UNLV

UNIVERSITY OF NEVADA, LAS VEGAS

Program Review Self-Study

Program Reviewed: Health Physics: Medical Physics Sub-plan

Degrees: M.S.

Program Chair or Director: Dr. Steen Madsen

Dean: Dr. Ronald Brown

Date of Report: 4/30/18

GENERAL INSTRUCTIONS

1. Please provide Faculty CVs as a single electronic file (PDF preferred) or on a thumb drive *for the external reviewers*.
2. **Please complete the program review self-study using this template**.
3. If this review is covering several degree levels, please be sure to address ***each level*** in your responses to the questions.
4. Contacts for questions:
   Chair of the Faculty Senate Program Review Committee found here:
   https://www.unlv.edu/facultysenate/committees/program-review
   - or the Chair of the Graduate College Program Review Committee found here:
     https://www.unlv.edu/graduatecollege/program-review-committee
   - Dr. Rainier Spencer, Vice Provost for Academic Programs: rainier.spencer@unlv.edu, 702-895-5833
   - Nora Carroll, Academic Programs Analyst, Eleonora.carroll@unlv.edu, 702-895-1888

I. Program Description

A. College/Department/Program

1. College or School: *School of Allied Health Sciences*
2. Unit: *Health Physics and Diagnostic Sciences* Web address: https://www.unlv.edu/hpds
3. Program(s) being reviewed: *Master of Science in Health Physics: Medical Physics Sub-plan*
   a. Degrees and their abbreviations: *M.S. Health Physics: Medical Physics Sub-plan*

B. Primary individual completing this worksheet

1. Name: *Steen Madsen*
2. Title: *Professor and Chair, Health Physics and Diagnostic Sciences*
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C. Other faculty involved in writing this report:

All program faculty (Francis Cucinotta, Yu Kuang and Carson Riland) provided input.

D. Please insert the most recent catalog description(s) of the program(s). Due to display complications, this description must be typed into this form and **not** pasted from the Catalog.

The Master of Science (M.S.) – Heath Physics is designed to prepare students in the field of health physics to administer public and private radiation health programs; investigate medical uses of radioactivity; measure and control radiation in the workplace and the environment; ensure compliance with radiation protection regulations; assist in the cleanup of radioactive and hazardous waste sites; evaluate worker, patient and public radiation doses; and conduct research in radiation protection.

1. Is the description correct? If not, what needs to be changed?

   The description is incorrect as its primary emphasis is on the environmental health physics field. The description requires modification to include more aspects of the medical physics field.

II. Centrality to Mission

A. Department/Program Mission

What is the program's mission statement (or the department's if the program does not have one)?

The goal of the Master of Science in Health Physics Program is to provide a high-quality graduate education experience for students in the fields of medical and health physics. The educational experience is accomplished through rigorous classroom instruction, aided by computer and multi-media instruction, practical laboratory courses, clinical experiences, and student research and mentoring. The products of this experience are professionals capable of critical thinking and problem solving, devoted to a lifetime of learning, committed to providing the highest quality of medical services for patients, and highly sought after by employers.

B. Department/Program Mission Alignment

Briefly describe how this program is aligned to the mission of the University as described in the most recent mission statement, UNLV Mission https://www.unlv.edu/toptier/vision, and how it supports achievement of the institution's mission:

The program is aligned with the University's mission in the key areas of education, research, clinical services and health promotion. The program provides a high quality didactic education in radiation science and medical physics through numerous course offering taught by faculty who are experts in the field. Clinical education and research is offered through partnerships with local radiation oncology facilities and medical industries providing access to state-of-the art equipment as well as the medical and technical expertise to conduct cutting edge research in the field of radiation therapy.

C. Core Themes

Briefly describe how this program supports UNLV's Core Themes (the core themes can be found at https://www.unlv.edu/provost/nwccu/core-themes:

UNLV's Top Tier Mission is to promote community well-being and individual achievement through education, research, scholarship, creative activities, and clinical services. This is very much in line with the program's mission which is to produce competent medical physicists with sufficient knowledge and clinical experience to enter residency programs with the end goal of becoming certified medical physicists. The program provides a path to gainful employment in clinical medical physics and, as such, advances student achievement (Core Theme #1). All students in the program are required to conduct thesis research (Core Theme #2: Promote Research, Scholarship, Creative Activity). Basic research is conducted at UNLV while clinical research and clinical internships/practicums are performed at local radiation therapy technology companies and/or radiation therapy clinics (Core Theme #4: Foster Community Partnerships). The program provides extensive education in the core imaging modalities and, as such, students and faculty could provide imaging support for an Academic Health Center (Core Theme #4).

D. Excellence

List and briefly describe five highlights or areas of excellence of the program:

1. High quality didactic education in the fundamentals of radiation science and medical physics. Courses are taught by faculty with vast experience in all fields covered within the program.

2. Excellent clinical education provided through practicums at local radiation oncology facilities (Comprehensive Cancer Centers of Nevada: CCCN).

3. High quality clinical research via access to state-of-the art equipment at local radiation oncology facilities (CCCN) and medical equipment manufacturers (Varian Medical Systems).
4. High rate of placement of graduates in the medical physics field. In the past five years, all graduates are either practicing medical physicists or pursuing doctorate degrees (Ph.D. or DMP) in the medical physics field.
5. High pass rate of students taking their medical physics certification exams (100% passed the American Board of Radiology Part 1).

III. External Demand for Program

A. Stakeholders

1. Who are the main local and regional stakeholders of your educational programs, i.e., employers and entities benefiting from these programs, hiring the graduates, or admitting them to graduate and/or professional programs?

The primary stakeholders are educational institutions (universities and academic medical centers) offering medical physics residency training. This includes UNLV's Doctor of Medical Physics (DMP) program. Following graduation from residency programs, the primary stakeholder is radiation oncology clinics. Secondary stakeholders are companies manufacturing equipment and/or providing services for the radiation oncology field (e.g. Varian Medical Systems).

2. What are specific stakeholder needs for graduates?

To be eligible for a residency position, students must have graduated with an advanced degree (M.S. or Ph.D) from an accredited medical physics program such as the one offered at UNLV. The requirements are less stringent for employment in the medical physics industry, however, students are required to have mastery of both the fundamental and clinical principles of medical physics.

B. Needs for Graduates and Future Plans

1. What are the anticipated needs for program graduates over the next 3-5 years? Please cite sources of information.

Nevada's Department of Employment, Training and Rehabilitation does not keep statistics for medical physics or closely related professions. Medical physics is also not listed in the Federal Government's Outlook Handbook. The U.S. Bureau of Labor Statistics states that it does not collect employment data for medical physicists and suggests consulting the professional organization, i.e. the American Association of Physicists in Medicine (AAPM). According to a recent AAPM Newsletter (http://www.aapm.org/pubs/newsletter/default.asp#nlarchive), in order to meet current demand, approximately 150-180 new medical physicists are needed per year in the U.S. This demand is not being met by current medical physics programs. Due to the aging population (higher cancer rates) and the aging workforce (increased number of medical physicists leaving the field), there is a healthy job market for medical physics graduates, especially in the Mountain West region which is growing at a faster rate than most other regions in the U.S and which has large rural areas served by community hospitals which have traditionally found it difficult to recruit qualified medical physicists to their radiation oncology clinics.

2. What changes to the program will those require?

The department has addressed the demand for medical physics graduates by establishing a Doctor of Medical Physics (DMP) degree which provides a direct pathway to board certification. The masters program serves, in part, as a feeder program for admission of exceptional graduates to the DMP program. Growth of both medical physics programs is a long-term goal, however, this will be difficult to accomplish without additional clinical sites which has proved challenging, especially in the Las Vegas Valley.

C. Success of Graduates

1. What steps does the department take to facilitate the success of graduates (e.g., internships, career fairs, employment talks, etc.)?

   Limited clinical access for students is a significant challenge for many medical physics programs. We have addressed this problem by partnering with a local radiation oncology facility (CCCN) and Varian Medical Systems. Through practicums (HPS 742L), students have access to CCCN where they are exposed to all clinical duties performed by a medical physicist. Clinical-based thesis projects are also possible at CCCN. Through an agreement with UNLV, Varian provides students with the opportunity to take training courses in subjects relevant to their educational background. These courses are free of charge and students receive credit through HPS 790. A number of students have also performed their thesis research at Varian under the direct mentorship of Varian scientists. The comprehensive clinical education offered to students in the program makes them extremely competitive for admission to residency programs, or medical physics Ph.D. programs. Students receive employment advice from department faculty as well as from guest lecturers in the graduate seminar course (HPS 611).

2. Discuss the placements of recent graduates:

   Over the past five years (2013-18), 8 students have graduated from the program An additional 3 students will graduate in May 2018. Of those 11 students, 4 are practicing medical physicists in radiation therapy clinics (Reno, Milwaukee, Washington, DC, Napa Valley); 2 are pursuing PhDs at UNLV (Physics and Interdisciplinary Health Sciences); two are students in UNLV's DMP program; one has been accepted to the DMP program; one is completing a medical physics dosimetry degree at Univ. of Texas Health Sciences Center, San Antonio and one of the May 18 graduates is currently seeking admission to medical physics PhD programs.

3. If the department or program does not have placement information on graduates, what is the plan to implement gathering that information?

   Not applicable. We are mandated by our accreditation agency to obtain placement information for former students.

3. Do placements match stakeholder needs as identified above in A of this section?

   As evidenced from the high placement success, stakeholder needs are met. The stakeholders (educational institutions and radiation oncology clinics) require graduates of accredited medical physics educational programs who are well versed in the theory and clinical practice of medical physics.

4. If not, please explain.

   Not applicable.

5. Does the program assess whether the graduates are meeting employer's needs?

The program assesses whether graduates are meeting employer needs through employer surveys and from guidance provided by the department's Medical Physics Steering Committee composed of faculty and practicing medical physicists.

6. If not, what will the program do to place this NSHE-required assessment in place and by what date?

   Not applicable.

7. Additional Comments

   No additional comments.

IV. Program Resources

A. Faculty Time

1. Faculty and GA Resources

	Fall 2015	Spring 2016	Fall 2016	Spring 2017
Number of Full Time Faculty	4	5	3	3
Number of State-Supported GA lines	4	3	3	3
Number of PTIs	0	1	0	1
Number of FIRS & Visiting	0	0	1	1

	Fall 2015	Spring 2016	Fall 2016	Spring 2017
Percent of Classes Taught by Full Time Faculty	100	90	88	50
Percent of Classes Taught by Number of State-Supported GA lines	0	0	0	0
Percent of Classes Taught by Number of PTIs	0	10	0	20
Percent of Classes Taught by Number of FIRS & Visiting	0	0	12	30

	Fall 2015	Spring 2016	Fall 2016	Spring 2017
Student Credit Hours Taught by Full Time Faculty	22	22	16	11
Student Credit Hours Taught by Number of State-Supported GA lines	0	0	0	0
Student Credit Hours Taught by Number of PTIs	0	3	0	6
Student Credit Hours Taught by Number of FIRS & Visiting	0	0	3	9

2. For other non-major courses – e.g., upper division for the college or university, estimate the unit's resources allocated to them:

   During the time period in question, the department did not offer non-major courses.

B. Budget

1. Please fill in the table with three years of financial expenditures to be used to respond to questions 2 and 3 below.

Budget category	FY 14–15	FY 15–16	FY 16–17
State Operating (2101)	$ 44241	$ 42222	$ 42222
Student Fees	$ 0	$ 0	$ 0
Indirect Cost Recovery	$ 1613	$ 815	$ 3636
Self-supporting	$ 0	$ 0	$ 0
Total Allocations	$	$	$
Number of Graduate Assistantships (including GAs on grants)	4	4	3

2. Are these resources sufficient to meet the degree program's instructional and scholarship needs?

   Yes, the resources are sufficient to meet the needs of the program.

3. If not, approximately what line items and amounts would be needed?

   Not applicable.

C. General Education

1. If your program or unit offers General Education courses, please estimate what proportion of the unit's resources are allocated to this area:

   The program does not offer General Education courses.

2. Does the combined load from A and B above affect your unit's ability to offer courses for its major? If so, please describe:

   Due to faculty attrition, the department is currently short-staffed. Two faculty responsible for teaching core courses in the program resigned in 2016. The department is currently relying on part-time instructors and one full-time visiting professor to ensure that all core courses are offered to students in the program. The department currently has two faculty searches in progress with the goal of filling both vacancies by spring 2019.

D. Other Funding and Resources

1. Is funding from other sources sufficient to assist the program in achieving its outcomes? Other sources to be considered include: differential tuition, grants and contracts, endowment income, and one-time gifts for student scholarships, other one-time gifts.

   Funding from other sources is sufficient.

2. If not, which funding streams could most reasonably be increased to help the program attain its outcomes?

   The department has four productive research faculty who have obtained extramural funding to support their research programs. A further increase in grants and contracts is expected with the hiring of two additional research focused faculty. It is expected that part of this funding will be used for additional research assistantships to support graduate students in the department's programs. This will not only grow the department's graduate programs, but will also likely attract higher quality students.

3. Has any new donor revenue been generated since the last program review?

   Although no new donor revenue has been generated, the department has partnered with Varian Medical Systems, the world's largest manufacturer of linear accelerators for the treatment of cancer patients. Students have had unfettered access to Varian's educational training center in Las Vegas. A number of students have completed thesis projects using state-of-the art equipment and they routinely attend (free of charge) training sessions attended by experienced medical physicists from clinics throughout the U.S. who are typically charged thousands of dollars per session.

4. Has the unit engaged in fundraising activities to support the program over the last 5 years?

   The unit has not engaged in traditional fundraising activities in the past 5 years.

5. What has been the result of these fundraising activities?

   Not applicable.

6. Review the space data for your department and comment on its amount and quality. These data will need to be accessed by an individual with Archibus® access.

   The high quality of the department's laboratory space is a significant strength. Specifically, the teaching lab (BHS-117) taken by the students in the program has all the instrumentation necessary for a solid grounding in the fundamentals of radiation detection (HPS 603). There is adequate office space to accommodate current faculty. Additional office space will be required to support two new faculty hires. There is insufficient space for graduate students. A small office currently supports four graduate students, but space is needed for an additional 4-5 students.

7. Is the quality and quantity of available consumable materials and supplies (e.g., office supplies or lab supplies) adequate and if not, explain why not:

   The quality and quantity of available consumable materials and supplies are adequate.

8. Is the quality and quantity of available technology resources, such as computers adequate and if not, explain why not:

   The quality and quantity of available technology resources are adequate.

9. Is the quality and quantity of available equipment (other than computing) adequate and if not, explain why not:

   The quality and quantity of available equipment are adequate. In addition to the radiation detection equipment in BHS-117, students have access to clinical detectors at CCCN (HPS 742L) and Varian Medical Systems (HPS 790 and 797).

10. Is the quality and quantity of available library and information resources adequate and if not, explain why not:

    We are very pleased with the quality and quantity of library resources.

11. Staffing
    a. Are available department staff resources sufficient to attain the program's outcomes?

Department staff resources are sufficient.

b. If not, what additional staff resources are needed and how would they be funded?

Not applicable.

12. Additional Comments

No additional comments.

V. Size of Program

1. Below are headcount, course enrollment, and degrees conferred data from Decision Support.

Academic Level Key	
Undergraduate (UGRD):	Graduate (GRAD):
10 – Freshman	GR - Graduate
20 – Sophomore	PHD – PhD
30 – Junior	
40 – Senior	
50 – Post Bacc Undergrad	

Headcount

School of Allied Health Sciences

Fall 2012 Prelim	Spring 2013 Prelim	Fall 2013 Prelim	Spring 2014 Prelim	Fall 2014 Prelim	Spring 2015 Prelim	Fall 2015 Prelim	Spring 2016 Prelim	Fall 2016 Prelim	Spring 2017 Prelim
8 (6)	11 (8)	11 (9)	9 (7)	15 (8)	12 (7)	11 (7)	11 (7)	7 (7)	7 (7)
0	0	0	0	0	1	0	0	0	0

Source: UNLV Analytics - Official Preliminary Enrollment
Office of Decision Support, January 2018

Note: data provided by UNLV Analytics are for total MS students. Values in parentheses are for MS students in the Medical Physics Sub-plan.

Course Enrollments

Department Name of Course	Sub	Course Number Level	Spring 2014 Prelim	Fall 2014 Prelim	Spring 2015 Prelim	Fall 2015 Prelim	Spring 2016 Prelim	Fall 2016 Prelim	Spring 2017 Prelim
Health Phy and Diagnostic Sci	HPS	600-Level	14	15	32	17	19	12	23
		700-Level	22	27	22	48	27	24	21

Note: Includes lecture courses only.

Source: UNLV Analytics - Official Preliminary Enrollment

Office of Decision Support, January 2018

Degrees Conferred

Department	Health Phy and Diagnostic Sci
Academic Career	GRAD
Academic Plan Description	Health Physics MS (HPPMS)
Degree	MS
Degree Description	Master of Science

Academic Year - July to June	Degree Count
2005-06	1 (1)
2006-07	4 (2)
2007-08	4 (3)
2008-09	5 (2)
2009-10	2 (2)
2010-11	3 (0)
2011-12	3 (3)
2012-13	2 (2)
2013-14	2 (0)
2014-15	3 (3)
2015-16	3 (2)
2016-17	4 (1)

Source: UNLV Analytics - Degrees Conferred
Office of Decision Support, December 2017

Note: data provided by UNLV Analytics are for total MS graduates. Values in parentheses are for MS graduates in the Medical Physics Sub-plan.

2. Discuss the headcounts from the last five years, i.e., are the trends in line with projections in your unit's strategic plan?

   Headcounts for the MS Medical Physics Sub-plan have remained constant over the past five years. Given the current faculty size and make-up, and the recent establishment of two new graduate programs (Doctor of Medical Physics and Ph.D. Interdisciplinary Health Sciences), headcount is expected to decrease slightly as the emphasis will be to grow enrollment in the DMP and Ph.D. programs. Overall, course enrollments are expected to increase since the DMP and MS Medical Physics curricula are identical in the first two years of the DMP program. Highly qualified graduates from the MS program will be recruited into the DMP program.

3. If not, why not?

   See #2.

4. Does your program's enrollment trend differ from national trends?

The enrollment trend of our program closely mirrors that of other accredited MS programs and, compared to these programs, our program is of average size. This is quite impressive since our program is one of only a few not affiliated with an academic medical center.

5. If yes, please discuss the reasons:

   Not applicable.

6. Additional Comments
   No additional comments.

VI. Retention, Progression, Completion

A. Major Course Offerings

1. Are enough courses offered to meet enrollment demands?

   The course offering is sufficient to meet enrollment demands.

2. How many major courses have been added or eliminated in the last 5 years?
   __3__ Added __1__ Eliminated

3. Why were the actions taken?

   Courses were added to be in compliance with accreditation requirements/recommendations. Specifically, courses were added to emphasize medical physics ethics (HPS 792), cross sectional anatomy (HPS 676) and clinical physics (HPS 790). A lab course in diagnostic imaging (HPS 740L) was eliminated in order to avoid credit overload. This has had minimal effect on our program as the current emphasis is on radiation therapy physics rather than diagnostic imaging physics.

4. After reviewing the program, what additional actions should be taken to improve retention, progression, and completion?

   In the past five years (2013-17), five students have left the MS Medical Physics program. Three students left due to personal issues (all were in good standing) and two were separated due to poor grades. The two separated students, were admitted with marginal physics and math grades. To increase the probability of successful completion, the admissions committee has been admitting only students with decent math and physics grades. Due to the rigorous curriculum, students have had difficulties completing their thesis project in a timely manner, i.e., within two years of matriculation. To address this issue, faculty will make a concerted effort to design thesis projects that can be completed within the desired two-year time period.

5. Are there any courses that students routinely have difficulty getting enrolled in, that slow progression and/or graduation? If so, please identify them:

   This is not a concern for students in the program.

6. If last question was answered yes, what steps can be taken to reduce “bottle-necks” in these courses. Please indicate *both* financially-based and non-financially-based solutions.

   Not applicable.

7. Can any changes in sequencing of courses be made to facilitate graduations?

   Not applicable.

B. Curriculum

1. Is the program's curriculum aligned with current developments in the field?

   The program is accredited by CAMPEP and, as such, an annual curriculum review is mandated to ensure that it is current with developments in the field. The review is conducted by the department's Medical Physics Steering Committee which is composed of faculty teaching core courses in the program as well as practicing medical physicists from the Las Vegas area. As a result of these reviews, courses are constantly being modified to reflect the rapidly moving field of radiation oncology.

2. If not, what needs to be done to make it current?

   Not applicable.

C. Graduation Rates

Program graduation numbers and rates are summarized below.

New Masters Students Graduating in Less than Six Years (Health Physics MS - HPPMS)

Fall 2007 - Fall 2015 Cohort

Cohort		Graduated in...							
Term	Number	2 Years	%	3 Years	%	4 Years	%	5 Years	%
Fall 2007	4	1	25.0%	2	50.0%	2	50.0%	2	50.0%
Fall 2008	5	2	40.0%	3	60.0%	5	100.0%	5	100.0%
Fall 2009	3	0	0.0%	1	33.3%	1	33.3%	1	33.3%
Fall 2010	6	1	16.7%	2	33.3%	2	33.3%	2	33.3%
Fall 2011	3	2	66.7%	2	66.7%	2	66.7%	2	66.7%
Fall 2012	4	1	25.0%	2	50.0%	3	75.0%	3	75.0%
Fall 2013	3	0	0.0%	1	33.3%	2	66.7%	*15 / 25*	*60.0%*
Fall 201	7	2	28.6%	2	28.6%	*17 / 28*	*60.7%*		
Fall 2015	1	0	0.0%	*15 / 35*	*42.9%*				
Combined Cohort		*9 / 36*	*25.0%*						

Note: Shows new masters students who graduated in Health Physics.

Source: UNLV Analytics - RPC Benchmarks Dashboard; StudentTracking

Office of Decision Support, January 2018

Using the data in the tables above, please answer these questions:

1. Are trends in 6-year cohort graduation close to the University's goals (UNLV's undergrad goal is 50%)?

The table above is somewhat confusing as it includes data for students in both the Environmental Health Physics and Medical Physics programs. I have created a separate table with data limited only to MS students in the Medical Physics Sub-plan.

Months in program: MS Health Physics: Medical Physics Sub-option

Student #	Matriculation Date	Graduation Date	Months in Program
1*	August 2008	December 2011	41
2	August 2008	June 2010	23
3	August 2008	May 2010	22
4*	August 2008	December 2011	41
5	August 2010	May 2013	34
6	August 2011	May 2013	22
7	August 2012	March 2015	32
8	August 2012	August 2014	25
9	August 2012	January 2015	30
10	August 2013	May 2016	34
11	August 2014	In progress	45+
12	August 2014	February 2018	43
13	August 2014	May 2016	22
14	August 2014	In progress	45+
15	August 2015	May 2016	22

* denotes part-time student

Based on the data presented in the table, full-time students spend an average of 31 months in the program. 50% of full-time students graduate within the desired 2-year time period.

2. If not, what is being done to reach the goal?

   The goal is to graduate students within 24 months from matriculation. To accomplish this, faculty are scrutinizing applicants more closely to ensure that they have the appropriate math and physics background to successfully complete the curriculum. The vast majority of students who fail to graduate within the 24-month time window, do so because they have to repeat courses which results in significant delays in their thesis work. These students devote most of their efforts to coursework at the expense of their thesis research.

3. Discuss how and why the graduation rate is changing.

   Significant changes in the graduation rate have not been noted in the past 10 years. There are some statistical fluctuations which can be attributed to faculty turnover: during times when the department is short staffed, fewer students are accepted to the program.

4. Additional Comments

   No additional comments.

VII. Relationship to Other Programs

1. What relationship does your program have to other programs (such as transfers, collaborations, partnerships) in the NSHE system?

There are no formal relationships with other programs in the NSHE system.

2. What the relationship does this program have to other programs at UNLV (e.g., collaborations, partnerships, affiliated faculty, General Education requirements, etc.)?

   Some of the core courses (HPS 602, 603, 701 and 703) offered in the program are often taken to satisfy elective requirements by students in nuclear science programs in other Colleges including Engineering (Nuclear Engineering) and Sciences (Radiochemistry).

3. Additional Comments

   No additional comments.

VIII. Impact

1. What impact has this program had or will have in the following areas:

   a. University

   The program produces highly skilled health care professionals in a high-demand field (radiation oncology physics). In support of the University's Top Tier Mission, students conduct basic and clinical research under the supervision of renowned scientists resulting in publications and presentations at national and international conferences. Thesis data is used by faculty in support of extramural grant applications. A close integration is envisioned with UNLV's Medical School. Specifically, access to a radiation oncology clinic at the Medical School will provide students with clinical experience as well as facilitate program growth. Such a clinic will also stimulate collaborative research between department faculty and research oriented clinicians at the Medical School. This is significant since there have been relatively few clinical research projects at UNLV. The program could also have a significant impact on UNLV's proposed Academic Health Center, especially in support of diagnostic imaging initiatives since there is substantial imaging expertise in the department.

   b. Community

   The program addresses a shortage of medical physicists in Las Vegas and Reno. Due to a number of reasons, it's often difficult to attract medical physicists to Nevada. UNLV is the only institution in the State offering medical physics. Five graduates of the program are currently employed in the medical physics field in the Las Vegas Valley. The program has also impacted the local community in other ways, for example, by providing students for clinical development/research projects at medical physics vendors such as Varian Medical Systems.

   c. Field

   The program addresses a nationwide shortage of medical physicists. This is primarily due to an aging of the medical physics workforce: approximately 50% of current medical physicists are over the age of 50 and many will be retiring in the coming decade. Additionally, there has been an increased demand for medical physicists due to the development of new radiation sources and technologies. The shortage is especially acute in the Mountain West region which is growing at a faster rate than most other regions in the nation.

2. What are the benefits to the institution of offering this program?

   The program supports the University's Top Tier Mission by enhancing research and strengthening ties with the local community through partnerships with industry and radiation oncology clinics. The program also has the potential to foster collaborations between department faculty and faculty at UNLV's Medical School. The program could also benefit UNLV's Academic Health Center, especially in the field of diagnostic medical imaging.

3. Are there examples of the integration of teaching, research, & service that you would like to highlight (e.g., faculty mentoring leading to student presentations at conferences, service learning classes, community service activities involving students, or other student activities and/or achievements that you think are noteworthy)?

   Strong mentorship is provided by program faculty. This is evidenced from student presentations and publications. In the past five years (2013-2017) students have been contributing authors on 8 peer-reviewed publications.

4. Additional Comments

   No additional comments.

IX. Productivity

1. Please provide an indication of faculty productivity appropriate for your unit (lists of publications by type, grants by type, performances by type, installations by type, etc.):

   The three research faculty supporting the program (Cucinotta, Kuang and Madsen) have been very productive. The number of publications, grant funding and presentations during the past five years (2013-17) are summarized below. For additional details, please consult attached CVs.

   Number of peer-reviewed publications: 78
   Number of presentations (national/international): 68
   Extramural funding: $2.2 million
   Intramural funding: $60k

2. Additional Comments

   No additional comments.

X. Quality

A. Admission and graduation requirements

1. Please insert program admission requirements from the current UNLV catalog. Due to display complications, this description must be typed into this form and **not** pasted from the Catalog.

Students seeking admission to the graduate program in health physics must fulfill the following admission requirements:

1. Overall GPA of 3.00 (A=4.00 or equivalent) in undergraduate work. Applicants with a GPA below 3.00, but not less than 2.75, may be admitted as a graduate provisional student.

2. Successful completion (grade of C or better) of the following course work:
   a. Seven-semester credits in biology including an introductory modern biology course and one higher level course.
   b. Ten-semester credits in chemistry or geology including a general chemistry sequence and one higher-level course.
   c. Eight-semester credits in elementary calculus (mathematics through differential equations is recommended).
   d. Twelve semester credits in physics including a general physics sequence.
   e. A course in computer programming (an additional course in numerical methods or scientific computing is recommended). Applicants not meeting a limited number (maximum of nine credit hours) of prerequisite requirements may still be admitted to the program. However, prerequisite deficiencies must be completed during the first year of study and prior to registering for Thesis or Professional Paper.
3. Completion of a baccalaureate degree in health physics, one of the basic sciences, or in a closely related scientific or engineering field. Applicants holding a degree in a non-related field may be given special consideration if they have completed all prerequisite course work.
4. Student seeking entry to the medical physics specialization must have a strong foundation in physics and, as such, applicants are required to have either an undergraduate degree in physics or a degree in a related engineering or physical science discipline with course work equivalent to a minor in physics (includes at least three upper level undergraduate physics courses).
5. A score ranking in the 50th percentile or higher on the verbal and quantitative sections of the Graduate Record Exam (GRE). Tests taken prior to August 2011 require a composite score of 1,000 or higher on the verbal and quantitative sections of the Graduate Record Exam (GRE).
6. Six letters of recommendation from former instructors or employers that speak to the applicant's potential as a graduate student. Contact information for recommendation providers should be entered into the recommendation page of the online application. Recommenders will then upload their letters directly into the student's online application.
7. A statement of approximately 300 words indicating the student's professional goals and reason for seeking graduate education.
8. All domestic and international applicants must review and follow the **Graduate College Admission and Registration Requirements**.

2. Are there any updates that need to be made to the catalog and if so, what are they?

No revisions to the catalog are required.

3. How many full-time advisors are available at the college level?

Although students are advised primarily by the program director (Steen Madsen) and Yu Kuang, all program faculty participate in the advising process.

B. Outcomes and Assessment

1. Student Learning Outcomes and Program Assessment Plans and Reports by program concentration are listed at http://provost.unlv.edu/Assessment/plans.html. Please attach the most recent assessment report as Appendix 3.

2. Describe specific program changes made based on the program's evaluation of its assessment reports:

The lack of clinical experience opportunities was discussed in previous assessment reports. This issue has been addressed with the addition of clinical rotations (HPS 742L) at a local radiation oncology center (Comprehensive Cancer Centers of Nevada) taught by the chief clinical physicist, Dr. Ali Meigooni. Additional clinical training and research is provided by adjunct faculty employed at Varian Medical Systems (Matt Schmidt and Ben Smith). The UNLV-Varian partnership has provided students with access to training sessions covering a wide variety of clinically-related medical physics topics via HPS 790.

The lack of basic math and physics skills of incoming students has been addressed by limiting admission to students with at least a minor in physics. At present, the majority of incoming students are physics majors.

The time to degree completion (2.5 to 3 years) has been identified as a concern in assessment reports. Ideally, students should graduate within 2 years of matriculation. To address this issue, program requirements have been changed to require students to select their thesis advisor within their first semester in the program. Additional steps implemented to hasten graduation include access to summer GAs, research support from faculty (via RAs) and better-defined thesis projects tailored to a two-year time period.

3. Has the program revised its curriculum such as changing prerequisites, adding or eliminating required or elective courses, or co-curricular experiences for the degree(s) in the last 5 years?

    a. If yes, what changes were made and why?

    A number of curriculum changes have been made in the past five years. These include the addition of: HPS 676 (Sectional Anatomy), HPS 790 (Radiation Oncology Physics Clinical Internship) and HPS 792 (Ethics for Medical Physicists). HPS 676 teaches students to recognize normal anatomy and pathology in commonly used imaging modalities (CT, MRI, Ultrasound and Nuclear Medicine). Since the majority of students in the program are physicists, they have had little, to no exposure to anatomical visualization via the major imaging modalities which is an important component of the daily activities of a clinical medical physicist. HPS 790 was introduced to enhance the students' clinical knowledge. The course is taught by medical physics experts at Varian Medical Systems and it provides students with access to seminars on clinical physics topics especially those dealing with new technologic innovations and procedures. Medical physics ethics is an accreditation requirement and has traditionally been taught in a number of different courses. Due to its recent emphasis by the accrediting agency, a one-credit ethics course (HPS 792) was added to the curriculum.

    HPS 740L (Diagnostic Medical Physics Clinical Rotation and Laboratory) was dropped as a requirement. The MS Medical Physics Sub-plan is accredited as a therapeutic medical physics program and, as such, HPS 740L is not required by the accrediting agency. There is a separate accreditation for diagnostic imaging physics programs. With the addition of more relevant courses (see previous paragraph), a decision was made to drop the imaging lab course to avoid credit overload.

4. Has the program revised course content or instructional approaches (pedagogy, technology) in the last 5 years?

    a. If yes, what changes were made and why?

    A greater emphasis has been placed on solving "real world" problems in all core courses taken by students in both Medical Physics and Environmental Health Physics Sub-plans. The ability to solve clinical problems is vital for medical physics students and, as such, there has been a greater emphasis on clinical problem solving in HPS 742 and 742L. Revisions have been made to HPS 740 and 742 reflecting the introduction of new clinical technologies and treatment approaches including the integration of imaging techniques into radiation therapy. Modifications to HPS 730

(Advanced Radiation Biology) reflect the integration of new therapeutic combination modalities, e.g. radiation therapy and immunotherapy. In summary, core courses are constantly being revised in order to stay current with the rapidly evolving field of radiation oncology.

5. Describe any other changes made in the last 5 years (for example, advising) based on assessment reports:

   To facilitate timely graduation, students are advised to start working on thesis projects as soon as possible, i.e., within their first semester in the program.

6. List and describe two specific improvements in student learning outcomes and why they represent forward movement.

   Improvements have been noted in two student learning outcomes:

   1. To provide students with the clinical experience required for a complete understanding of the wide ranging clinical duties of therapeutic and diagnostic medical physicists.

   2. To provide students with research experiences in medical physics-related projects.

   Through affiliation agreements with CCCN and Varian Medical Systems, students have access to modern radiation therapy centers and equipment manufacturers that provide them with hands-on clinical experiences and access to state-of-the-art radiation therapy equipment which is invaluable for clinical research projects. Students are mentored by experienced clinical medical physicists who have adjunct appointments at UNLV. These improvements represent forward movement as they have produced graduates with significant clinical experience that make them more competitive for admission into clinical residency programs which is a requirement for medical physics certification. Therefore these improvements significantly enhance the students' chances of achieving their career goal of becoming practicing clinical medical physicists.

7. Additional Comments

   Since the program is accredited, student outcomes are evaluated on a regular basis. The accrediting body has a keen interest in both student education and their advancement in the medical physics field. To that end, the agency establishes stringent guidelines with regards to curriculum content thus providing the rationale for the core courses in the program, their contents and frequent revisions reflecting the changing field of medical physics.

XI. Conclusions, Self-Assessment

A. Faculty Review of self-study

1. On what date did the program and/or department faculty review this self-study?

   The self-study was sent to program faculty for review on 4/18/18

2. What were the results of the faculty review?

   Only minor stylistic changes were suggested by program faculty.

3. What are the top 3 priorities and/or needs for the future development of the program?

   The addition of clinical sites is the number one priority of the program. Additional sites will stimulate program growth and add variety to the clinical experience. Presently, the program has only one affiliated site in the Las Vegas Valley. The development of a radiation oncology clinic at UNLV's Medical School, would certainly address the shortage of clinical sites, however, the establishment of such a center is unlikely in the immediate future. The department's DMP program currently has three clinical affiliates, but none are local (St. George, Provo and Reno) which makes clinical education at those sites logistically challenging for our masters students.

   A second priority is to attract board-certified medical physics faculty to the program. The department currently has two faculty vacancies, one of which is targeted to a medical physicist who can mentor students in the clinic and also conduct impactful research. Another aspect of this priority is faculty retention. The current medical physics faculty is excellent and therefore retaining them is a high priority, not only for maintaining the high quality of the program, but also to facilitate growth.

   A third priority is to diversify and increase funding which will facilitate program expansion and timely graduation. This can be accomplished primarily via funding from research grants (RAs) and, as such, faculty are encouraged to budget for student salaries when submitting funding proposals. Such funding can support students during the summer thus facilitating a timely graduation.

4. What are the strengths of the program?

   A particular strength of the Medical Physics program is its dedicated and highly competent faculty: based on student evaluations, faculty are excellent teachers and, as such, provide students with a solid grounding in all aspects of radiation physics. Didactic coursework is integrated closely with lab courses providing students with hands-on experiences with state-of-the art radiation detection instrumentation. The addition of two faculty has strengthened the program significantly. Dr. Kuang is a board certified medical physicist and Dr. Cucinotta has a strong background in both radiation biology and dosimetry. Both faculty have strong research backgrounds and have secured external funding from a number of agencies including the NIH.

   Students receive a high quality clinical experience via access to radiation oncology centers and medical physics equipment vendors. Adjunct faculty at the affiliated sites are experts in their fields and provide students with mentorship in clinical physics, clinical research and state-of-the art radiation therapy equipment and associated instrumentation/computation. The clinical experiences produce graduates who are highly competitive for entry into clinical physics residency programs – a required stage in the medical physics certification process.

   The high level of State support for students is another strength of the program. Over the past ten years, 3-5 students have received State sponsored graduate assistantships each year. These students also receive generous health insurance benefits from the State. Students not receiving State funding have been supported from external grants.

   The Dept. has state-of-the-art research and teaching laboratories which are sufficiently maintained through State funding, external grants, F&A recoveries, and revenue generated from the Health Physics Service Laboratory.

   The Dept. and its faculty have traditionally enjoyed an excellent working relationship with the Dean's Office. Nowhere is this more evident than in the support the Dean has provided for securing start-up funding for new faculty and additional laboratory space for teaching and research initiatives.

5. What are the challenges facing the program?

   The primary challenging facing the program is the lack of clinical sites in the Valley. Presently, the department has only one local affiliate (CCCN). Although a five-year renewal was signed earlier this year, renewal is not guaranteed. If CCCN decides to sever its relationship with the department, the program would be left without clinical access. This challenge would be addressed with the establishment of a radiation oncology clinic at UNLV's Medical School.

   Hiring and retaining competent faculty is also challenging, especially in the post-recession environment in Nevada. Medical physics faculty are highly specialized and in high demand nationwide. This challenge can also be addressed with the development of a UNLV radiation oncology center which would provide access to faculty for clinical work and research projects.

   Lack of non-State funding for students is challenging and provides a barrier for program expansion. This can be addressed through increased student funding from research grants.

6. What recent additions, corrections, or other changes have been made to the program that reflect changes or developments in the field?

   As previously discussed, curricular and course changes occur frequently as mandated by the accrediting body. This is a reflection of the fact that new technologies and procedures are constantly being implemented in the radiation oncology clinic.

B. Other comments

1. Is there anything else you would like to discuss about the program?

   UNLV's Medical Physics Sub-plan received initial accreditation in 2011 with subsequent renewal in 2013. The program will submit a self-study later this year to apply for another 5-year renewal. Faculty and adjunct faculty are highly competent and provide students with a high quality didactic and clinical education. The high quality of the program is evidenced from the high placement of program graduates in the medical physics field – all graduates are either working in the field, or have pursued higher degrees. All health and medical physics programs in the department are relatively small, however, students in all programs share common core courses, many of which are cross-listed with upper division undergraduate courses (400/600 offerings) which optimizes department resources thus allowing faculty to devote sufficient efforts to research thereby supporting the University's Top Tier initiative.

The NSHE also requires that any action steps identified based on the review of the program and the status of the action steps be ready for consideration at the December board meeting the year the program review is completed. You will be contacted about this after the external review has been completed.

NEXT STEPS:

A. Email the self-study to:
   - Chair of the Faculty Senate Program Review Committee found here: http://facultysenate.unlv.edu/committees/program-review or the Chair of the Graduate College Program Review Committee found here: https://www.unlv.edu/graduatecollege/program-review-committee.
   - Dr. Rainier Spencer, Vice Provost for Academic Programs, rainier.spencer@unlv.edu, 702-895-5833.
   - Nora Carroll, eleonora.carroll@unlv.edu, 702-895-1888

Congratulations on completing the self-study!

Appendix 3: Assessment Report

Annual Academic Assessment Report Cover Sheet

Assessment reports are due the 1st Wednesday after the Fall Term
Email to: assessment@unlv.edu

Program Information:

Program Assessed	Health Physics M.S. Program
Department	Health Physics & Diagnostic Sciences
College	Allied Health Sciences
Department Chair	Steen Madsen
Assessment Coordinator	Steen Madsen, Interim Graduate Program Coordinator
Date Submitted	Dec. 11, 2017
Contact Person for This Report	
Name	Steen Madsen
Phone	702-895-1805
Email	steen.madsen@unlv.edu

Please attach a narrative (not to exceed 4 pages, excluding appendices) addressing the following:

- What are the student learning outcomes? Please provide a numbered list.
- Which learning outcomes were assessed?
- How were they assessed? (Programs must use at least one direct assessment of student learning.)
- Undergraduate programs should assess at least one University Undergraduate Learning Outcome (UULO) each year, which may or may not overlap with a program learning outcome.
- Graduate programs should assess at least one outcome related to one of the following graduate level requirements each year:
    - student engagement in research, scholarship, creative expression and/or appropriate high-level professional practice.
    - activities requiring originality, critical analysis and expertise.
    - the development of extensive knowledge in the field under study.

- What was learned from the assessment results?
- How did the program respond to what was learned?

Please limit the narrative portion of your report to no more than four pages. You may attach appendices with data, tables, charts, or other materials as needed. Please explain the relevant conclusions from any appendices in your narrative. Please contact the Office of Academic Assessment if you have questions or need assistance.

Student Learning Objectives

The goal of the Master of Science in Health Physics Program is to provide a high-quality graduate education experience for students in the fields of medical and health physics. The program consists of two sub-plans targeting the primary paths to employment: Environmental Health Physics (EHP) and Medical Physics (MP). The EHP sub-plan is accredited by the Accreditation Board of Engineering and Technology (ABET, 2015) and the MP sub-plan is accredited by the Commission on Accreditation of Medical Physics Education Programs (CAMPEP, 2014).

The academic program consists of a common core coursework shared by both sub-plans, augmented by discipline-specific coursework and thesis research. The student learning objectives are developed at the program level, and are addressed primarily through the common core courses. Sub-plan specific courses supplement the core courses on the SLO's and serve to deliver additional content to ensure students meet the requirements of the accrediting bodies.

Student Learning Objectives (SLO)

1. Graduates able to demonstrate knowledge of theoretical fundamentals of health physics
2. Graduates competent in advanced disciplines related to health physics
3. Graduates capable of assessing and solving problems related to health physics
4. Graduates will have had "hands-on" experience with experimental equipment and techniques and abilities to analyze data and develop reports
5. Graduates able to gain practical experience with state-of-the-art equipment and software
6. Graduates able to write technical documents
7. Graduates able to communicate with technical & non-technical audiences
8. Graduates able to function within a team
9. Graduates able to participate in the research process and disseminate results
10. Graduates cognizant of the need for life-long learning and professional responsibility
11. Graduates exposed to professional practice
12. Graduates able to interact with professionals in a less formal setting
13. Graduates exposed to health physics and medical ethics
14. Graduates cognizant of the need to understand socio-cultural, political, and environmental issues related to health physics

Assessment Activities – 2017

Our accrediting bodies require an annual self-evaluation of the program, program objectives, student learning objectives and performance. This self-evaluation is performed as part of the end of the academic year program faculty meeting. The annual self-evaluation is focused on the performance of the students and feedback on courses from the previous year (FA and SP terms), performance on the oral examinations, and thesis defenses with the intent of addressing any immediate concerns or issues with the program content and direction. As part of the self-assessment process, the faculty will also review the alumni and employer feedback on alumni performance and capabilities to identify any concerns or deficiencies. The program faculty will also meet with our external review committees (for EHP and MP) to discuss and evaluate the program outcomes, student learning outcomes, and the feedback gathered over the course of the academic year. This year's assessment process was performed with additional emphasis regarding SLO's 6-8 (students being able to communicate effectively). These SLO's tie directly into the graduate program level requirement: "effective communication in both oral and written forms".

Performance of the academic program with regards to the SLO's was evaluated directly by the faculty involved in teaching the courses by comparing student performance on assignments, quizzes, exams, reports, and presentations against the course and program expectations as well as against previous year's student performance. Student evaluations of the course provided feedback to the instructor as well as the department chair on the content relative to program objectives. The performance of students in the comprehensive oral examination also provided feedback on areas that need improvement in the program.

In addition to the data and observations from classroom performance, the program was also assessed through exit interviews with graduating students (all 3 students declined exit interviews this cycle). The preparation of students for the workforce was assessed by surveying alumni's employers (0 responses this cycle). We also had three medical physics students take their national board exams during the past year.

We also held three external advisory committee meetings: the Environmental HP external advisory board met on Sept 16, 2016 and the Medical Physics external advisory board met on Dec. 13, 2016 and May 2, 2017. As part of these meetings the department faculty and external advisors reviewed the program SLO's and accreditation program goals, curriculum, student performance, and program performance.

Assessment Results / Lessons Learned

Based on student performance in the coursework and on the cumulative oral examination, a slight improvement in their ability to solve "real world" problems, i.e., the types of problems commonly encountered in the health physics field was noted. This is likely due to a greater emphasis on this type of problem solving in both medical and environmental health physics courses.

All four students taking the department comprehensive oral exam passed on their first attempt. Three students took the American Board of Radiology (ABR) part 1 exam. Two students passed both sections while the third passed general physics but failed the clinical section. Based on results from the oral comprehensive exam and the national certification exam, our program is successful in preparing students for careers in both environmental health physics and medical physics.

Program Responses ("Closing the Loop")

HPS 616 (advanced health physics) is currently being redesigned by a part-time instructor. Additional modifications to the course, as well as other courses in the environmental health physics sub-track will be made as soon as new health physics faculty have been hired (two searches are in progress). The modifications to HPS 616 include a group design project in health physics. These changes are intended to address the program requirement and SLO promoting working in teams (SLO 8).

The time to degree completion (2.5 to 3 years) remains a concern. The primary factor appears to be students delaying their thesis work until the completion or near completion of their coursework. To address this issue we have changed the program requirements to require students to select their thesis advisor within their first semester in the program. Another factor in the length of time to completion is the lack of graduate assistantships over the summer, resulting in students leaving the program for the summer months. While faculty are attempting to resolve this gap with external research funding, additional state support for state GA's over the summer could also be useful in supporting students performing thesis work over the summer.