residents
- No dedicated release time for faculty to do research
- No dedicated release time for residents to do research
- Faculty patient-care time is increasing because of financial constraints

C. Program Leadership

1. Please rate your skill or knowledge level in the following areas:

	Novice	Working Knowledge	Competent	Expert
Critical analysis of medical literature	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Interpreting biostatistics	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Research design	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Scientific writing	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Grant writing	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
All aspects of research methods	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

2. Please rate the research director's (or the person you identified in question 5 on the first page) skill or knowledge level in the following areas: (leave blank if you do not have an official or unofficial research director)

	Novice	Working Knowledge	Competent	Expert
Critical analysis of medical literature	_____	_____	_____	_____
Interpreting biostatistics	_____	_____	_____	_____
Research design	_____	_____	_____	_____
Scientific writing	_____	_____	_____	_____
Grant writing	_____	_____	_____	_____
All aspects of research methods	_____	_____	_____	_____

3. With which statements do you agree? [Check all that are appropriate.]

_____ In general, a Ph.D.-trained person is more qualified than a physician to teach research skills.

_____ In general, a Ph.D.-trained person is more qualified than a physician to mentor the design of a resident research project or study.

_____ The best combination to mentor a resident's research project is: a physician as the medical content expert/advisor, working with a Ph.D. as supervising research mentor.

D. What is your opinion?

Circle A if you Agree with statement; D if you Disagree with the statement; and O if you have No Opinion.

- A D O Basic research methods skills improve clinical reasoning skills.
- A D O Actively participating in research improves clinical reasoning skills.
- A D O Critical evaluation of the literature skills improves clinical reasoning skills.
- A D O The culture of a radiology residency program does little to convince residents that research is worthwhile and important.
- A D O Our residents have a comfortable working knowledge of research evaluation and critical analysis of the literature.
- A D O Medical schools are not doing an acceptable job of teaching basic research methods skills to students.
- A D O Medical schools are not doing an acceptable job of teaching basic medical literature analysis skills.
- A D O Experience is a requisite for expertise.
- A D O Participating in research increases a resident's ability to evaluate medical literature, just as clerkship and residency increase the resident's ability to apply the medical knowledge that he/she learned in medical school.
- A D O The radiology residency is unique. Unlike other residencies, we must begin with the basics, therefore, we don't have enough time to add new content. The ACGME/RRC or AOA should exempt us from the research and scholarly activity requirements.
- A D O One goal of a successful scholarly environment is that all faculty become competent in the skills necessary for critical evaluation of the medical literature.
- A D O "Scholarly Activity" in academic medicine, in general, and residency education, in particular, is well defined.
- A D O For me (or my program), a universally-accepted definition of 'scholarly environment' would be helpful.

- A D O The purpose of a diagnostic radiology residency is to train competent clinicians. Adding scholarly activity requirements, detracts from that purpose.
- A D O The application of research methodology knowledge (i.e. actively participating in a research project) reinforces the concepts taught in the classroom and helps make the resident a more knowledgeable consumer of medical literature in the future.
- A D O A competent physician must be able to evaluate the strengths and weaknesses of studies published in medical journals.
-

E. Which description best describes your program (curriculum, outcomes) in meeting the research and scholarly activity standard?

- ___ needs improvement, but we're working on it
- ___ meets the letter of the standard, but not the spirit
- ___ good to competent
- ___ excellent, top 25% nationally
- ___ superior, top 10% nationally

Thank you !!!!!

Please feel free to explain any answers or to comment about your program, my study, or the scholarly activity standard.

Appendix F

Tables

Table 1. Response Rates by Program Characteristics

Characteristic	N	n	% returned
Accreditation body			
AOA	11	5	45.45
ACGME	192	90	46.88
Gender of Director ¹			
Female	44	20	45.45
Male	159	75	47.17
Program Size ²			
10 or fewer residents	26	6	23.10
11 – 30 residents	143	68	47.55
31 – 50 residents	20	10	50.00
51 or more residents	3	2	66.67
Geographical Region			
New England	21	5	23.80
Mid Atlantic	60	23	38.33
South East	20	7	35.00
Mid West	50	28	56.00
South Central	25	17	68.00
Rockies and West	27	15	55.60

¹ Gender estimated by first name of program director; directors having unisex names (4) were included in the male group.

² ACGME programs only; size groupings according to ACGME.

Table 4. Research Director Degree and Position Categorization

	M.D. / D.O.	Ph.D. only	M.D., Ph.D	M.D., Docorate ¹	M.D., M.P.H.	Total
In Medical Education department		1		1		2
Full time research director	5	2	3			10
Part time RD, Full time faculty	21	3	1		1	26
Unofficial research leader	10	1			1	12
Total	36	7	4	1	2	50

¹ examples of non-research doctorates were given, e.g. Sc.D, Ed.D.

Table 5. Administrative Affiliations of Radiology Residency Programs

	n	%
University administered: close teaching	46	47.9%
University administered: minimal teaching	7	7.3%
University affiliated	23	24.0%
Independent	17	17.7%
Military	3	3.1%

Table 6. Administrative Affiliation and Research Director categorization

	University close	University minimal	University affiliated	Indepen dent	Military	Total
Medical Education				2		2
Full time R Director	7	1	2			10
Part time R Director	15	4	4	2	1	26
Unofficial R Leader	4	1	4	2	1	12
None	20	1	12	11	1	45
Total	46	7	22	17	3	95

Table 7. Administrative Affiliation and Degree of Research Director.

Degree	University close	University minimal	University affiliated	Independent	Military	Total
M.D. or D.O. only	16	5	10	3	2	36
Ph.D. only	5	1		1		7
M.D./D.O. & Ph.D.	4					4
M.D./D.O. & doctorate				1		1
M.D./D.O. & M.P.H.	1			1		2
Total	26	6	10	6	2	50

Table 8. Relationship Between Grants and Research Director Position.

Research Director Position	Grants important to budget	Grants not important to budget	Total
In Medical Education	1	1	2
Full time Research director	6	3	9
Part time research director	8	17	25
Unofficial research leader	3	8	11
None	8	35	43
Total	26	64	90