

Recommended ethics curriculum for medical physics graduate and residency programs: Report of Task Group 159

Christopher F. Serago^{a)}

Department of Radiation Oncology, Mayo Clinic, Jacksonville, Florida 32224

Jay W. Burmeister

Wayne State University School of Medicine, Karmanos Cancer Center, 4100 John R Street, Detroit, Michigan 48201

Peter B. Dunscombe

Department of Medical Physics, Tom Baker Cancer Centre, Calgary, Alberta, AB T2N 4N2, Canada

Ashley A. Gale

Department of Radiation Oncology, Mayo Clinic, Jacksonville, Florida 32224

William R. Hendee

Departments of Radiology, Radiation Oncology, Biophysics, and Population Health, Medical College of Wisconsin, Milwaukee, Wisconsin 53226

Stephen F. Kry

Department of Radiation Physics, The University of Texas M.D. Anderson Cancer Center, 1515 Holcombe Boulevard, Houston, Texas 77030

Cheng-Shie Wu

Department of Radiation Oncology, Columbia University, New York, New York 10032

(Received 4 February 2010; revised 17 May 2010; accepted for publication 19 May 2010; published 29 July 2010)

The AAPM Professional Council approved the formation of a task group in 2007, whose purpose is to develop recommendations for an ethics curriculum for medical physics graduate and residency programs. Existing program's ethics curricula range in scope and content considerably. It is desirable to have a more uniform baseline curriculum for all programs. Recommended subjects areas, suggested ethics references, and a sample curriculum are included. This report recommends a reasonable ethics course time to be 15–30 h while allowing each program the flexibility to design their course. © 2010 American Association of Physicists in Medicine. [DOI: 10.1118/1.3451116]

Key words: ethics, professional conduct, morals

TABLE OF CONTENTS

I. INTRODUCTION.....	4495
II. BACKGROUND.....	4496
III. RECOMMENDATIONS.....	4497
APPENDIX: ETHICS CURRICULUM FOR MEDICAL PHYSICS GRADUATE AND RESIDENCY PROGRAMS.....	4498
I. ETHICAL PRINCIPLES, HISTORICAL PERSPECTIVE.....	4498
II. ETHICAL ENCOUNTERS OR DILEMMAS.....	4498
III. PROFESSIONAL CONDUCT I.....	4498
IV. PROFESSIONAL CONDUCT II.....	4499
V. CLINICAL PRACTICE ETHICS.....	4499
VI. RESEARCH ETHICS I.....	4499
VII. RESEARCH ETHICS II.....	4499
VIII. RESEARCH ETHICS III.....	4499
IX. EDUCATION ETHICS.....	4499

I. INTRODUCTION

As professionals, medical physicists must acquire and demonstrate their comprehension of a wide body of knowledge

of medical physics and behave in an ethically sound manner. It is a hallmark of professionals to recognize the importance of ethical behavior. The professions of medicine and law have long recognized the fundamental importance of principled ethical behavior as an elemental aspect of their respective professions. The American Medical Association (AMA) created a code of ethics for physicians at the time of its establishment in 1847. The 1847 AMA code was based substantially on the code of ethics, written by an English physician, Thomas Percival, in 1803. The medical profession can further trace its ethical roots to ethical principles crafted by the ancient Greek physician, Hippocrates. A modern version of the Oath of Hippocrates is still administered to many medical students at the time of their graduation. The American Bar Association (ABA) adapted their first Canons of Professional Ethics in 1908. In the United States, law students must pass the Multistate Professional Responsibility Examination (MPRE) for admission to the bars in all but four US jurisdictions. The MPRE is intended to measure the examinee's understanding of established standards related to a lawyer's professional conduct.

Medical physicists have also recognized the importance of ethics in their profession. The American Association of

Physicists in Medicine (AAPM) created an ethics committee at the time of its formation in 1958. The American College of Medical Physics (ACMP) similarly formed an ethics committee at its inception in 1983. The AAPM Guidelines for Ethical Practice for Medical Physics were used for many years as guidance for medical physicists. Those guidelines were recently replaced by the AAPM Code of Ethics which the AAPM Board of Directors approved July 2008. This code of ethics was subsequently published in *Medical Physics* in January 2009.¹

Whether or not a formal course in ethics should be a mandatory requirement of a medical physics education has been a point of debate within our profession and the physics education community. Personal observations and perceptions appear to influence one's assessment of the necessity of ethics education. *Medical Physics* published a Point/Counterpoint article by Switzer, Detorie, and Hendee² on this topic in 2003. There, Switzer and Detorie argue the pros and cons of requiring a formal ethics course as part of the medical physics curriculum. The issue of ethics education for the general physics community is discussed at some length in articles published in *Physics Today* in 2004, one of which is authored by Kirby and Houle.³ Kirby and Houle present the results of a survey conducted by a task force of the American Physical Society (APS). One interesting finding of the APS survey illustrating how people in different positions or of different ages perceive whether or not problematical ethical situations exist was the contrast in response from junior members of the APS and physics department chairs. For example, 39% of the junior members reported observing ethical violations compared to 10% of department chairs.

AAPM Report No. 79,⁴ Academic Program Recommendations for Graduate Degrees in Medical Physics, was published in 2002. Report No. 79 has been revised and the new version in Report No. 197⁵ had the same title as Report No. 79. These reports include professional ethics as one of the special core topics to be included in a medical physics degree program. The introduction of Reports 79 and 197 note that "recent experience indicates that Medical Ethics and Statistics may require more in-depth coverage." Reports 79 and 197 do not have a specific recommendation for the length of the ethics component of the medical physics education.

Currently, various approaches are available for ethics education within medical physics graduate and residency programs. Program directors described the format for ethics education within their respective programs in the 2007 and 2009 surveys referred to in Sec. II of this report. Some programs offer and require a formal ethics course, while other programs offer an ethics course as a nonrequired elective. Ethics may be taught within the structure of a seminar series or an online course. Some programs offer no formal course but teach ethics through the example of daily practice of the faculty and/or mentor.

The purpose of this report is to recommend curriculum standards for ethics education in graduate and residency medical physics programs.

II. BACKGROUND

The AAPM Professional Council approved the formation of Task Group 159, Recommended Ethics Curriculum for Medical Physics Graduate and Residency Programs, in August 2007 to develop guidelines for an ethics curriculum for graduate and residency medical physics programs. It was believed that ethics should be a component of a medical physics education and that a more consistent curriculum for medical physics programs would be beneficial to the profession and to those that it serves. TG 159 includes members of the AAPM ethics committee, members of active CAMPEP (Commission on Accreditation of Medical Physics Educational Programs) accredited medical physics graduate and residency programs, and a recent graduate of a CAMPEP accredited medical physics graduate program. The task group conducted their work at face-to-face meetings and with electronic correspondence.

In May 2007, a survey was sent by the chair of TG159 to all CAMPEP accredited graduate and residency programs, as well as all non-CAMPEP programs listed on the AAPM and CAMPEP web pages at that time. The purpose of the survey was to determine the presence or absence of ethics education in these medical physics programs, as well as to ask what method of teaching was employed. In total, 61 programs were sent surveys. A second, simplified survey was sent to *only* CAMPEP accredited graduate (21 in number) and residency (31 in number) programs in August 2009.

Twenty-four out of 61 programs that received the May 2007 survey responded. Approximately 50% of the responding programs did offer some type of a formal ethics education course as part of their program. The course format was quite varied: traditional didactic, seminar, and online courses were some of the formats stated. The remaining programs that did not offer an ethics course responded either (1) that it was assumed that the student had already acquired adequate knowledge of ethics, (2) that ethics knowledge is assimilated in the department environment, or (3) that ethics is taught by example.

The response rate from the second similar August 2009 survey was much greater, perhaps because of the simplified version of the survey. Nineteen out of 21 (90%) of the accredited graduate programs and 26 out of 31 (84%) of the accredited residency programs responded to the survey. 74% (14/19) of the graduate programs required some type of ethics education to complete their program. The mean number of hours for the graduate programs was 11.2 (median = 7.5 h). The majority, 53%, of the graduate programs offered a didactic course format. The great majority, 92% (24/26), of the residency programs did not require prior completion of an ethics course for acceptance into their programs. However, 61% (16/26) of the residency programs did require completion of some form of ethics education. The mean number of hours for ethics education in the residency programs was 5.7 h (median, 2.5 h), with the primary course format being a seminar.

TABLE I. Recommended ethics subjects for medical physics graduate and residency programs.

Ethical principles
Historical perspective
Ethical encounters or dilemmas
Basic ethical values
Relationships
Clinical conflicts
Continuing education
Public responsibility
Employer/employee relationships
Conflict of Interest
Human research principles
Scientific principles
Scientific misconduct
Publication practices
Animal research
Teacher education ethical issues
Student education ethical issues

III. RECOMMENDATIONS

The task group has summarized in Table I a list of recommended ethics subjects for medical physics graduate and residency programs. This subject material may be taught in either the graduate or the residency program; it is not necessary to repeat the material in the residency program if it was already accomplished in the graduate program. A sample curriculum outline that encompasses these subjects is given in the Appendix. Some of the Table I subjects are described more explicitly in the curriculum outline; some are intentionally less well defined. For example, the subject “Relationships” refers to relationships between medical physicists and their peers, medical professionals, regulators, administrators, recruiters, research associates, students, teachers, and so on. Reference to these different relationships are scattered through the curriculum outline.

Table II is a list of suggested ethics references compiled by the task group and represents only a small sample of the very numerous ethics references available in the literature.

Neither the subject list nor the curriculum outline recommends a specific number of teaching or encounter hours. An ethics “course” could have a variety of formats. A traditional didactic course in a classroom setting is just one possible option, whereas a series of seminars may be better suited for some programs. Web-based learning modules are yet another option. The time each program decides to spend on case studies is likely to vary considerably. Some programs may cover different parts of the ethics curriculum in separate courses not necessarily titled “ethics.” Nonetheless, it is expected that the relevant topics will receive explicit and structured attention. With these caveats, the recommended curriculum outline has nine major areas which implies a minimum course time of 9 h, though a more reasonable estimate would be 15–30 h. The task group intends their recommendations to be flexible so each program may determine their best pathway to incorporate a satisfactory ethics course.

TABLE II. Suggested ethics references.

General references
(1) American Association of Physicists in Medicine Code of Ethics, http://www.aapm.org/medical_physicist/ethics.asp
(2) Ethics, Values, and the Promise of Science, 1993 Forum Sigma Xi, The Scientific Research Society, Research Park Triangle, North Carolina, 1993
(3) Honor in Science, Sigma Xi, The Scientific Research Society, Research Park Triangle, North Carolina, 2000
(4) The Responsible Researcher: Path and Pitfalls, Sigma Xi, The Scientific Research Society, Research Park Triangle, North Carolina, 1999
(5) T. F. Budinger and M. D. Budinger, <i>Ethics of Emerging Technologies: Scientific Facts and Moral Challenges</i> (Wiley, New Jersey, 2006)
(6) H. T. Tavani, <i>Ethics and Technology: Ethical Issues in an Age of Information and Communication Technology</i> (Wiley, Jersey, 2007)
(7) R. E. Bulger, E. Heitman, and S. J. Reiser, <i>The Ethical Dimensions of the Biological and Health Sciences</i> , 2nd ed. (Cambridge University Press, Cambridge, 2002)
(8) “Ethical principles and guidelines for the protection of human subjects of research,” The Belmont Report, U.S. Department of Health, Education, and Welfare, 1979. Available at http://www.hhs.gov/ohrp/humansubjects/guidance/belmont.htm
(9) “Ethical Principles for Medical Research Involving Human Subjects,” World Medical Association Declaration of Helsinki, WMA General Assembly, 1964. Available at http://www.wma.net/e/policy/b3.htm
(10) Introduction to the Responsible Conduct of Research, Office of Research Integrity, U.S. Department of Health and Human Services. Available at http://ori.hhs.gov/documents/rcrintro.pdf
(11) Online Ethics Center for Engineering and Research http://beta.onlineethics.org/Resources/Cases.aspx
Research/education specific references
(12) Office of Research Integrity, http://ori.dhhs.gov/
(13) National Institutes of Health, http://history.nih.gov/research/downloads/belmont.pdf
(14) Association for Assessment and Accreditation of Laboratory Animal Care International, http://www.aaalac.org/
(15) International Committee of Medical Journal Editors, http://www.icmje.org/
(16) Compact between postdoctoral appointees and their mentors, http://www.aamc.org/postdoccompact
(17) National Academy of Sciences, National Academy of Engineering, Institute of Medicine, Advisor, Teacher, Role Model, Friend. <i>On Being a Mentor to Students in Science and Engineering</i> (National Academy Press, Washington, DC, 1997). Available at http://www.nap.edu/readingroom/books/mentor

AAPM Report No. 79 recommends the inclusion of professional ethics as part of the curriculum of a medical physics graduate program. The report appears to recommend a broad coverage of ethics, as indicated by the statement: “This material is intended to cover ethical issues in clinical medicine and scientific research and in the professional conduct of the medical physicist.” The topical outline of Report 79 does include “General Professional Conduct” as a section heading, but seems to focus more on ethics related to research and publications. It also appears from comments

made on the 2009 survey that most programs' ethics curricula focus on research related topics. That, of course, is an important component. As is evident from the recommended curriculum in this report, Task Group 159 believes that an ethics curriculum should include a more comprehensive range of topics.

It should be emphasized that both the subject list and curriculum outline are *recommendations* intended to be a foundation upon which individual programs may build. Both the subject list and curriculum outline are open to some interpretation and can be customized by the local education program. Each program is encouraged to design its program appropriately for its institutional resources to best achieve the goal of teaching the ethics subject material.

The task group recognizes that it will be a challenge for medical physics programs whose institutions do not currently offer an appropriate ethics course for medical physicists. Therefore, programs may need ample time (3–5 yr) to develop such a course. Again, the course format could follow a variety of formats as described previously. It is further recommended that the AAPM support the development of web-based ethics education modules or other means to assist programs/institutions with their need to implement a medical physics ethics course. We encourage CAMPEP to verify that accredited graduate or residency programs require their graduates to have completed an acceptable ethics course.

ACKNOWLEDGMENTS

The task group would like to sincerely thank Lynne Fairbent for her reliable, efficient, knowledgeable support as the staff representative for the AAPM.

APPENDIX: ETHICS CURRICULUM FOR MEDICAL PHYSICS GRADUATE AND RESIDENCY PROGRAMS

I. Ethical Principles, Historical Perspective

- Historical evolution of ethical principles
 - Hippocratic Oath
 - Ancient and modern versions, medical ethics principles*
 - Nuremberg Code
 - Medical experimentation on humans, war crimes, Nuremberg 10 points*
 - Declaration of Helsinki
 - Ethical principles for medical research involving human subjects*
 - Belmont report
 - Belmont principles of respect for persons, beneficence, and justice*
- Moral/ethical theories
 - Virtue, justice, rights, duty, utilitarianism*
- Ethics versus Laws
 - Mandatory, enforceable behavior versus voluntary code of conduct*

Professional Codes of Ethics

Rationale for professionals to have codes of ethics, AMA, ABA, AAPM, ACMP, examples and histories

II. Ethical Encounters or Dilemmas

- Identification of encounter or dilemma
 - Conflicting outcomes, interests, values*
- Description of conflict, origin of encounter/dilemma
 - Statement of facts, history of events, perspective from all viewpoints*
- Review of applicable ethical code or guidelines
 - Professional ethics codes, institutional code of conduct*
- Methods of resolution
 - Impartial evaluation, nonjudgmental dialogue, identification of benefits or detriments of competing solutions*
- Case examples

III. Professional Conduct I

- Honesty
 - Truthful and open communication with colleagues, truthful documentation of work and reports*
- Respect for all people
 - Mutual respectful relationships with colleagues, other health professionals, patients, general public*
- Academic freedom
 - Promotion of a work environment free of political, ideological, or religious pressures or constraints, a research atmosphere free of intellectual constraint or bias*
- Discrimination
 - Review of legal description of discrimination recruiting, hiring, job evaluations, promotion policies, training, compensation, and disciplinary action*
- Sexual harassment
 - Review of legal description of sexual harassment, context, graduation of misbehavior, and contrast of perception between persons, cultural, or ethnical variations*
- Exploitative relationships
 - Coercive work environment, take unfair advantage of colleague*
- Continuing Education
 - Lifetime learning relevant knowledge and skills for profession, share knowledge with colleagues and allied health professionals*
- Responsibility to Public
 - Education, dissemination of information
 - Reporting impaired or incompetent health care providers
 - Protect the safety welfare of patients*
 - Reporting incidents
 - Medical events, sentinel events, regulatory requirements*
 - Whistleblower protection
 - Definition and description of whistleblower situations*

IV. Professional Conduct II

Employment

Employment investigation

Honest rapport with potential employer, reasonable prospect to consider position, visiting multiple employers, act with respect and consideration of existing medical physicist-employees

Recruiter relationship

Honest communication, accurate and complete information provided

Acceptance of employment

Commitment, contract, oral agreement, handling multiple offers

Physicist as the recruiter

Advertising, contacting potential employees, respect for current employer

Vacating a position

Notification time, documentation of work, orderly transition

Conflict of interest

Disclosure and management of conflict of interest, recognition of real or perceived conflicts

Gifts or Kickbacks

Recognition of inappropriate gifts or kickbacks, improper expectation of gift or kickback

Peer review

Friendly or hostile review

Requested peer review versus imposed peer review, interaction with reviewer

V. Clinical Practice Ethics

Patient responsibility

Primary welfare of patient, respect dignity and confidentiality of patient (HIPPA), recognizes and manages knowledge or experience limitations

Professional relationships

Collaborative teams, open exchange of information, supervisors support and develop colleagues under their supervision

Conflicting views or interests

Financial institutional interests versus patient care interests, physician or administrative view versus medical physicist view, billing and coding issues

Reporting incidents

Report according to institution policies and regulatory requirements, minimize risk of future events

Impaired health care workers

Report according to institution policies and regulatory requirements

VI. Research Ethics I

Scientific misconduct

Data fabrication, falsification

Identifying and reporting misconduct

Conflict of interest

Financial, prestige, recognition

Acquisition, management, sharing, ownership of research data

Ensure data are real, unbiased conditions for data collection, record keeping, data privacy, patent considerations

Intellectual property

Patents

Copyright

VII. Research Ethics II

Publication practices

Authorship

Assigning and ranking authors

Repetitive and duplicative publications

Same material publication in multiple journals

Corrections and retractions

Obligation to report known errors, misstatements

Sufficient description of methods

Plagiarism

Collaborative research

Maintain confidentiality, agreed upon research goals, sharing information

Guidelines for authorship assignment

Substantial intellectual contribution from coauthors

VIII. Research Ethics III

Human participants, history of past misconduct

Nazi war crime medical experiments, Tuskegee syphilis study, Willowbrook study, Jewish chronic disease study, radiation tests on mentally retarded boys

Informed consent/Right to withdraw

Voluntary without coercion, knowledgeable, maintain legal rights, risks and benefits of research, ability to withdraw

Risk without benefit

Patient confidentiality

HIPAA, Research involving records

Research involving records

Maintenance of confidentiality, sharing records

Institutional Review Board

Protect research subjects' rights and welfare, authority to approve, modify, disapprove, or terminate research

Vulnerable subjects/Group harms

FDA-regulated research

Regulations for federally funded research

Animal research

Laws, regulations, and standards of animal handling

IX. Education Ethics

Teacher

Living example, daily practice of ethical behavior

Formal documented pathway to degree completion, defined educational goals for student to achieve, conflict of interest with institutional goals such as research grants or nonstudent publications

Respectful communication

Teacher-student relationship and communication style

Student confidentiality

Confidentiality of student evaluations, student personal records

Fair evaluation

Impartial, documented evaluation of student's work

Academic freedom

Promotion of an education environment free of political, ideological, or religious pressures or constraints, a research atmosphere free of intellectual constraint or bias

Acknowledgment of student or others' work

Teaching material, publications, presentations

Consensual student relationship

Teacher's responsibility to maintain proper relationship

Student

Adherence to institutional policies and procedures

Respect and adherence to policies, procedures and property, completion of required institutional training, patient and institutional confidentiality

Academic honesty and integrity

Acknowledge work of others

Freedom of expression

Respect for students, teachers, staff, and patients

^{a)}Electronic mail: serago.christopher@mayo.edu

¹C. F. Serago *et al.*, "Code of Ethics for the American Association of Physicists in Medicine: Report of Task Group 109," *Med. Phys.* **36**, 213–223 (2009).

²D. Switzer, M. Detorie, and W. R. Hendee, "All medical physicists entering the field should have a specific course of research and practice ethics in the educational background," *Med. Phys.* **30**, 3049–3051 (2003).

³K. Kirby and F. A. Houle, "Ethics and the welfare of the physics profession," *Phys. Today* **57**(11), 42–46 (2004).

⁴B. R. Paliwal, J. C. H. Chu, P. M. Deluca, A. Feldman, E. E. Grein, D. E. Herbert, E. F. Jackson, F. M. Khan, R. L. Maughan, V. Natarajan, E. B. Podgorsak, E. R. Ritenour, and M. K. Zaidi, "Academic program recommendations for graduate degrees in medical physics," AAPM Report No. 79 (Medical Physics Publishing, 4513 Vernon Blvd., Madison, WI, 2002).

⁵B. R. Paliwal, P. M. Deluca, E. E. Grein, D. E. Herbert, E. F. Jackson, E. B. Podgorsak, E. R. Ritenour, J. Smilowitz, and G. Starkschall, "Academic program recommendations for graduate degrees in medical physics," AAPM Report No. 197 (Medical Physics Publishing, 4513 Vernon Blvd., Madison, WI, 2009).