Professional Doctorate Program in Medical Physics (DMP)

University of Cincinnati

Program Assessment

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I. Program Outcomes

Please include in this section your program learning outcomes as they are listed in the P-1 form in eCurriculum. If you are already planning to revise those program learning outcomes, indicate in this section which ones might be changed, and what the new program learning outcomes are likely to be. In general, learning outcomes should be measurable, assessable, or observable in some way and aligned with national standards.

To provide an overview of the Medical Physics graduate program, a brief review of the program history is provided here.

The graduate program in Medical Physics at the University of Cincinnati has a long history dating back to 1959. The current development of the Doctorate of Medical Physics (DMP) program is the logical next step to follow a long history of radiologic science academic programs. These programs started with a series of educational initiatives under the direction of Dr. James G. Kereiakes, Ph.D., in 1959. These earlier programs included the physics of radiology for resident physicians; MS, PhD, and post-doctoral programs for radiation physicists and health physicists; an MS program in radiologic administration; both AS and BS degree programs in nuclear medicine technology and an AS degree in radiation therapy

Up until February of 2013, the objective of the MS Graduate Educational Program in Medical Physics was to prepare individuals as entry-level medical physicists with a particular orientation towards radiation oncology physics, or to prepare them to enter a medical physics residency in a CAMPEP accredited program. In February of 2013, the State of Ohio Board of Regents granted the Medical Physics graduate program the authority to grant students the degree of Doctorate of Medical Physics (DMP). In May of 2013, all University of Cincinnati administrative issues were addressed to allow granting of the DMP degree. The intention of the DMP program is to matriculate students in the fall of 2014 with the goal of providing the students with all the educational and clinical prerequisites necessary for entry into the American Board of Radiology board certification process in Therapeutic Medical Physics.

The DMP program is divided into two parts: two years of didactic studies referred to as the Academic Biennium, followed by two years of clinical experience and studies referred to as the Clinical Biennium. The first two years of the program also constitute an MS degree in Medical Physics, which is still offered by the program.

The MS program is currently accredited by the Commission on Accreditation of Medical Physics Educational Programs (CAMPEP), and the program has recently applied for CAMPEP accreditation for the DMP program.

The structure of the Academic Biennium follows the CAMPEP guidelines set forth in the document *Standards for Accreditation of Graduate Educational Programs in Medical Physics*, and the structure of the Clinical Biennium follows the CAMPEP guidelines set forth in the document *Standards for Accreditation of Residency Educational Programs in Medical Physics*.

The (original) learning outcomes for the MS in medical physics, as listed in the program P-1, are:

1. Graduates should be able to provide the necessary oversight to the physical and technological aspects of a radiation oncology treatment center to maintain the highest standards of patient care.

2. Graduates must demonstrate preparation for initiation of the Boarding Process of the American Board of Radiology, Physics Examination.

3. Graduates should be prepared to enter a CAMPEP accredited residency in medical physics or continuation of their education in a doctoral program

4. Graduates should be prepared for the life-long learning necessary of the maintenance of certification as required by the American Board of Radiology and the appropriate regulatory agencies.

5. Graduates should be informed as to the ethical standards appropriated for a health care professional functioning in today's society.

The (original) learning outcomes for the DMP in medical physics, as listed in the program P-1, are:

In order for the program graduates to gain access to the American Board of Radiology certification process in Therapeutic Medical Physics, the program must demonstrate that graduates are capable of performing duties appropriate to an independently operating medical physicist. These duties include:

1. Acting as a consultant to the radiation oncologist with regard to physical issues associated with the treatment of a specific patient. The ability to act as such a consultant will be demonstrated by the completion of both a written and an oral examination.

2. Practicing medical physicists are also required to complete patient specific treatment plans to assist the treatment of patients. The ability to accomplish this task will be demonstrated by the creation of a portfolio of treatment plans as appropriate for the broad range of targets.

3. Additionally, a medical physicist should be able to ensure the proper operation of all radiation therapy treatment and imaging devices. Students will demonstrate this ability by both direct observation by the faculty, and amassing the results of various quality assurance inspections over the course of the program.

The revised program learning outcomes are listed below.

MS learning outcomes:

1. Graduates will have a fundamental understanding of the scientific basis of medical physics as outlined in the topics listed in the American Association of Physicists in Medicine (AAPM) report entitled *Academic Program Recommendations for Graduate Degrees in Medical Physics*. These topics include radiation biology, anatomy & physiology, radiation physics, imaging physics, instrumentation, quality assurance protocols, and radiation safety.

2. Graduates will have mastered basic laboratory techniques and the use of instrumentation in clinical medical physics. They should be knowledgeable of and competent in using radiation planning devices, radiation delivery equipment, radiation detectors and instrumentation, imaging devices, and they should be able to perform basic quality assurance (QA) techniques.

3. Graduates will be knowledgeable of state and federal radiation regulatory issues and the safe administration of radiation.

4. Graduates will have engaged in a radiation science research project to develop a systematic analytical approach to problem solving and to gain familiarity with the scientific method.

5. Graduates will have developed effective skills in written and oral communication of technical information.

6. Graduates will be exposed to professional aspects of medical physics such as career planning, the role of a medical physicist in a hospital, lifetime learning, board certification and maintenance of certification, and ethical issues in medical physics.

DMP learning outcomes – the above plus:

7. Graduates will be competent in all the topics listed in the American Association of Physicists in Medicine (AAPM) report entitled *Essentials and Guidelines for Clinical Medical Physics Residency Training Programs (in Radiation Oncology Physics)*. These topics include all aspects of patient treatments, treatment planning, treatment equipment, radiation detectors and instrumentation, imaging devices, acceptance testing and commissioning of equipment, quality assurance, and radiation safety.

8. Graduates will have completed a clinical research project to further develop their skills in scientific problem solving and the application of the scientific method to a clinically relevant problem.

9. Graduates will have been introduced to the literature of medical physics and will have developed skills in critically reviewing and presenting results from the literature.

10. Graduates will have performed the duties of a junior medical physicist for two years and will be ready to assume the duties and responsibilities of a clinical medical physicist.

11. Graduates will be prepared to complete the American Board of Radiology certification exam in Therapeutic Medical Physics.

II. Curriculum/Program Map

Please include in this section a grid that identifies connections that exist between required courses in this program and the corresponding program-level learning outcomes. In other words: how will program outcomes be met? This grid should further indicate the expected levels of learning at each level (whether emerging, strengthening, or achieved).

MS Program

Course/Learning Outcome	1. Graduates will have a fundamental understanding of the scientific basis of medical physics.	2. Graduates will have mastered basic laboratory techniques.	3. Graduates will have engaged in a radiation science research project.	4. Graduates will have developed effective skills in written and oral communication of technical information.	5. Graduates will be knowledgeable of state and federal radiation regulatory issues.	6. Graduates will be exposed to professional aspects of medical physics.
BE7022 Introduction to Biostatistics	E, S					
MP9001 Professional Aspects of Medical Physics						E, S, A
MP9005 Introduction to Clinical Oncology I	E, S					
MP9006 Introduction to Clinical Oncology II	E, S					

MP9013 Hospital Radiation Protection	E, S				E, S, A	
MP9015 Clinical Radiation Oncology	E, S					
MP9041 Radiobiology I	E, S					
MP9042 Radiobiology II	E, S					
MP9044 Radiation Physics and Dosimetry I	E, S					
MP9045 Radiation Physics and Dosimetry II	E, S					
MP9050 Diagnostic Radiological Imaging Physics I	E, S					
MP9051 Diagnostic Radiological Imaging Physics II	E, S					
MP9053 IT in Radiation Therapy	E, S					

MP9011 Clinical Radiation Dosimetry I	E, S					
MP9012 Clinical Radiation Dosimetry II	E, S					
MP9072 Radiological Sciences Lab I	E, S	E, S		E, S		
MP9073 Radiological Sciences Lab II	E, S	S, A		E, S		
MP9095 A&P for Radiotherapy Treatment Planning	E, S					
MP9096 Radiotherapy Treatment Planning I	E, S	E, S				
MP9097 Radiotherapy Treatment Planning II	E, S	S, A				
MP9091 Research in Radiological Sciences	E, S	S, A	E, S, A	E, S, A		
MP9092 Seminar: Current Research Topics in Rad Sciences	E, S			E, S, A		

Written Competency Exams	A				A	
Oral Competency Exams	A				A	

DMP Program

Course/Learning Outcome	7. Graduates will be competent in all the topics listed in the American Association of Physicists in Medicine (AAPM) report entitled *Essentials and Guidelines for Clinical Medical Physics Residency Training Programs in Radiation Oncology Physics*.	8. Graduates will have completed a clinical research project to further develop their skills in scientific problem solving and the application of the scientific method to a clinically relevant problem.	9. Graduates will have been introduced to the literature of medical physics and will have developed skills in critically reviewing and presenting results from the literature.	10. Graduates will have performed the duties of a junior medical physicist for two years and will be ready to assume the duties and responsibilities of a clinical medical physicist.	11. Graduates will be prepared to complete the American Board of Radiology certification exam in Therapeutic Medical Physics.
MP9061 Clinical Practicum – 3DCRT	S, A			S, A	S, A
MP9062 Clinical Practicum – IMRT	S, A			S, A	S, A

MP9063 Clinical Practicum – SRS and SBRT	S, A			S, A	S, A
MP9064 Clinical Practicum – Brachytherapy	S, A			S, A	S, A
MP9081 QA in Radiation Therapy – Treatment Planning Devices	S, A			S, A	S, A
MP9082 QA in Radiation Therapy – Treatment Delivery Devices	S, A			S, A	S, A
MP9083 QA in Radiation Therapy – Imaging Devices	S, A			S, A	S, A
MP9084 QA in Radiation Therapy – Patient Specific Dosimetry	S, A			S, A	S, A
MP9092 Seminar: Current Research Topics in Radiological Sciences			S, A		

MP9094 Journal Club			S, A		
MP9099 Clinical Research in Medical Physics		S, A	S, A		
Written Competency Exams	A			A	A
Oral Competency Exams	A			A	A

E = Emerging
S = Strengthening
A = Achieved

III. Methods and Measures

Please include in this section a description of the assessment methods that your program plans to use in assessing each of its program learning outcomes.

Learning Outcome	Assessment Tools	Course/Experience	Time Line	Responsible Person(s)
1. Graduates will have a fundamental understanding of the scientific basis of medical physics.	Competency Checklists Oral and Written Competency Exams	All	Competency Checklists each semester. Exams at end of years 2,3,and 4.	Program Director
2. Graduates will have mastered basic laboratory techniques.	Observation by Faculty	MP9072 MP9073	Years 1 and 2	Laboratory Instructors
3. Graduates will be knowledgeable of state and federal radiation regulatory issues.	Competency Checklists Oral and Written Competency Exams	MP9013	Competency Checklists each semester. Exams at end of years 2,3,and 4.	Program Director
4. Graduates will have engaged in a radiation science research project.	Written Report and Oral Presentation	MP9091	Year 2	Program Director/ Faculty
5. Graduates will have developed effective skills in written and oral communication.	Written Reports and Oral Presentations	MP9072 MP9073 MP9091 MP9092 MP9094 MP9099	Each Semester	Program Director/ Faculty

6. Graduates will be exposed to professional aspects of medical physics.	Classroom discussions	MP9001	Year 1	Program Director
7. Graduates will be competent in all the topics listed in the American Association of Physicists in Medicine (AAPM) report entitled *Essentials and Guidelines for Clinical Medical Physics Residency Training Programs in Radiation Oncology Physics*.	Competency Checklists Oral and Written Competency Exams; direct observations of clinical skills	MP9061 MP9062 MP9063 MP9064 MP9081 MP9082 MP9083 MP9084	Years 3 and 4	Program Director/ Faculty
8. Graduates will have completed a clinical research project to further develop their skills in scientific problem solving and the application of the scientific method to a clinically relevant problem.	Written Report and Oral Presentation	MP9099	Year 4	Program Director/ Faculty
9. Graduates will have been introduced to the literature of medical physics and will have developed skills in critically reviewing and presenting results from the literature.	Written Reports and Oral Presentations	MP9092 MP9094 MP9099	Each Semester	Program Director/ Faculty
10. Graduates will have performed the duties of a junior medical physicist for two years and will be ready to	Competency Checklists Oral and Written Competency Exams; direct observations of clinical skills	Clinical Rotations MP9061 MP9062 MP9063	Years 3 and 4	Program Director/ Faculty

assume the duties and responsibilities of a clinical medical physicist.		MP9064 MP9081 MP9082 MP9083 MP9084		
11. Graduates will be prepared to complete the American Board of Radiology certification exam in Therapeutic Medical Physics.	Competency Checklists Oral and Written Competency Exams	All	All Years	Program Director/ Faculty

IV. Assessment Infrastructure

Please include in this section a description of the process by which your program intends to assess its learning outcomes.

- *Describe which program faculty will be charged with overseeing the execution of the assessment plan as well as the ways in which they will carry out that charge, including a description of the planned timeline for assessment.*
- *Identify what kinds of administrative support will be available for those faculty*

Please note that assessment plans should be capable of producing reports annually based on their review of the relevant data from their programs. The work of your faculty might also be coordinated and aligned with similar assessment efforts at the college and institutional levels.

The Graduate Affairs Committee (GAC) of the Medical Physics program under the direction of the Program Director is responsible for the assessment of student performance. All members of the medical physics faculty are also members of the Graduate Affairs Committee. This includes the medical physics academic faculty of the Department of Radiation Oncology and the Department of Radiology as well as the medical physics adjunct faculty. A radiation oncologist physician is also on the GAC. Additionally, a student representative is invited to all GAC meetings. The graduate student representative is excused from the meeting whenever confidential student information is discussed. At the monthly meetings of the GAC, the general progress of individual students is discussed. A more detailed examination of student progress is reviewed during the end of semester GAC meeting.

Course-specific grades are the responsibility of each course instructor or individual course director. The Program Director and the Program Coordinator will review all individual course grades and share that information with the GAC. Any less than acceptable performance by any student will be discussed in detail with the GAC and suggestions to improve the student's performance will be entertained. This information will then be shared with the student, along with suggestions to improve the student's performance. Each course instructor is expected to counsel the student, if that student's performance in a course is not deemed to be satisfactory. At the end of each semester course, students are afforded the opportunity to evaluate the course, the course instructor, and the program in addition to their own performance in each course.

During the clinical participation courses, students are evaluated at the completion of each clinical rotation by the clinical instructor(s). This evaluation includes the student's professionalism, knowledge, and problem solving skills. All attributes necessary to succeed as a medical physicist. This information is shared with the student as well as suggestions for improvement, if appropriate.

While accomplishing the research components of the program requirements, the student's performance is evaluated as the research project proceeds. Early in the development of the research project, the student is required to present orally, a report of the literature related to the selected topic. Prior to the initiation of the project, the student is required to prepare a written proposal. The written proposal is then presented to the student research committee. The research committee is expected to interact with the student to evaluate both the project worth and the quality of the written document. The research committee is expected to interact with the student frequently. Upon completion of the project, the student will present both an oral report of the completed project and a written document. The student is also expected to submit a report of the research project to at least one of the following: a local scientific meeting of the American Association of Physicist in Medicine, Ohio Valley Annual Meeting: a national scientific meeting of the American Association of Physicist in Medicine or a peer reviewed scientific journal.

At the end of the second, third, and fourth years, all students are required to complete both a written comprehensive examination and an oral examination. These examinations are modeled after the American Board of Radiology Medical Physics professional boarding examination, both in content and format. The content of these examinations includes the material a medical physicist would be called upon to assist the physicians and therapists in the treatment of patients. Format for the written examination is approximately one hundred multiple choice questions written and graded by the program director. The oral examination is administered as a one-on-one interview by various members of the program faculty. The assessment of the student performance is then evaluated by the program faculty and the evaluation is then shared with the student.

Competency checklists are used throughout the program along with the students' own activities journals to ensure that the students are successfully learning all required materials. Students meet with the program director at least once each semester to review their progress through the competency checklists.

As the entire program student population is relatively small, generally less than twelve students, the Program Director is able to frequently interact with the students on a one-to-one basis. Student progress assessments are shared frequently on both a formal basis, as well as, a less formal format. Students are informed at the end of each semester as to the status of the progress being made by the student.

As the program is converting from a two year MS granted program to a four year DMP granted program, the assessment of student program will need significant modification. The general format of the assessment methodology is intended to be maintained, with greater emphasis on the development of the student's clinical skills, greater attention will be devoted to the clinical faculty both evaluating the student performance and the clinical faculty sharing the student's performance with the program director. The program director will need be involved with both documenting the student's performance as sharing the evaluation with the student.

With regard to future additional assessment tools, as our goals include preparing students for careers as medical physicist, we need to maintain contact with our students throughout their careers. Information as to the performance of our alumni, from the perspective of their

employers, would serve as a valuable assessment of our accomplishing our stated goal. Additionally, the information gained from the alumni experiences beyond completion of our program would be of significant value. Such information has been occasionally shared but the program should gather such information in a much more organized fashion. The program will initiate a system to collect alumni information.

V. Use of Findings

In this final section, you will describe how your program intends to make use of the program-level assessment *data it has gathered.*

- *How will this information be presented to and discussed among the faculty?*
- *How might this data or these discussions result in review and possible revision of course or program learning outcomes and pedagogical strategies?*

This document was distributed to the faculty of the graduate program and will be discussed, in detail, at a meeting of the Graduate Affairs Committee. After review, we intend to incorporate greater organization in the review process to both improve the assessment and documentation of the student's progress and to share that information with the student. With the goals of the program stated in the newly formulated clearer and more succinct fashion necessitated by the conversion of the MS to the DMP, new emphasis will be placed on ensuring the goals for the student performance. As the educational background of the new graduate is required to incorporate a greater professional maturity as necessitated by the granting of the four year DMP rather than the previous two year MS, greater emphasis need be incorporated to ensure the greater professional maturity. Not only is this appropriate for the granting of a doctoral degree but is also a requirement of the American Board of Radiology (Physics) boarding process. New courses, predominately clinical classes, will be instituted and additional methodology for assessing student process will need to be also incorporated.