AMERICAN ASSOCIATION of PHYSICISTS IN MEDICINE

IMPROVING HEALTH
THROUGH MEDICAL PHYSICS

AAPM NEWSLETTER

January/February 2022 | Volume 47, No. 1

IN THIS ISSUE:

COVID-19 UPDATE

Notice as of Sunday, January 2, 2022, 9AM Eastern Time.

- COVID-19 Information for Medical Physicists
- As of August 1, 2021, AAPM allows in-person meetings and AAPM-funded travel for those fully vaccinated, with the understanding that individuals may participate virtually if they do not feel comfortable traveling. Meetings at AAPM HQ must follow guidelines established by EXCOM as appropriate to circumstances at the time of the meeting.

IT'S NOT TOO LATE TO REGISTER . . .

This two-day virtual workshop will bring together thought-leaders and practitioners to re-envision how QA for IMRT fits into a comprehensive, safety-focused operation and will explore the ways in which new knowledge and discoveries may lead towards changes in guidance.

After each session, attendees will participate in small group discussions on the virtual platform. Each day concludes with a panel discussion incorporating feedback from the small group facilitators.

Register Today ➤ aapm.me/2022IMRT

AAPM NEWSLETTER is published by the American Association of Physicists in Medicine on a bi-monthly schedule.
AAPM is located at 1631 Prince Street, Alexandria, VA 22314

TABLE OF CONTENTS

January/February 2022 | Volume 47, No. 1

REPORTS IN THIS ISSUE

EVENTS/ANNOUNCEMENTS

SUBMISSION INFORMATION

Please e-mail submissions
(with pictures when possible) to:
newsletter@aapm.org
AAPM Headquarters
Attn: Nancy Vazquez

PUBLISHING SCHEDULE

The AAPM Newsletter is produced bi-monthly.
Next issue: March/April 2022
Submission Deadline: February 4, 2022
Posted Online: Week of February 28, 2022

CONNECT WITH US!

Editor's Note

I welcome all readers to send me any suggestions or comments on any of the articles or features to assist me in making the AAPM Newsletter a more effective and engaging publication and to enhance the overall readership experience. Thank you.

AAPM SPRING CLINICAL MEETING 2022

Hyatt Regency New Orleans

Reconnect with your medical physics peers in-person for 3.5 days of great content and networking opportunities in New Orleans!

The 2022 Spring Clinical Meeting is the first ***live and in-person*** AAPM Meeting since 2019, offering the intimate setting this meeting is known for to reconnect with colleagues and vendors in-person and not on a screen!

Registering for in-person or virtual participation includes on-demand content available 24 hours post-session.

MARCH 26–29
NEW ORLEANS, LA

AAPM.ME/CLINICAL

JANUARY 3	JANUARY 17	FEBRUARY 16
Meeting Program Available	Meeting Registration and Housing Available	Deadline to receive Discounted Registration Fees

2022 AAPM SUMMER SCHOOL

Small Field Dosimetry, Stereotactic Radiosurgery, and Stereotactic Body Radiation Therapy: The Future is Here

Southern Methodist University & UT Southwestern Medical Center | Dallas, TX

SAVE THE DATES:

- **February 15, 2022**
  Registration and housing available online
- **March 1, 2022**
  Deadline to submit Scholarship Application

Join us
live and in-person
June 7–12, 2022!

HAPPY NEW YEAR!

NEWSLETTER EDITOR'S REPORT Jennifer Pursley, PhD | Massachusetts General Hospital

Happy new year to all, and welcome to the first edition of the 2022 AAPM Newsletter! I'm thrilled to begin my service as the Newsletter Editor and grateful to outgoing Editor Jessica Clements and the amazing AAPM HQ staff for their hard work and guidance that results in a high-quality publication every time. You may notice some changes in the Newsletter going forward, but they will be thoughtful and gradual, and I encourage all readers to reach out to me with feedback and suggestions. You can reach me by email, Twitter, or LinkedIn, whichever you prefer. The AAPM Newsletter is publicly available, so please share the articles that catch your eye on your favorite social media channel.

In this issue, you will find reports from incoming President **Dan Bourland**, incoming Treasurer **Sam Armato**, and Executive Director **Angela Keyser**. Other features include a timely review of the Medicare 2022 final rules, a celebration of Hispanic Heritage Month from the Professional Council's newly formed Equity, Diversity and Inclusion Committee, and diverse contributed reports on topics ranging from the Medical Physics Leadership Academy case studies to early career and student travel grants. We also have a special feature on **Chris Williams, PhD, DABR**, a clinical therapy physicist selected as a NASA astronaut candidate.

All AAPM members are encouraged to submit content and ideas for the Newsletter either to me or directly through the submission link on the Newsletter page. I particularly encourage submissions from new AAPM members; this Newsletter is intended to provide relevant information to all members. If you think of something you'd like to see in the Newsletter, there are probably many other members who would like to see it as well! Enjoy this issue of the Newsletter, and I look forward to connecting with many of you online. ■

Twitter: @jenpursley_phd

Email: jpursley@mgh.harvard.edu

LinkedIn: jennifer-pursley-b8352926/

AAPM Leadership

Outgoing Officers

Mahadevappa Mahesh, PhD | Treasurer, 2016–2021

M. Saiful Huq, PhD | Chair of the Board, 2021

Outgoing Board Members

Samuel Armato, PhD | Board Member-at-Large, 2019–2021

Olivier Blasi, MS | Rocky Mountain Chapter Board Representative, 2019–2021

Vladir Colussi, PhD | Penn-Ohio Chapter Board Representative, 2019–2021

Indra Das, PhD | Board Member-at-Large, 2019–2021

Sebastien Gros, PhD | Midwest Chapter Board Representative, 2019–2021

Brian Hasson, PhD | Mid-Atlantic Chapter Board Representative, 2019–2021

Chang Ming Charlie Ma, PhD | Board Member-at-Large, 2019–2021

Michael Mills, PhD | Board Member-at-Large, 2019–2021

X. Sharon Qi, PhD | Southern California Chapter Board Representative, 2019–2021

Gregory Sharp, PhD | New England Chapter Board Representative, 2019–2021

Incoming Officers

Samuel Armato, PhD | Treasurer, 2022–2024

Ehsan Samei, PhD| President-Elect, 2022

Incoming Board Members

Jay Burmeister, PhD | Board Member-at-Large, 2022–2024

Rebecca Howell, PhD | Board Member-at-Large, 2022–2024

Mary Ellen Jafari, MS | Board Member-at-Large, 2022–2024

Martha Matuszak, PhD | Board Member-at-Large, 2022–2024

Theo Apostol | Midwest Chapter Board Representative, 2022–2024

Ross Berbeco, PhD | New England Chapter Board Representative, 2022–2024

Jeremy Donaghue | Penn-Ohio Chapter Board Representative, 2022–2024

Kiernan McCullough, MS | Rocky Mountain Chapter Board Representative, 2022–2024

Tyler Fisher, MS | Southern California Chapter Board Representative, 2022–2024

A NEW YEAR FOR AAPM

PRESIDENT'S REPORT J. Daniel Bourland, PhD | Wake Forest School of Medicine

Greetings AAPM Colleagues:

It's a pleasure and honor to write to you as AAPM President, and I send you my sincere greetings for the new year. With AAPM's great number of volunteers and robust activities, our challenges and opportunities include our strategic planning, governance, facilitation of our work, efficiency of operations, fiscal oversight, and communications with stakeholders, all while also serving our members.

I would like to recognize the EXCOM Officers and Directors of the Board who have just completed their terms — thank you all for your years of dedicated service to the AAPM. Officers are **M. Saiful Huq**, Board Chair, and **Mahadevappa Mahesh**, Treasurer. With the new year, AAPM Officers are now: **Jim Dobbins**, Board Chair; **Dan Bourland**, President; welcoming **Ehsan Samei** as President-Elect; **Jennifer Johnson**, Secretary, and welcoming **Sam Armato** as Treasurer; and **Angela Keyser**, Executive Director. Please do not hesitate to contact any of us with your questions, concerns or suggestions.

Over the past year, EXCOM, Board, and Councils have been discussing, strategizing, and deciding priorities and directions. Here are highlights of these important initiatives:

- **NEW Governance Committee** — The Board of Directors approved the creation of a Governance Committee, a standing committee of the Board, which will provide counsel for the corporate governance of the AAPM. The Governance Committee's role will be to provide recommendations for governance principles and practices, such as review of policies and procedures, the conduct of board meetings, board nominations and appointments, and other processes. The charge and implementation of the Governance Committee will be formulated over the next year.
- **NEW Communication Coordination Committee** — The Board of Directors approved the creation of a Communication Coordination Committee, a standing committee of the Administrative Council. This committee was proposed as a conclusion to the work performed by the Ad Hoc Committee on External Communications and Social Media. The committee will serve to consolidate and coordinate AAPM's communications with our multiple internal and external stakeholders. Importantly, an additional staff member at Headquarters was also approved by the Board and will be recruited to bring full-time effort to AAPM's communications.
- **Work by the Ad Hoc Committee on Membership** — Work is proceeding to help AAPM consider our membership categories, privileges, and benefits,

Email: bourland@wakehealth.edu

Please let me know if you have comments or suggestions about AAPM's mission, priorities, and committees or would like me to participate in your meeting or seminar.

with the goal for clarity and simplicity for all of our members. Recommendations are planned for the coming year for consideration by the Membership.

- **A Major Success with CMS!** — Through the efforts of the Professional Economics Committee, CMS accepted AAPM's recommendations on clinical labor rates for medical physicists (literally, $$ per minute), based on submission of the AAPM 2020 Professional Survey Report. This increase is phased in over time. AAPM is preparing a statement to share with members and others on this success and its significance.

As President, I am working on the following priorities for AAPM:

- **Future Revenue Streams** — AAPM has three main sources of revenue: our membership fees, our meetings, and our publications. With active planning and monitoring of these sources, there is a sense that some may decrease and that it would be wise to consider other potential sources. Thus, I will be forming an Ad Hoc Committee to provide recommendations to the Board on future revenue streams.
- **Boot Camps for Artificial Intelligence** — We all hear about AI and its pervasiveness for our field and other applications. One question I receive from colleagues is about how to prepare one's self for AI in medical physics. To address this, I'm proposing that AAPM organize Boot Camps for AI in Medical Physics and to offer these several times a year for the next 2–3 years. Stay tuned as this is decided one way or another — we want to be leaders in AI for medical physics.

- **2022 Annual Meeting** — Reflecting the opportunity to meet in-person as well as our contributions to healthcare, the 2022 Annual Meeting, July 10–14 in Washington, DC, has the theme of "Celebrating Medical Physics: Transforming Human Health." We are quite aware that travel and face-to-face meetings have been limited during the last two years and will be carefully monitoring the ongoing pandemic to provide for a safe and enjoyable meeting. Stay tuned as more meeting details are shared.

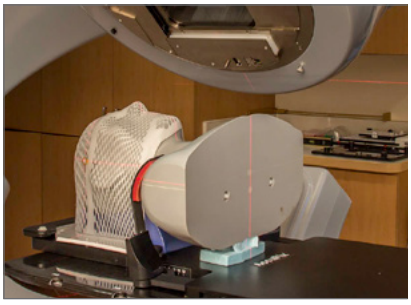
What are our highest priorities? As I've written before, the richness of AAPM resides in our remarkable members, volunteers, headquarters staff, and other colleagues. Together, we bring a diverse mix of expertise, experiences, interests, and cultures to AAPM's mission of *Improving Health*. ■

High-Fidelity Simulation
for Your SRS Program

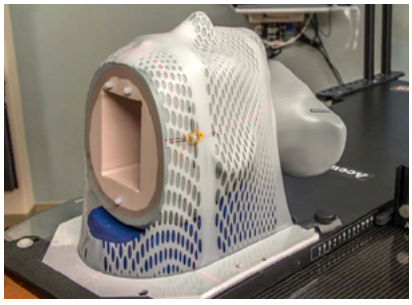
The CIRS Stereotactic End-to-End Verifcation Phantom (STEEV™) serves as a surrogate patient to assess every step of the treatment process - from immobilization and multi-modality imaging (CT, MRI, PET), to thorough treatment plan verification. STEEV's detailed anatomical features provide a realistic clinical simulation and allow evaluation of the effects inherent in complex intra- and extra-cranial anatomies.

STEEV™
STEREOTACTIC END-TO-END VERIFICATION

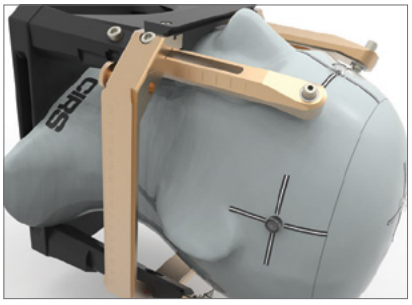
e2e SCAN PLAN LOCALIZE TREAT



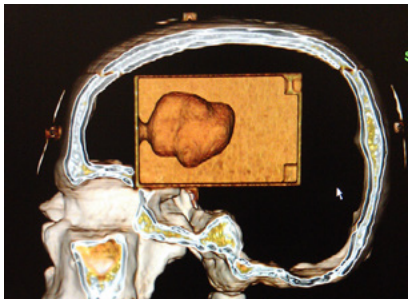
Perform QA on OBI systems



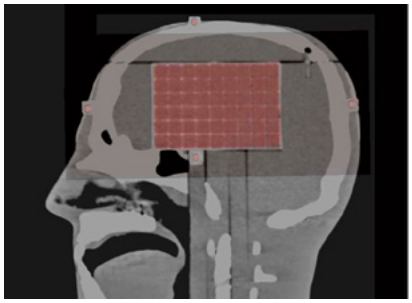
Verify patient positioning using frame/frameless systems, head/shoulder masks or other fixation devices



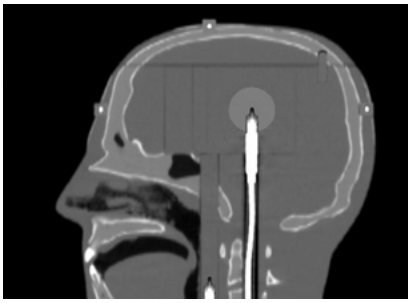
Quick, repeatable positioning in frame based systems



Evaluate TPS deformable image registration algorithms



Assess TPS image fusion and image transfer accuracy with multi-modality imaging inserts for CT, MRI and PET



Verify patient treatment plans in critical regions

*Proudly Partnering With **Radiology & RT Professionals** for Over 30 Years*

CIRS
900 Asbury Ave • Norfolk, Virginia 23513 • USA • Tel: 757-855-2765 • **WWW.CIRSINC.COM**

AMERICAN ASSOCIATION OF PHYSICISTS IN MEDICINE

2022 AAPM FUNDING OPPORTUNITIES

- **AAPM | RSNA Imaging Physics Residency Grant**

  This grant provides 50% support of a resident's salary for two imaging physics residencies.

  Award Duration:
  7/1/23 – 7/1/25

  Application Deadline: 5/3/22

- **2022 Research Seed Funding Grant**

  Three $25,000 grants will be awarded to provide funds to develop exciting investigator-initiated concepts, which will hopefully lead to successful longer term project funding from the NIH or equivalent funding sources. Research results will be submitted for presentation at future AAPM meetings.

  Award Duration:
  8/31/22 – 8/31/23

  Application Deadline: 4/1/22

- **2022 AAPM BEST Award**

  BEST Medical will provide a stipend to be used for travel, food and lodging expenses to attend the 2022 Annual Meeting in Washington, DC. AAPM will provide complimentary 2022 Annual Meeting registration for each recipient.

  Application Deadline: 5/3/22

Seeking mentors for these programs!

- **Summer Undergraduate Fellowship Program**

  This 10-week summer program provides opportunities for undergraduate university students to gain experience in medical physics by performing research in a medical physics laboratory or assisting with clinical service at a clinical facility. Students are selected for the program on a competitive basis with each receiving a $6,000 stipend.

  Application Deadline: 2/3/22

- **DREAM — Diversity Recruitment through Education and Mentoring Program**

  DREAM is a 10-week summer program designed to increase the number of underrepresented groups in medical physics by creating new opportunities, outreach, and mentoring geared towards diversity recruitment of undergraduate students in the field. Each DREAM fellow receives a $6,000 stipend.

  Application Deadline: 2/2/22

- **2022 AAPM Science Council Associates Mentorship Program (SCAMP)**

  This grant provides travel support for eight Associates to attend two AAPM Annual Meetings. The program itself begins at the time of selection through the end of the following calendar year. The Associate will shadow AAPM-related activities of the mentor, including virtual committee meetings, abstract review, Young Investigator judging, and committee activities at the Annual Meeting. Interested persons may submit applications starting January 10, 2022.
  Application Deadline: 4/11/22

Visit gaf.aapm.org for regularly updated information on these programs as well as other opportunities, including:

- **ASTRO-AAPM Physics Resident/Post-Doctoral Fellow Seed Grant**
- **2022 AAPM RSNA Doctoral and Masters Graduate Fellowships**

HAPPY NEW YEAR!

TREASURER'S REPORT Samuel G. Armato, III, PhD | The University of Chicago

Happy New Year to all of you! It's a tremendous (and humbling) honor for me to serve as the treasurer of AAPM, and I look forward to working with the other members of EXCOM and the amazing staff at HQ to help AAPM take advantage of the opportunities before us as we enter 2022. I wish to express my sincerest thanks to Mahadevappa Mahesh for his incredibly talented leadership as Treasurer these past six years and for his generosity in taking the time to impart his wisdom to me during the transition.

Financial Position and Estimates for 2021

As of October 31, 2021, we estimate that AAPM will finish the year with a healthy surplus from our operations budget. The finance team recently analyzed year-to-date revenue and expenses versus their budgeted amounts. For those line items that were on pace to finish the year near the budgeted amounts, the year-end estimate was left unchanged at the budgeted amount. For those lines where the year-to-date revenue or expense was trending significantly above or below the budgeted amount, the year-end estimate was modified to reflect this trend.

The 2021 budget (approved in 2020) estimated revenue at $8.34 million and expenses at $9.70 million, for a budget deficit of $1.36 million. Now that 2021 is drawing to a close, we estimate an actual revenue of $9.49 million and actual expenses of $9.38 million, for an estimated actual surplus of $0.11 million. The major driver creating the surplus this year is that AAPM received forgiveness of its Paycheck Protection Program (PPP) loan. In 2020 to offset the negative financial impact of COVID, AAPM applied for a PPP loan as authorized by Congress under the Coronavirus Aid Relief & Economic Security Act (CARES Act). After fulfilling all of the requirements under the loan, AAPM applied for and received forgiveness of the loan and accrued interest from the Small Business Administration (SBA) so that the loan amount ($615k) is now recognized as Miscellaneous Income for 2021.

As a result of the lingering impact of the global pandemic, AAPM budgeted for a 10% reduction in membership; I am pleased to report that membership dues are projected to finish 4.3% ahead of 2020 and 10% ahead of the 2021 budget. Placement Service revenue is having a tremendous year and through October is $213k (56%) above budget. As the result of pandemic-related travel restrictions imposed through July 31, 2021, travel and catering costs were down dramatically across all areas of AAPM. Finally, as a result of very strong market performance during 2021, investment reserve balances exceed $17.6M as of October 31, 2021.

Email: s-armato@uchicago.edu

"AAPM's leadership has deftly steered our Association's finances through a couple of tumultuous years, and I am fortunate to assume my new role with a solid foundation on which to continue the forward momentum."

2022 Budget

I would like to thank the Council and Committee Chairs along with their liaisons who worked extremely hard together in developing their budgets.

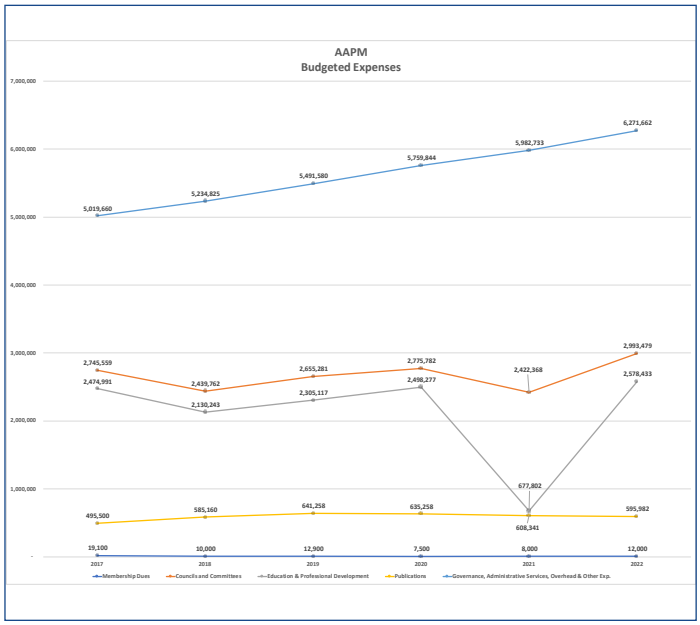
Led one last time by Mahadevappa Mahesh, the Finance Committee met virtually to review the 2022 draft budget. The Committee reviewed the initial draft and, after making several changes, approved an initial draft of the 2022 budget. A couple of weeks later, the Committee heard several appeals, and after reviewing the appeals, the Committee approved a final budget to submit to AAPM's Board of Directors, which approved the 2022 budget during its virtual meeting on November 20, 2021.

The 2022 budget summary is included in this report. Below you will see revenue and expense projections for the approved budget. The statistical model predicted a deficit of $941,628, although the deficit as approved by the Finance Committee and the Board is greater than this predicted deficit. While costs continue to rise, the Finance Committee felt that the anticipated surplus in 2021 operations, fueled predominately by the one-time PPP loan forgiveness of $615k as well as the strength of the operating reserves (both of which will help fund the anticipated deficit), warranted approving a deficit significantly higher than the statistical model and would allow AAPM to continue to serve its mission and achieve its strategic objectives. Approving a deficit this large is not a long-term fiscal strategy, but leadership felt it was warranted in the short term given the circumstances. Note that, as a result of the vote by the membership, the attached budget does not reflect any increase in the membership dues rate for 2022, which would have had a substantive impact on reducing the budget deficit.

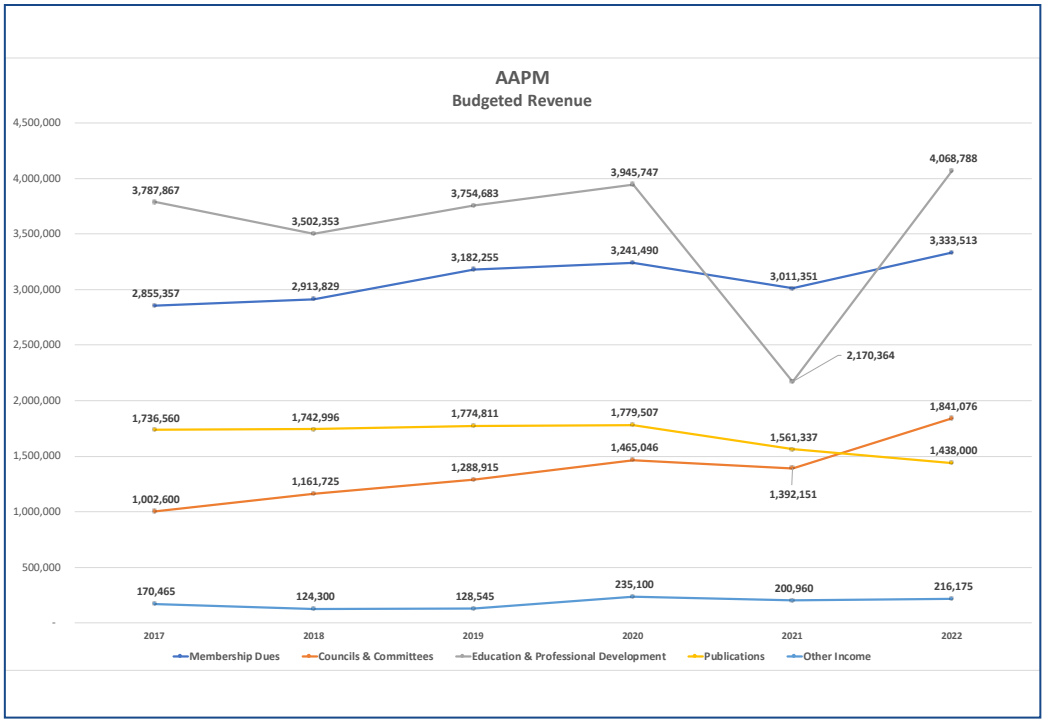
	2022 Budget
Total Revenue	$10,897,552
Total Expenses	12,451,556
Deficit from Operations	$1,554,004

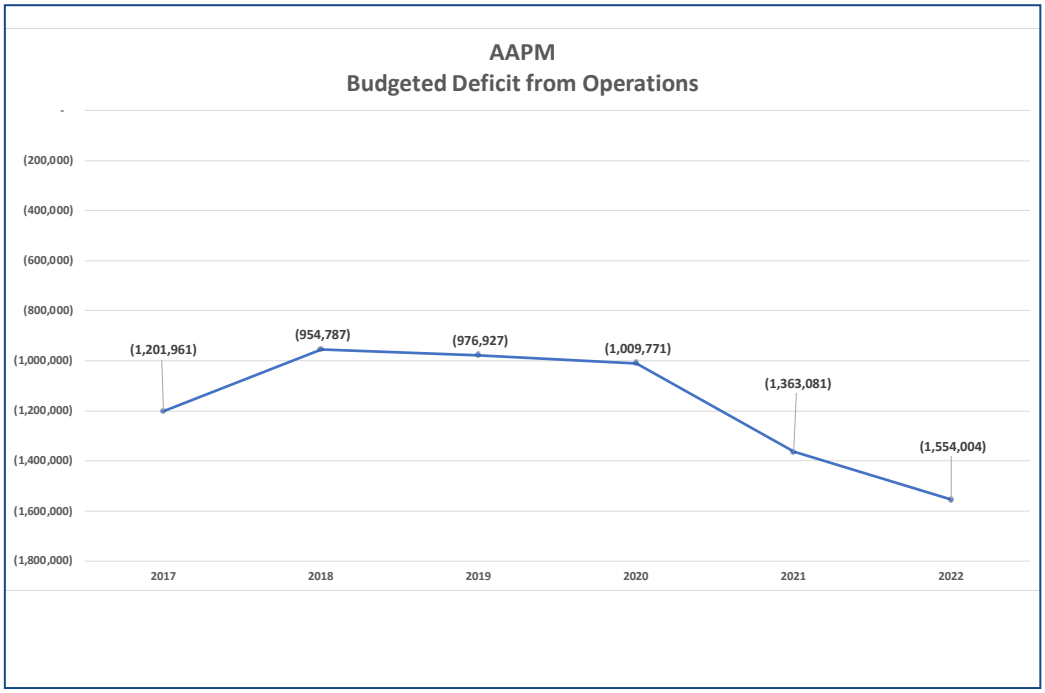
In addition to a copy of the approved budget, you will find graphs showing budgeted revenue, budgeted expenses, and budgeted deficits from operations over the past five years.

In closing, AAPM's leadership has deftly steered our Association's finances through a couple of tumultuous years, and I am fortunate to assume my new role with a solid foundation on which to continue the forward momentum. I would like to thank **Robert McKoy** for his help during the budget process, and I look forward to his continued proficient guidance in the upcoming years. I'm looking forward to a rewarding and fulfilling 2022! Please feel free to reach out to me if you have any questions concerning this report. ■



TREASURER'S REPORT, Cont.





TREASURER'S REPORT, Cont.

2022 Final Budget Approved by Board

	Revenue	Expenses			Net
Final Budget Approved by Board 11.20.21		Direct	Overhead	Total	
Membership Dues					
Dues	3,309,013	12,000	100,500	112,500	3,196,513
Reinstatement Fees	6,500	0	0	0	6,500
Applications Fees	18,000		0	0	18,000
Subtotal	$3,333,513	$12,000	$100,500	$112,500	$3,221,013
Membership Services					
Member Inquiries/Services	0	0	200,000	200,000	(200,000)
Membership Directory	0	0	7,500	7,500	(7,500)
AAPM Web Site	0	0	375,000	375,000	(375,000)
Subtotal	$0	$0	$582,500	$582,500	($582,500)
Organizational					
Governance	0	258,815	351,000	609,815	(609,815)
Governance - Contingency	0	15,000	0	15,000	(15,000)
Subtotal	$0	$273,815	$351,000	$624,815	($624,815)
Councils and Committees					
Administrative Council	28,000	704,580	560,000	1,264,580	(1,236,580)
Education Council	605,310	360,250	175,000	535,250	70,060
International Council	0	287,045	150,000	437,045	(437,045)
Professional Council	692,900	455,077	186,000	641,077	51,823
Science Council	514,866	1,085,732	308,000	1,393,732	(878,866)
Committees Reporting to the Board	0	100,795	165,000	265,795	(265,795)
Subtotal	$1,841,076	$2,993,479	$1,544,000	$4,537,479	($2,696,403)
Education & Professional Development					
Annual Meeting	3,385,785	2,029,645	680,000	2,709,645	676,140
Summer School	330,008	238,979	50,000	288,979	41,029
Spring Clinical Meeting	352,995	206,571	100,000	306,571	46,424
RSNA	0	103,238	59,000	162,238	(162,238)
Specialty Meetings	0	0	45,000	45,000	(45,000)
Subtotal	$4,068,788	$2,578,433	$934,000	$3,512,433	$556,355
Publications					
Journals	1,438,000	595,982	194,750	790,732	647,268
Subtotal	$1,438,000	$595,982	$194,750	$790,732	$647,268
Administrative Services					
Administration/Prof Services/AIP	0	242,274	138,000	380,274	(380,274)
General Operations /Prince Street	0	150,405	1,533,567	1,683,972	(1,683,972)
Subtotal	$0	$392,679	$1,671,567	$2,064,246	($2,064,246)
Other Income & Expense					
AAPM Mailing Lists	25,000	0	27,000	27,000	(2,000)
Membership Certificates	25	0	0	0	25
Royalties - ARP	64,000	0	0	0	64,000
Investment Earnings & Fees	4,500	0	0	0	4,500
CAMPEP	109,800	0	88,000	88,000	21,800
RSEA	0	0	0	0	0
SDAMPP	11,550	0	18,000	18,000	(6,450)
MPWB	0	0	1,600	1,600	(1,600)
Web Hosting	800	0	0	0	800
Meeting Evaluation	500	0	0	0	500
Contributions and Donations	0	8,000	0	8,000	(8,000)
Dues and other payments/AIP		84,251	0	84,251	(84,251)
Miscellaneous	0	0	0	0	0
Subtotal	$216,175	$92,251	$134,600	$226,851	($10,676)
TOTAL FROM OPERATIONS	**$10,897,552**	**$6,938,639**	**$5,512,917**	**$12,451,556**	**($1,554,004)**
AAPM Education & Research Fund	617,800	549,675	4,200	553,875	63,925
Investment Income	170,000	42,000	0	42,000	128,000
Grand Total	**$11,685,352**	**$7,530,314**	**$5,517,117**	**$13,047,431**	**($1,362,079)**

2022 Model to Break-Even	($914,631)
2022 Model Debt Service	($941,628)
2022 Debt Service Loss	($73,552)

Connecting medical physicists with the finest jobs

Find your future at
aapm.org/careers

AAPM SCIENCE COUNCIL ASSOCIATES MENTORSHIP PROGRAM

The AAPM Science Council Associates Mentorship Program (SCAMP) has been established to recognize and cultivate outstanding researchers at an early stage in their careers, with the goal of promoting a long-term commitment to science within AAPM. SCAMP uses the process of shadowing to integrate the Associates into the scientific activities of the organization. Our review working group will select eight Associates then assign each one to a Mentor from the AAPM Science Council, Research Committee, Data Sciences Committee, Therapy Physics Committee, Imaging Physics Committee, or Technology Assessment Committee. The Associate will participate in selected meetings of their assigned Mentor's Committee and join a Task Group (chosen with input from the Mentor). Other shadowing AAPM-related activities include abstract review, Young Investigator judging, committee activities at the Annual Meeting, etc.

The Associates will participate in the program through the end of the following calendar year. Each Associate will be reimbursed up to $2000 to cover the costs (travel-related expenses including flight, hotel, and meeting registration) to attend the 2022 Annual Meeting in DC and the 2023 Annual Meeting in Houston. Announcement details, along with Associate's picture and short biosketch, will be posted on the AAPM website by early June.

OPEN FOR APPLICATIONS:

January 10, 2022

ELIGIBILITY CRITERIA:

- PhD candidates or early career Medical Physicists within five years of earning a doctoral degree
- Must be a member of AAPM at the time of application (any membership category) and maintain membership for the duration of the award period.

  Pending membership status not acceptable

  Prior Mentorship Program recipients are ineligible

DIRECT INQUIRIES: scamp@aapm.org

APPLICATION REQUIREMENTS:

- Cover letter outlining current contributions to Medical Physics research, describing future career plans, and reasons for interest in the SCAMP program
- The cover letter should specify the committee(s) and/or committee member(s) of interest — e.g., Science Council, Research Committee, Therapy Physics Committee, Imaging Physics Committee, or Technology Assessment Committee, and/or member(s) therein
- A diversity statement limited to one single-spaced page that describes how you will support and achieve SCAMP and AAPM's goals of equity, diversity and inclusion, especially as it relates to supporting the role of women and underrepresented groups in the field
- CV (no more than four pages)
- Brief letter of support from supervisor
- Please combine and submit all application documents as one PDF

AMERICAN ASSOCIATION *of* PHYSICISTS IN MEDICINE

INFORMATION FROM HQ

EXECUTIVE DIRECTOR'S REPORT Angela R. Keyser | AAPM

New AAPM Reports

Report No. 222
Report of AAPM Task Group 222 — Recommendations for Intraoperative Mesh Brachytherapy.

Report No. 262
Report of AAPM Task Group 262 — Electronic Charting of Radiation Therapy Planning and Treatment.

2022 Funding Opportunities

DREAM — Diversity Recruitment through Education and Mentoring Program

Application Deadline: February 2, 2022

The Diversity Recruitment through Education and Mentoring Program "DREAM" is a 10-week summer program designed to increase the number of women and racially underrepresented groups in medical physics by offering research opportunities, outreach, and strategic mentorship geared towards recruiting a more robust and diverse group of skilled undergraduate students in the field of medical physics. DREAM students will be placed into summer research and mentorship groups consistent with their research and career interests. Up to six $6,000 stipends will be awarded based upon an expectation of a 40-hour per week effort for 10 weeks.

Sponsored by the AAPM Education Council through the AAPM Education & Research Fund. DREAM (formerly known as Minority Undergraduate Summer Experience Program) Award Winners History.

View additional information and access the online application »

Summer Undergraduate Fellowship Program

Application Deadline: February 3, 2022

The Summer Undergraduate Fellowship Program is a 10-week summer program designed to provide opportunities for undergraduate university students to gain experience in medical physics by performing research in a medical physics laboratory or assisting with clinical service at a clinical facility. The term of the fellowship is May - September. The mentor and Fellow will determine the exact 10-week schedule. In this program, AAPM serves as a clearinghouse to match exceptional students with exceptional medical physicists, many of whom are faculty at leading research centers. Students participating in the program are placed into summer positions consistent with their interests. Students are selected for the program on a competitive basis to be an AAPM summer fellow. Each summer fellow receives a $6,000 stipend based upon an expectation of a 40-hour per week effort for 10 weeks.

Twitter: @AngelaKeyser

Email: akeyser@aapm.org

Who Does What on AAPM's HQ Team?
See a list with contact information and brief descriptions of responsibilities online. An Organization Chart is also provided.

Sponsored by the AAPM Education Council through the AAPM Education & Research Fund. Summer Undergraduate Fellowship Award Winners History.

View additional information and access the online application »

ASTRO-AAPM Physics Resident/Post-Doctoral Fellow Seed Grant

Application deadline: February 11, 2022

AAPM and the American Society of Radiation Oncology (ASTRO) are jointly funding a research seed grant for Medical Physics Residents and Post-Doctoral Fellows. The goal of the joint seed grant is to advance the field of radiation oncology in novel ways through the support of talented early-career scientists involved in radiation oncology physics-related research. With this jointly supported grant, both societies aim to help support the next generation of researchers in the field of radiation oncology. One grant of up to $25,000 will be awarded. The 2022 award cycle will begin on July 1, 2022, and end on June 20, 2023.

View additional information and access the online application »

Research Seed Funding Grant

Application Deadline: April 1, 2022

Three $25,000 grants will be awarded to provide funds to develop exciting investigator-initiated concepts, which will hopefully lead to successful longer-term project funding from the NIH or equivalent funding sources. Funding for grant recipients will begin on August 31 of the award year. Research results will be submitted for presentation at future AAPM meetings.

Sponsored by the AAPM Science Council through the AAPM Education & Research Fund. A list of Award Recipients can be found here.

View additional information and access the online application »

2022 AAPM / RSNA Doctoral and Masters Graduate Fellowships

Application deadline: April 20, 2022

The Fellowship awards program has been restructured from its original single award mechanism to four Doctoral awards (PhD or DMP) and three MS awards of $10,000 each. Additionally, one of the MS and Doctoral awards will be reserved for under-represented applicants.

Doctoral Graduate Fellowships:

- Four PhD Awards of $10,000 each.
- Two awards will be for first-year Doctoral Students.
- Two awards will be for second-year or higher Doctoral Students.
- Paid to the institution, which in turn transfers it to the student. Money can be used for tuition, professional and research development.

MS Graduate Fellowships:

- Three MS Awards of $10,000 each.
- All first- and second-year MS students are eligible to apply.
- Paid to the institution, which in turn transfers it to the student. Money can be used for tuition, professional and research development.

Sponsored by the AAPM Education & Research Fund. A list of Award Recipients can be found here.

View additional information and access the online application »

AAPM / RSNA Imaging Physics Residency Grant

Application deadline: May 3, 2022

The purpose of the AAPM funding is to provide 50% support of a resident's salary for two imaging physics residency programs. The awardee institution(s) will provide the other 50% support. After the period of the award is over, the intent is that the awardee institution(s) will continue to fully support this new imaging physics residency position. Demonstration of this intent should be included in the application materials.

History:

On November 29, 2017, the AAPM Board of Directors approved $140,000 in funding for two new imaging physics residency positions, in diagnostic, diagnostic with a nuclear medicine option, or nuclear medicine. With this funding, the selected institution(s) will receive $35,000 per year for two years as matching support for one resident.

The AAPM Board of Directors has approved $420,000 in support over 6-years ($70,000/year starting in 2019) to fund six spots in existing or new imaging residency programs. The RSNA Board of Directors approved $210,000 in funding for three additional slots in existing or new imaging residency programs.

Sponsored by the AAPM Education Council through the AAPM Education & Research Fund. A list of Award Recipients can be found here.

View additional information and access the online application »

Please visit online ads

AAPM sponsors are partners in the publication of AAPM's journals, and the links they provide in their online advertisements might provide information useful to your practice. Please consider clicking through if you see something that interests you.

2022 Dues Renewal

2022 dues renewal notices were distributed in October. You may pay your dues online or easily print out an invoice and mail in your payment. I am pleased to report that all twenty-one AAPM Chapters have elected to have HQ collect chapter dues. We hope you will appreciate the convenience of paying your national and chapter dues with one transaction!

As the administrative staff of the AAPM, we must consistently enforce the rules of the organization. The AAPM Rules are very specific regarding the cancellation of membership if dues are not paid by the deadline and the fees required for reinstatement. It would be very difficult to make exceptions for some members and enforce such fees on others. If you need any assistance or have any questions about the dues process, please contact Janelle Priestly. ■

OUR CONDOLENCES

Edward R. Epp, PhD

Earle L. Kitts Jr., PhD

Paul Richard Moran, PhD

Hobart Shackford, MS

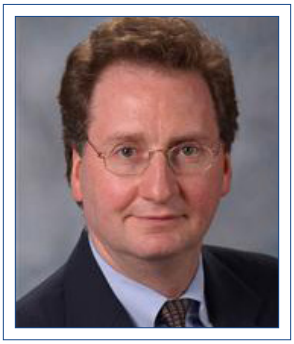
Kenneth D. Williams, MS

Our deepest sympathies go out to the family. We will all feel the loss in the Medical Physics community.

If you have information on the passing of members, please inform HQ ASAP so that these members can be remembered appropriately. We respectfully request the notification via e-mail to: 2022.aapm@aapm.org
(Please include supporting information so that we can take appropriate steps.)

UPDATES FROM THE AWARDS SELECTION SUBCOMMITTEE

EDUCATION COUNCIL REPORT Osama Mawlawi, PhD | MD Anderson Cancer Center



We are very excited to share with you some wonderful news from the Awards Selection Subcommittee (AS) of the Education Council (EC) about the awards this subcommittee manages for deserving applicants.

Email: omawlawi@mdanderson.org

Historically, the AS has awarded one graduate fellowship annually to a student in their first two years of graduate studies leading to a doctoral degree in Medical Physics (PhD or DMP). The total award was $36K, funded through the AAPM Education and Research Fund, which was given in the form of a two-year stipend of $13K per year plus up to $5k per year in tuition support ($18K/year). To qualify for the award, applicants must graduate from an undergraduate program in physics or equivalent majors (e.g., engineering-physics, math-physics, nuclear engineering, or applied physics) from an accredited university or college in North America. Further, qualifying candidates must have an undergraduate grade point average greater than 3.5 (based on a 4.0 scale), and each applicant must submit an application and secure an acceptance for graduate study to one of the CAMPEP accredited doctoral programs.

These qualification criteria presented a challenge to the members of the AS that are charged with selecting the best candidate since applicants typically fell into one of two main groups: 1) Students who just finished their bachelor's degree from an accredited university or college in North America and have secured an acceptance to a doctoral program; or 2) Students who are currently in their first or second year of their doctoral program. The major challenge for the AS is that applicants from the second group end up having richer CVs showing several publications, presentations, and awards. This compares to applicants from the first group who have less research/clinical experience and accolades supporting their applications, making them less competitive for the fellowship award.

In this regard, the AS has long worked towards restructuring the graduate fellowship award in such a way to recognize deserving students from both groups as well as those students who are pursuing a master's degree in medical physics. Additionally, the AS sought to align the awards with AAPM's strategic initiative of diversity, equity, and inclusion. Following several years of discussion with the leadership of AAPM's Education and Training of Medical Physicists Committee (ETC), Education Council (EC), Development Committee (DEV), and Administrative Council (AC), the AAPM Board of Directors approved changes to the RSNA/AAPM fellowship in August 2021. The Awards Selection Subcommittee is pleased to share that starting this year (2022), the graduate fellowship award has been restructured into the following format:

EDUCATION COUNCIL REPORT, Cont.

1) The 2-year fellowship award of $36K (2 x $18K each year) has been converted into four annual $10K awards. Two of the four awards will be given to students who recently completed their bachelor's degree from an accredited university or college in North America and have secured an acceptance to a doctoral program (group 1 described above), while the remaining two awards will be given to students who are currently in their 1st or 2nd year of their doctoral program (group 2 students described above).
2) A minimum of one award will be reserved for minority applicants (e.g., African Americans, Latino Americans, Native Americans, and Asian Pacific Islanders) as identified on the application.

Advantages of this restructure are: 1) recognizing the differences in experience between incoming doctoral students and ongoing doctoral students, 2) reserving awards for minority doctoral students, 3) increasing the number of awards in recognition of the efforts and contributions of the new generation of medical physicists.

It was also recognized that the aforementioned graduate fellowship awards were explicitly reserved for students in or preparing to begin their graduate studies leading to a doctoral degree in Medical Physics (PhD or DMP) and that no other AAPM fellowship award was specific for MS students in medical physics. In response, the AS, with strong advocacy and support from ETC, EC, and DEV leadership, developed a proposal for a new graduate fellowship award specifically targeting students who are pursuing their CAMPEP accredited master's degree in Medical Physics. This proposal was also approved by the Board of Directors in August 2021 and will fund three new MS fellowship awards ($10K each) beginning in 2022. Similar to the doctoral awards and in alignment with AAPM's strategic initiative on diversity, equity and inclusion, at least one of these awards will be reserved for minority applicants (e.g., African Americans, Latino/-x Americans, Native Americans, and Asian Pacific Islanders) as identified on the application.

To differentiate the doctoral awards from the master's awards, the doctoral awards will be named "AAPM/RSNA Doctorate Graduate Fellowship Award" while the master's awards will be called "AAPM/RSNA MS Graduate Fellowship Award."

In summary, the RSNA/AAPM graduate fellowship award has been restructured to four doctoral awards of $10k each rather than the original single award of $36K. This is an increase of $4K in total award funds while recognizing more students who are deserving of such an award. Furthermore, three additional awards of $10K each were created (total of $30K) specifically for students pursuing their MS degree in medical physics — a degree that did not previously have any AAPM funding. So, in essence, the Awards Selection SC has for the year 2022 onwards increased the number of awards to deserving students from one award to seven awards with a total increase in awarded money from $36K to $70K. For each award mechanism (doctoral and masters), at least one award will be reserved for minority applicants in alignment with AAPM's strategic initiative on diversity, equity, and inclusion.

We would like to thank the hard work and dedication of the members of the AS, the support and advocacy of ETC, EC, DEV, and AC, and the support of the AAPM Board of Directors. We look forward to reviewing the upcoming candidates and continuing this wonderful tradition of recognizing the tremendous efforts of our next generation of medical physicists.

For additional details and submission requirements of these awards, please visit AAPM's Grants and Fellowships webpage. ■

REPORT FROM THE WORKING GROUP ON GRAND CHALLENGES (WGGC)

SCIENCE COUNCIL REPORT Samuel G. Armato III, PhD | University of Chicago

The Working Group on Grand Challenges (WGGC) is sponsoring its sixth round of challenges selected from proposals submitted by AAPM members. Three AAPM-sponsored Challenges will be conducted in the months leading up to the 2022 AAPM Annual Meeting, and the results of these Challenges will be presented during what has become an annual session, the AAPM Grand Challenges Symposium.

The Deep-Learning for Inverse Problems: Spectral Computed Tomography Image Reconstruction Challenge (DL-Spectral CT), organized by Emil Sidky and **Xiaochuan Pan** from the University of Chicago, will follow the successful DL-Sparse-View CT Challenge that was presented at last year's Annual Meeting. Spectral CT, based on dual-energy CT, represents a cutting-edge technology that is gaining interest in the medical imaging community. A major effort in spectral CT research is the development of image reconstruction that can yield quantitative images from spectral CT transmission data. The DL-Spectral CT Challenge seeks to address a tomographic imaging problem that is of current research interest with potential clinical implications.

The Truth-Based CT Reconstruction Challenge (TrueCT), organized by **Ehsan Samei** from Duke University, will take advantage of the resources of the recently funded Center for Virtual Imaging Trials (CVIT) to create a dataset of realistic CT images of virtual patients with known ground truth to provide an objective evaluation of CT reconstruction methods. The increased use of "approximating" reconstruction methods in CT, including iterative reconstruction (IR) and deep learning (DL) methods, creates uncertainty in how much native information might be distorted in the reconstruction process. With knowledge of the true underlying anatomy and physiology, the precise limitations of the reconstruction process can be objectively quantified.

The Standardizing Imaging Protocols for Quantitative SPECT/CT Post Yttrium-90 Microspheres Delivery Challenge (SIRPRISE), organized by **Diane Alvarez** from the Miami Cancer Institute, will seek to standardize a clinically practical acquisition and reconstruction protocol for SPECT scans that are acquired to quantify and localize Y-90 delivery for radioembolization. The advancement of Y-90 radioembolization from a palliative setting to a more frontline therapy will depend on the ability to determine the absorbed doses to tissues, which is a critical future component of managing patient follow-up. Furthermore, undertreated areas of a tumor could be identified to allow for alternative or adjuvant therapies.

Email: s-armato@uchicago.edu

Grand Challenges require an organizing committee comprised of domain experts from potentially multiple institutions. Members of the organizing committee generally have a substantial interest in the Challenge task—hence their commitment to serving in this capacity. Moreover, this interest and domain expertise positions organizing committee members and their research groups as likely to perform well in the task of a specific Challenge. Although the contributions to a Challenge, by Challenge organizers are invaluable and are meant to serve the advancement of the field, there exists an inherent (real or perceived) conflict in an individual who both serves as an organizing committee member and enters the Challenge as a participant. Therefore to promote best practices and preserve the overall integrity of a Grand Challenge, individuals who serve as Challenge organizers and individuals who report to Challenge organizers are prohibited from participating in that specific Grand Challenge.

For more details on how to participate in these three Challenges or for updates on their progress, please visit the Grand Challenge page on AAPM's website.

The WGGC is charged with promoting the conduct of Grand Challenges designed to assess or improve the use of medical imaging in diagnostic and/or therapeutic applications. To that end, a call for proposals goes out each Spring, with proposals due in late June. The WGGC has a budget that allows partial support for up to three proposals each year (including free registration to the Annual Meeting for one member from each of the two top-performing teams and one member of the organizing committee). The selected Challenges are announced shortly after the Annual Meeting, which gives Challenge organizers nearly a full year to plan, prepare and complete their Challenge. ■

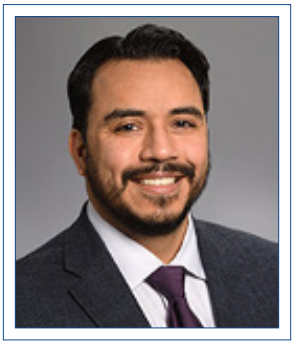
TIME TO CELEBRATE OUR LATINO/-X AND HISPANIC AAPM MEMBERS

EQUITY, DIVERSITY AND INCLUSION COMMITTEE REPORT

Julianne Pollard-Larkin | MD Anderson Cancer Center

Every year brings a celebration that is somewhat personal to me; the US celebrates Hispanic Heritage Month from September 15 through October 15. As someone raised in Miami, arguably the best and one of the most diverse cities in America, I have a deep appreciation for Latino/-x and Hispanic culture. Miami is like a cultural oasis that celebrates each group's unique contribution to our local music, food scene, customs, artistry, and more. Hispanic Heritage Month is a national celebration that allows all of us, regardless of our backgrounds, to remember and highlight the achievements and honors that our Hispanic and Latino/-x Americans have earned.

In AAPM, we have several leaders and leaders just on the horizon who are not only changing the face of Medical Physics; they are leading some of our most innovative research efforts and recruiting the next generation of Hispanic and Latin-x medical physicists. Most importantly, AAPM's brand new Equity, Diversity and Inclusion Committee (EDIC) has just created a new affinity group for AAPM's community of Hispanic and Latin-x physicists. Here's a quick introduction to the officers of our brand-new Hispanic and Latin-x Medical Physics subcommittee affinity group, as well as other outstanding physicists in this community:



Rick Castillo, PhD is the new vice-chair of EDIC and new chair of the Diversity and Inclusion subcommittee (DISC) under the Professional Council. Not only is he a true force behind our EDI efforts in AAPM, but he is also a formidable researcher world-renowned for his Deformable Image Registration Lab (www.Dir-Lab.com), which he created as a graduate student alongside his mathematician brother, **Dr. Edward Castillo**, and radiation oncologist Dr. Thomas Guerrero. Yes, you read that right, Dr. Castillo helps oversee a powerhouse of Latin-x talent in image registration and programming. He is a phenomenal scientist, with multiple active and past NIH-funded awards, a trailblazer since he was arguably the first Latin-x PhD recipient at UT MD Anderson Cancer Center, and a wonderful representation of the role model underrepresented scientists look up to. Dr. Castillo is an Associate Professor in the Dept of Radiation Oncology at Emory University, where he is also Director of the Medical Physics certificate program and a member of the Emory University Faculty Council. Outside of Emory, Dr. Castillo is a charter member of the NIH Imaging Technology and Development Study Section, oral board

Twitter: @JulieLarkin305

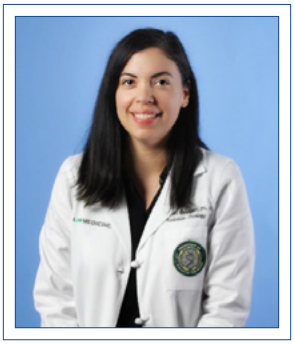
Email: JMPollard@mdanderson.org

Hispanic Heritage Month is a national celebration that allows all of us, regardless of our backgrounds, to remember and highlight the achievements and honors that our Hispanic and Latino/-x Americans have earned.

examiner for the ABR, and member of the Red Journal Editorial Board. Dr. Castillo co-founded the public Medical Physics Hispanic Community Outreach & Mentorship platform www.urimedphys.org.

Soleil Hernandez is one of the founding members of the Hispanic and Latin-x Medical Physics subcommittee, and she's one of UT MD Anderson Cancer Center's top graduate students in **Dr. Laurence Court**'s lab. Dr. Court's lab is the perfect spot for this budding scientist since her passion is global health and pediatric radiation oncology. She recently won the Med Phys Slam competition for the Southwest Chapter of AAPM and is a former recipient of the AAPM Diversity and Recruitment through Education and Mentoring (DREAM). Soleil's steady success and progress since receiving DREAM is evidence of the kind of talent the program recruits and the kind of mentorship and research skill development it is known for.

Angélica Pérez-Andújar, PhD currently serves as the Chief Physicist for the Memorial Sloan Kettering Cancer Center at Westchester NY. She was born and raised in Puerto Rico and is the proud daughter of a coffee farmer and a social worker. She studied theoretical Physics at the University of Puerto Rico-Mayaguez and came to the mainland United States to pursue her PhD in Medical Physics at the University of Wisconsin-Madison. She was a postdoctoral Fellow at the University of Texas MD Anderson Cancer Center and later joined the University of California-San Francisco, where she was an Assistant Professor for many years and one of the UCSF champions for Equity, Diversity and Inclusion. While at UCSF, she worked on implementing a Holistic Review process for the Radiation Oncology and Medical Physics residency program applicants. She also worked on several initiatives across UCSF to increase the number and visibility of underrepresented minorities. In terms of research, Dr. Pérez-Andújar devoted many years to the study of neutron doses in proton therapy. In more recent years, she has worked in the area of SRS treatments for multiple brain metastases and quality assurance. Dr. Pérez-Andújar is an active member of several committees in the AAPM and is currently the chair for Task Group 210 on Conventional Linac Acceptance Testing and is the Vice-Chair of the Diversity and Inclusion Subcommittee. She is very passionate about Medical Physics, but above all, she is passionate about mentoring and empowering the diverse future generation of medical physicists.



Elizabeth Covington, PhD is an associate professor and Director of Quality and Safety at the University of Michigan. She received her PhD in physics at the University of Michigan, where she studied the use of gold nanoparticles for the detection of explosives. She also completed her therapeutic medical physics residency at the University of Michigan. In her role as the director of the medical physics residency program at the University of Alabama at Birmingham, Dr. Covington introduced gender, age, race, and visa-status blinding for residency application review. She also introduced initiatives to reduce bias via standardized interview questions and unconscious bias training for interviewers. With her colleagues **Dr. Kelly Paradis** and **Dr. Jean Moran**, Dr. Covington published "The state of gender diversity in medical physics" in the Medical Physics journal which quantified gender diversity in leadership and award recipients in medical physics. Dr. Covington currently serves as the chair of Task Group 263U1: Update to Report No. 263 - Standardizing Nomenclatures in Radiation Oncology (TG263U1) and the vice-chair of Working Group on Radiation Oncology - Incident Learning System. Her research includes surface imaging during stereotactic radiosurgery, automation of processes in radiotherapy, EDI in medical physics, and health equity. Dr. Covington was born and raised in Texas and tries to stay in touch with her Mexican-American roots by teaching her kids how to make Mexican food and forcing them to listen to 90s Tejano music. ■

TRACKING BIDEN ADMINISTRATION'S REGULATORY AGENDA

LEGISLATIVE AND REGULATORY AFFAIRS REPORT Richard J. Martin, JD | AAPM

Following in the path of prior presidential administrations, the Biden Administration is advancing its own regulatory agenda that is recasting the influence and authority of federal agencies. We can anticipate regulatory changes in health care, education, energy, environmental, and labor arenas. Accordingly, monitoring and analyzing regulations that may impact medical physicists is an essential part of AAPM's government relations work.

You can keep informed about the new administration's regulatory plans by reviewing the Unified Agenda of Regulatory and Deregulatory Actions reports on the actions administrative agencies plan to take in the near and long term. The agenda is released by the Office of Information and Regulatory Affairs twice per year, and it provides public notice and transparency about proposed regulatory and deregulatory actions within the Executive Branch. See agenda and additional information here.

In addition, some non-profits are providing tracking and analysis of the administration's regulatory activity. For example, the Brookings Institution, a non-profit public policy organization in Washington, DC, has re-launched the Brookings Center on Regulations and Markets Regulatory Tracker ("Reg Tracker"). The Reg Tracker "tracks and provides insights into important regulatory actions by the federal government." The Reg Tracker was first launched to monitor the impact of President Trump's Executive Order 13771, which required all agencies to enact two deregulatory measures for every new regulatory action. The tracker will look at both regulatory and deregulatory actions during the Biden administration. Of note, Brookings states that it will report on rules repealing or revising those implemented by the Trump administration. ■

The AAPM Government and Regulatory Affairs Committee (GRAC), is closely monitoring regulatory activity that may impact the practices of medical physicists, and we will keep you updated on any developments, as well as AAPM's advocacy efforts on behalf of members. If you have questions or require additional information, please contact Richard J. Martin, JD, AAPM's Government Relations Program Manager, at richard@aapm.org.

CMS ISSUES MEDICARE 2022 FINAL RULES

HEALTH POLICY AND ECONOMIC ISSUES REPORT

Wendy Smith Fuss, MPH | AAPM Consultant | Health Policy Solutions

Written on behalf of the Professional Economics Committee.

Radiation Oncology Alternative Payment Model

The Radiation Oncology Alternative Payment Model (RO Model) final rule was issued on November 2nd in conjunction with the 2022 Hospital Outpatient Prospective Payment System (HOPPS) and Ambulatory Surgical Center (ASC) Payment System final rule.

The RO Model will begin on January 1, 2022, with a five-year model performance period ending December 31, 2026. The RO Model remains a mandatory model encompassing 30 percent of all eligible radiotherapy (RT) episodes. CMS estimates that 500 Physician Group Practices (including 275 freestanding radiation therapy centers) and 450 Hospital Outpatient Departments will furnish radiation therapy services in the selected zip codes.

The RO Model is designed to test whether prospective, site-neutral, modality agnostic, episode-based payments to physician group practices (PGPs), freestanding radiation therapy centers, and hospital outpatient departments (HOPDs) for RT episodes of care reduce Medicare expenditures while preserving or enhancing the quality of care for Medicare beneficiaries.

Under the RO Model, Medicare would pay participating providers specified professional and technical RT services furnished during a 90-day episode of care to Medicare beneficiaries diagnosed with 15 cancer types.

The Centers for Medicare and Medicaid Services (CMS) notes that they are finalizing the majority of the proposals without modification, and there are two proposals that they are finalizing with modification. These include the definitions for RO Track One and RO Track Two, as well as the extreme and uncontrollable circumstances (EUC) policy.

CMS included in the model an extreme and uncontrollable circumstances policy associated with the COVID-19 Public Health Emergency (PHE) that will grant RO participants some flexibility on quality reporting and monitoring requirements in the first performance year (PY1).

According to the final rule, the EUC policy will provide RO participants with the option not to collect and submit quality measures and clinical data elements (CDEs) in PY1. As a result, the 2 percent quality withhold will be removed from the payment methodology. Additionally, the Agency is making the requirements associated with participating in an AHRQ-listed Patient Safety Organization (PSO) and conducting peer review optional in PY1. Should the

Email: wendy@healthpolicysolutions.net

For additional information including Medicare rule summaries, 2022 proposed payments and impacts visit the AAPM website.

Secretary of Health and Human Services (HHS) terminate the renewal of the PHE prior to January 1, 2022, then the EUC policy will also be terminated, and quality measure and CDE reporting will be mandatory.

As a result of the flexibility granted through the EUC, RO participants will not have to comply with these reporting requirements to be deemed eligible for Advanced APM status and receive the 5 percent bonus associated with Advanced APM participation.

Other key changes include:

- The baseline period is 2017–2019.
- The Discount Factors are 3.5 and 4.5 percent for the professional and technical components, respectively. The discount factor reserves savings for Medicare and reduces beneficiary cost-sharing.
- Brachytherapy is not included under the RO Model; it will still be paid fee-for-service (FFS). Brachytherapy sources will continue to be paid separately in addition to the procedure.
- Liver cancer will not be included in the RO Model as it does not satisfy the model's cancer inclusion criteria.
- The RO Model will include an Extreme and Uncontrollable Circumstances policy. This policy will provide CMS the flexibility to delay the model performance period, reduce the administrative burden of RO Model participation, including reporting requirements, and adjust the payment methodology as necessary.
- There are three tracks related to status under the Quality Payment Program (QPP), based on RO participant type and compliance with RO Model requirements. CMS finalized with modification to define Track Three of the RO Model.
    - Track One will be for RO participants who comply with all RO requirements, including certified electronic health record technology (CEHRT). Track One RO participants will be considered Advanced APMs and MIPS APMs. Only Track One is eligible for the Professional Component bonus payment.
    - Track Two will be for those RO participants who comply with all RO Model requirements except for CEHRT, therefore making these participants MIPS APMs only.
    - Track Three will be for all other RO participants who will not be considered an Advanced APM or MIPS APM.

CMS estimates that on net, the Medicare program would save $150 million over the 5-year model performance period, which is a modest decrease from the anticipated $160 million in savings anticipated in the 2022 proposed rule.

CMS estimates that, on average, Medicare payments to Physician Group Practices will increase by 6.3 percent, and Medicare payments to Hospital Outpatient Departments will decrease by 9.9 percent over the duration of the model demonstration period. The shifts in payment are due to the site-neutral payment methodology that the RO Model seeks to test, which increases PGP Medicare FFS payments and decreases HOPD Medicare FFS payments. These estimates do not include changes to the Clinical Labor Price inputs included in the 2022 Medicare Physician Fee Schedule (MPFS) final rule. According to the final rule, the clinical labor price input updates would result in an increase of 10.2 percent for PGPs and a decrease of 11.3 percent for HOPDs over the lifetime of the RO Model.

The concerns of the radiation oncology community were largely ignored in the final rule. AAPM believes the RO Model may seriously jeopardize access to radiation therapy for patients served by practices mandated to participate in the model. AAPM is working closely with ASTRO and other stakeholders to ask Congress to intervene before the demonstration model begins on January 1st.

For additional information, visit the Center for Medicare and Medicaid Innovation (CMMI) RO Model website.

Medicare Physician Fee Schedule

CMS released the 2022 Medicare Physician Fee Schedule (MPFS) final rule on November 2, 2021. The MPFS specifies payment rates to physicians and other providers, including freestanding cancer centers. It does not apply to hospital-based facilities.

CMS finalized its proposal to update the clinical labor pricing for 2022, in conjunction with the final year (year 4 of the transition period) of the medical equipment and supply pricing update. CMS believes it is important to update the clinical labor pricing to maintain relativity with the recent equipment and supply pricing updates.

Clinical labor rates were last updated for 2002 using Bureau of Labor Statistics (BLS) data and other supplementary sources where BLS data were not available. CMS recognizes that the BLS survey of wage data does not cover all the staff types, including Medical Physicists and Dosimetrists.

CMS proposed to use the 75th percentile of the average wage data for a Physicist as the crosswalk to update the Medical Physicist clinical labor type. In written comments to CMS, the AAPM advised that the BLS wage data for a Physicist is not equivalent or representative of a Medical Physicist, even at the CMS proposed 75th percentile labor rate.

In response to the proposed rule, the AAPM recommended an updated rate of $2.25 per minute based on the 2020 Professional Survey Report on salary data. CMS acknowledged appreciation of the additional wage data specifically for Medical Physicists and agreed that the BLS wage data for a Physicist is not representative of a Medical Physicist. The submitted AAPM data with a median salary of $205,838 for certified qualified Medical Physicists with a Masters or PhD degree yielded a rate of $1.65 per minute based on the CMS methodology. However, since CMS finalized a different fringe benefits multiplier, the final adjusted clinical labor rate is $2.14 per minute. Based on the AAPM's written comments and salary data, the Medical Physicist labor rate will be increased by 41 percent from the current rate of $1.52 per minute. This updated clinical labor rate also increased the rate per minute for the mixed staff type Medical Dosimetrist/Medical Physicist.

After consideration of stakeholder comments, CMS finalized the proposal to implement the clinical labor pricing update through the use of a four-year transition, with modifications. Rather than using the proposed BLS fringe benefits multiplier and the BLS mean wage data, in response to public comments, CMS will apply the BLS private industry fringe benefits multiplier for 2019 of 1.296 (1.366 multiplier in the proposed rule) and use the BLS median wage data for the majority of clinical staff types (not including medical physicists).

CMS isolated the anticipated effects of the clinical labor pricing update on specialty payment impacts by comparing the 2022 MPFS rates with and without the clinical labor pricing updates in place, including with both the fully implemented pricing update and the first year of a four-year transition. The estimated impacts for several specialties, including radiation oncology, reflect decreases in payments relative to payment to other physician specialties, largely due to the redistributive effects of the clinical labor pricing update. The services furnished by these specialties involve practice expense (PE) costs that rely primarily on medical equipment or supply items and therefore are affected negatively by the updates to clinical labor pricing. Since PE is budget neutralized within itself, increased pricing for clinical labor holds a corresponding relative decrease for other components of PE such as medical equipment and supplies. In the final rule, CMS revised the radiation oncology overall impact from this policy as minus 3.0 percent (over four years) and minus 1.0 percent for 2022 (year 1 of phase-in).

The 2022 MPFS policy changes result in estimated overall cuts of 6.75 to 7.75 percent to radiation oncology services. Given the 4-year transition to update clinical labor pricing, the 2022 estimated impact is a 4.75 to 5.75 percent payment reduction to radiation oncology. The reduction is associated with three specific actions:

1) The December 31, 2021 expiration of the Consolidated Appropriations Act established a 3.75 percent rate increase to the Conversion Factor in 2021. The expiration of the 3.75 percent increase to the conversion factor legislative provision for 2022 is a statutory change that takes place outside of budget neutrality.
2) A 1.0 percent cut associated with the final year of the pricing update to medical equipment and supplies.
3) A 3.0 percent cut associated with the update to the clinical labor price inputs, which will be phased in over a four-year period. CMS estimates the impact of the clinical labor pricing update in 2022 (year 1) is 1.0 percent.

Hospital Outpatient Payment System

The 2022 Medicare Hospital Outpatient Prospective Payment System (HOPPS) final rule, which provides facility payments to hospital outpatient departments, was published on November 2nd. The finalized policies and payments are effective January 1, 2022. This rule does not impact payments to physicians or freestanding cancer centers.

HEALTH POLICY AND ECONOMIC ISSUES REPORT, Cont.

CMS estimates an overall 2.0 percent increase in hospital outpatient facility payments in 2022. Radiation oncology-related Ambulatory Payment Classifications (APCs) have payment increases that range from 1.5 to 2.3 percent in 2022. Payment for medical physics consultation codes 77336 and 77370 assigned to APC 5611 have a pay increase of 2.1 percent. Due to the COVID-19 public health emergency, CMS used 2019 outpatient claims data to calculate 2022 payments. Typically, CMS would have used 2020 outpatient claims data to determine 2022 payments.

For 2022, CMS proposed to continue to assign CPT code 76145 (Medical physics dose evaluation for radiation exposure that exceeds institutional review threshold, including report (medical physicist/ dosimetrist)) to APC 5611 (Level 1 Therapeutic Radiation Treatment Preparation) with a proposed payment rate of $130.19.

In written comments to CMS, the AAPM disagreed with the assignment to APC 5611 and requested reassignment to APC 5724 (Level 4 Diagnostic Tests and Related Services) with a proposed payment rate of $943.96. CMS disagreed with the AAPM recommended APC noting that they have no claims data for this service and that APC 5724 is not an appropriate assignment based on clinical similarity or similar costs. However, based on their review of the service associated with CPT code 76145 and input from their medical advisors, CMS believes that APC code 5612 may be a more appropriate assignment for the code.

CMS reported that APC 5612 contains CPT code 77307 (Teletherapy isodose plan; complex (multiple treatment areas, tangential ports, the use of wedges, blocking, rotational beam, or special beam considerations), includes basic dosimetry calculation(s)), which is clinically similar to CPT code 76145 in that CPT code 77307 describes the work of a medical physicist and dosimetrist. Once CMS has claims data (anticipated for 2023 rulemaking), they will review the APC assignment and determine whether a change is necessary.

In summary, CMS reassigned medical physics code 76145 from Radiation Oncology APC 5611 (Level 1 Therapeutic Radiation Treatment Preparation) to 5612 (Level 2 Therapeutic Radiation Treatment Preparation) with a 2022 payment of $345.85, a significant increase from the current 2021 payment of $126.87.

Beginning in 2022, CMS designates standard clinical APCs, brachytherapy APCs, and New Technology APCs with fewer than 100 single claims that can be used for rate-setting purposes as Low Volume APCs. Under the Low Volume APC policy, the payment rates for these APCs would be set at the highest amount among the geometric mean, median, or arithmetic mean, calculated using up to four years of data, which for 2022 would be claims data from 2016 through 2019. This policy designates five brachytherapy source APCs Low Volume APCs under the HOPPS. ■

APC	APC Description	Geometric Mean Cost without Low Volume APC Designation	Median Cost	Arithmetic Mean Cost	Geometric Mean Cost	2022 APC Cost
2632	Iodine-125, sodium iodide solution, therapeutic, per millicurie	$26.04	$30.24	$38.52	$34.16	$38.52
2635	Brachytherapy source, High Activity, Palladium-103, greater than 1.01 mCi, per source	$44.37	$34.04	$43.53	$36.72	$43.53
2636	Brachytherapy linear source, Palladium-103, per 1 MM	$30.59	$24.78	$50.16	$36.43	$50.16
2645	Brachytherapy source, Gold-198, per source	$280.90	$61.85	$588.31	$131.86	$588.31
2647	Brachytherapy source, Non-High Dose Rate Iridium-192, per source	$275.13	$145.36	$196.38	$94.24	$196.38

APPROPRIATENESS REVIEW OF MEDICAL PHYSICS OLA QUESTIONS; AN ONGOING PROCESS

ABR NEWS Kalpana M. Kanal, PhD, ABR Trustee | University of Washington

It has been almost two years since the ABR implemented Online Longitudinal Assessment (OLA) for medical physicists. OLA is based on the concept of walking around knowledge. This is the knowledge that a typical medical physicist would need in order to provide general clinical medical physics (MP) services without having to access reference texts or consult with a colleague.

Each year, committees made up of MP diplomates write OLA questions that undergo extensive review before being used. Opportunities for diplomates to provide feedback and rate questions are built into the OLA software. The passing standard is criterion-referenced; OLA is not graded on a curve, nor is a diplomate's performance compared to that of their peers. The passing standard for each OLA question is established by participants who volunteer as question raters, and the aggregate rating of the question defines the passing standard, known as the Angoff value. Each diplomate participating in OLA can become a question rater and assist in setting the OLA passing standard.

In order to continually improve OLA questions, our OLA question review process was recently modified to include a statistical analysis of each question and its variant (except for nuclear medical physics, where no variants are given). In the near future, statistics for question writers will also be available. This information will be reviewed by the MP associate executive director (AED) with the discipline-specific MP trustees and the OLA question writing committee as appropriate to further improve the quality of the OLA questions. All steps in the process are discussed below.

Data Collection:

Statistics
Total Participating (N)
Item Difficulty (Pvalue)
% of Question Declines (% Decline)
Average Participant Ranking (Angoff)
Number Comments Recieved (% Commented)
Average Relevance Rating (Relevance)

Twitter: @KalpanaKanal

Email: kkanal@UW.edu

The ABR collects statistics on all OLA questions. Questions whose performance is not optimum are reviewed and considered for editing or removal.

For each question, the following statistics are collected:

Here is a screenshot of an example OLA item (note that in this screenshot, the values labeled "% Declines" and "% Commented" are actually expressed as decimal fractions):

N Value	Pvalue	% Declines	Angoff	% Commented	Relevance	Question ID
705	0.84	0.03	0.95	0.00	4.42	2097480
680	0.79	0.03	0.93	0.01	4.42	2097479

N Value	PValue	% Declines	Angoff	% Commented	Relevance	Variant ID

Review Process:

General trends in the statistics are examined, and problem items are identified and reviewed. Problem items are identified by the P value of the question, the Angoff value, the number of comments received, the frequency of the responses that differ from the key, and the relevance of the question. If the P value is too high, that may indicate the question is too easy, and if the P value is too low or below the Angoff value, that may indicate the question is challenging or not phrased correctly, leading to difficulty in interpretation. Problem items are discussed with the committee, and question changes are made as appropriate for future use. Question changes may include modifying the question or removing it from the OLA pool. If the feedback received is about a diplomate's practice – e.g., a diplomate saying "I don't do this in my practice" – the original question would not necessarily be modified. MP OLA assessment is not offered at a granular practice level, i.e., it is not customized to a diplomate's clinical practice (see AAPM newsletter article on OLA granularity). This review process is in the early stages and still is being fine-tuned.

Question writer statistics:

It is also possible to get similar statistics for each question writer. Collecting and reviewing these statistics is in its infancy, but we believe once this information is available, it will provide useful feedback to the question writers. We expect they will review the performance of their questions and the comments received from OLA participants so they can improve the quality of the questions they write in the future.

The ABR is continually improving the process of reviewing the statistics and feedback on each OLA question and using it to improve the questions. This process is done annually to introduce questions in the OLA administration. OLA committees have completed the preparation of questions for 2022.

At the time of this writing, the following MP OLA statistics are available:

- Over 3,400 diplomates (99.5%) have answered at least one OLA question, and OLA questions have been presented and answered 466,000 times.
- 49% of participants have agreed to serve as OLA question raters.
- Fewer than 5% of OLA questions have been declined.
- The average response time for 1-minute questions is 29 seconds and for 3-minute questions is 60 seconds.
- 94% of participants have completed their 2021 OLA annual progress requirement.

The MP trustees, governor, and AED welcome comments and questions about OLA and thank all participants for their feedback.

Please contact us at information@theabr.org ■

ACR ACCREDITATION & MORE: INFO FOR MEDICAL PHYSICISTS

UPDATES FROM ACR HQ Dustin A. Gress, MS | Senior Advisor for Medical Physics

Attention All Phantom Manufacturers!

I realize that our industry partners are not typically the audience most interested in this column, but we nonetheless figured it was best to include this invitation in as many places as possible:

The American College of Radiology is seeking phantom manufacturers interested in immediately producing and selling the ACR MRI Medium Phantom. Details for producing and selling the Large and Small Phantoms will follow in the near future.

If interested in producing and selling the ACR MRI Medium Phantom, please email me and Cynthia Davidson to request phantom specifications and schematics. After hearing back from ACR, the process will require the submission of two (2) phantoms, built to the specifications provided, for evaluation. Once approved, the manufacturer may begin marketing and selling the phantom as the "ACR MRI Medium Phantom."

Do not hesitate to get in touch if you have any questions. We look forward to hearing from you.

Joint Statement

Many of you are probably aware, but it's worth repeating that AAPM, ACR, and HPS released a joint statement back in August 2021, which was quickly endorsed by RSNA. The statement clarifies the evidence-based position and consensus of the organizations that medical imaging exams should be ordered for clinical reasons, and that exam ordering should not be based on past radiation exposures. Several other organizations also endorsed the statement in relatively short order, including Image Wisely®, co-chaired by **Beth Schueler**, PhD, FAAPM, FACR, and Diana Litmanovich, MD, FNASCI. ACR's press release can be found here.

Know Any Radiology Practices That Want to "Test Drive" AI?

As published on acr.org in November 2021, radiology practices can now register "to take part in the next-generation American College of Radiology Data Science Institute® artificial intelligence (AI) federated learning program hosted on the AI-LAB™ platform.

"This free, vendor-neutral toolset allows users to 'test drive,' develop and train AI algorithms at their institutions using local patient data. With federated learning, registered sites soon can participate in multi-site algorithm creation while allowing their data to remain safely on their own servers. These sites will have access to both the community-created models and anonymized performance benchmarks so that they can understand performance of the

Twitter: @DustinGress

Email: dgress@acr.org

In each issue of this Newsletter, I will present information of particular importance or relevance for medical physicists. You may also check out the ACR's accreditation web site portal for more accreditation information and QC forms. A big THANK YOU to all of the other staff that keep ACR programs running and assist with creating the content in this column.

ACR recognizes the value of engaging our younger and incoming generations of medical physicists. Applications for the Medical Physics Graduate Student Scholarship are due December 11. The Morin Fellowship (for medical physics residents and fellows) application period will open soon. We look forward to again receiving applications from excellent candidates for both awards.

algorithm produced by the greater clinical community to one that is fine-tuned to their own site's data. This process will help them tune their own AI implementations to meet clinical needs."

Taking additional content directly from the AI-LAB™ platform site: "Creating an artificial intelligence (AI) model for a healthcare application which works well at multiple institutions typically requires a large collection of training data acquired from varied sources. Obtaining such large and varied healthcare training datasets can be difficult given the sensitive nature of medical data. Beginning in early 2022, AI-LAB users will be able to participate in federated learning (FL) through AI-LAB to help mitigate these issues. FL enables data from multiple institutions to be used for AI model training without data leaving institutional firewalls. This is accomplished by sharing AI models, not sensitive data, with participating institutions. As the COVID-19 pandemic is still ongoing globally, the inaugural AI-LAB FL experiment will aim to create a COVID-19 classification model which has robust performance across multiple institutions.

"Participating in AI-LAB FL experiments will require an on-prem ACR Connect installation or a secure ACR-Connect instance in the cloud. To participate in an FL experiment, institutions will be required to create and validate a relevant dataset using ACR-Connect Data Manager. To join an AI-LAB FL experiment, a designated point of contact will select to join the FL experiment on a scheduled date and time. From there, the experiment will be automated for institution participants.

"Behind the scenes, an ACR central server will pass a base model to the ACR Connect instance at each participating institution. At each institution, the base model will then be trained on the previously prepared local dataset to create a new model. New models from each institution will be passed back to the ACR central server for aggregation. The process of aggregation will create a single model, which will be used as the base model in the next round of training. This process will be repeated many times to create a final FL model on the ACR central server, as well as a local model at each institution finetuned on data from that institution."

Finding opportunities to assist our physician colleagues in the cautious and deliberate adoption of AI is of critical importance. Those interested may consider following the Data Science Institute® closely and taking advantage of the available resources.

Participate! Make a Few Extra Measurements and Contribute to a Research Study

Leon et al published in 2020 a paper demonstrating the feasibility of using a helical acquisition technique for estimating CTDI during medical physics annual surveys. I have partnered with those researchers and other interested colleagues to investigate the generalizability of their proposed measurement method. In other words, their results indicate that the helical measurement method can work, and we are now investigating whether the helical method can reliably work for everyone.

We encourage all our colleagues who practice in CT to add a handful of extra measurements to their CT testing routine and contribute data to the study. The more data we can collect for analysis, the more we will all learn from the results! You can download the Excel template with instructions here, and you can drag & drop your completed Excel templates at the study landing page.

When you submit data, you'll need to attest that your dosimetry equipment has been calibrated within 24 months of your measurements, and that you are not submitting PHI, facility information, or CT device identifiers. ■

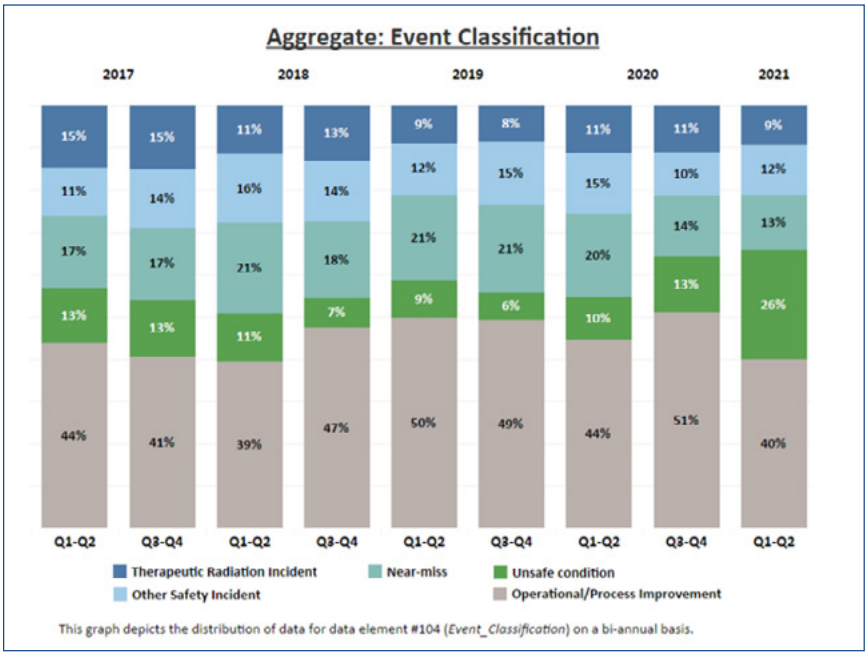
QUALITY IMPROVEMENT THROUGH ASTRO APEX ACCREDITATION

ASTRO QUALITY IMPROVEMENT Kamil Yenice, PhD | University of Chicago

The field of radiation oncology has seen an unprecedented expansion of new technology and innovations for the treatment of patients with cancer, such as combined immunotherapy and radiation therapy, biological and anatomical guided adaptive treatments, and the recent use of artificial intelligence.[1-4] While these advancements are progressively making radiation therapy a more effective agent against cancer, they also highlight the importance of standardization and quality improvement in daily practice. An obvious prerequisite of quality in any clinical program is safety.

The most recent Radiation Oncology – Incident Learning System (RO-ILS) aggregate data for the second quarter of 2021 reports nearly 1,000 events, which is similar to the data reported in the previous quarter, as shown in Figure 1. A review of the data categories for reported events over the last five years shows that 40-50% of radiation events continue to be related to the issues pertinent to operational/process improvement. Another study of historical RO-ILS data also demonstrates that errors do propagate all the way to treatment delivery with remarkable frequency.[5] While physicists play a key role in establishing a quality program and appropriate safety measures, addressing the operational and process improvement-related issues require a more comprehensive team approach within the radiation oncology setting.

Figure 1



Twitter: @kmyenice

Email: kyenice@radonc.uchicago.edu

APEx ties it all together with its team-oriented approach by bringing together everyone in the team, presenting a unique opportunity for physicists to work on safety and quality improvement processes and procedures collaboratively.

The American Society for Radiation Oncology's (ASTRO) APEx - Accreditation Program for Excellence® provides the ideal set of tools for continuous quality improvement (CQI) to achieve safe and high-quality care for all patients in a radiation oncology practice (ROP).[6] Safety is in the "DNA" of the APEx program structure as it was established in the framework of the seminal ASTRO publication: Safety is No Accident.[7] APEx ties it all together with its team-oriented approach by bringing together everyone in the team, presenting a unique opportunity for physicists to work on safety and quality improvement processes and procedures collaboratively. Let's look at how the APEx process achieves this.

APEx Process

Once an application is complete, the APEx process starts with the Self-Assessment, a key feature that separates ASTRO's practice accreditation program from the other accreditation programs. The APEx Self-Assessment is a preliminary review by the practice for the purpose of self-investigation and reflection, which allows the practice to identify and rectify shortcomings with respect to predefined APEx standards. Any deficiencies or non-compliances identified in the Self-Assessment can be addressed through process improvement or implementation of quality initiatives before the facility visit. The Self-Assessment consists of three sections: Medical Records Review, Document Upload, and Interview Preparation.

The **Medical Records Review** is an assessment of how information is documented in each patient's medical record. APEx doesn't dictate how or where information is documented but requires that standard practice is utilized so any piece of information will be found in the same place for every patient. This standardized approach promotes safe treatment and reduces the chance of information being missed. From a physics perspective, this is important in terms of the process so that the plan or treatment checks, patient specific QA, and other items are documented in a consistent manner. It also supports good checking procedures, reducing assumptions and improving efficiencies when looking for information.

The **Document Upload** section requires assessment of the ROP's quality management system, including policies and procedures, staffing and training documents, QA processes and other such documents. Assessing that documentation enables staff to follow standard procedures, which helps to prevent errors. The documents are externally reviewed, and an interim feedback report identifies the extent to which the practice is compliant with evaluation criteria and highlights deficiencies that should be addressed as part of quality improvement.

The third section is the **Interview Preparation**, which is a series of questions aimed at preparing the ROP for the facility visit by highlighting the types of questions asked by surveyors.

After the successful completion of the Self-Assessment, a facility visit is scheduled. This external review provides an opportunity for ROP to demonstrate the strength of their practice and any new processes that have been put in place. The surveyor team — one radiation oncologist and one medical physicist — splits up during the day to assess the relevant parts of practice.

Accreditation determinations are made by the objective review of blinded results by ASTRO's Practice Accreditation Committee, which is composed of board-certified radiation oncologists, medical physicists, dosimetrists, and therapists.

Quality Improvement in Physics

The APEx Standards form the framework for assessing compliance with the program. Overall, APEx has 233 requirements that are evaluated as part of the accreditation and cover all aspects of the radiation therapy service. Several physics focus areas include machine quality assurance, treatment planning and patient specific QA, supervision and competencies, information systems and process management. While the Machine Quality Assurance is among the highest performing areas for APEx-accredited facilities, proving the wide adoption of AAPM's guidance on QA practice and regulatory compliance, simulation equipment QA is one of the lowest performing components. In particular, the QA of motion management equipment in simulation is also a common low compliance item in APEx with an often-cited reason being that the equipment to check 4-D is expensive. A lack of process and/or oversight with the QA of equipment located outside radiation therapy for simulation (e.g., CT scanner located in diagnostic department) is another area of inconsistency.

Similarly, many facilities have not fully developed well-documented processes for the Process Management (reinstating clinical use of equipment, data deviations and trend analysis). Very few facilities have a documented process for reinstating the clinical use status of equipment after maintenance, repair or upgrade and rely on verbal communication methods. Based on APEx aggregate data, it is the third lowest rate of documentation in radiation oncology practices. APEx data also shows that a review of the above data for trends is not consistently completed and documented.

One of the most serious radiation incidents that happened in the last decade was a radiation overdose to a patient receiving IMRT treatments that resulted in a fatality. The subsequent New York Times article brought public awareness to the detriments of technology.[8] One of the underlying issues in that incident and similar radiation events later was found to be the inter-connectivity and communication problems between systems, which prompted the AAPM/ASTRO sponsored IHE-RO initiative for integration of systems in radiation oncology.[9] While designing the APEx program, ASTRO took this safety issue as one of its core areas to be addressed and established specific standards that check the integrity of data transfer (DICOM transfers between systems, manual transfer of patient data, etc.). APEx requires compliance with these standards for assuring safety of patient treatments. Compliance in this ever-expanding computer technology domain remains an area of improvement for many facilities.

Another focus area of APEx is the documented communication specific to treatment planning. A treatment planning directive is documentation that guides the treatment planning process; it tells the physicist or dosimetrist what the radiation oncologist wants for each patient. A planning directive should be completed prior to the initiation of treatment planning. This also helps process efficiency; as every clinical physicist knows well, without a set of well-defined planning goals, the planning process can be a "moving goal post." This can potentially degrade the standard of care for all patients.

APEx also puts a special emphasis on overall QA performance of systems and procedures in addition to the functioning of individual components of a system; be it a machine QA process or a treatment process, it is important to measure the overall performance in a well-designed end-to-end test that can identify issues linking the interconnected systems. This is highlighted in numerous recent AAPM TG reports, and at least one of the recent serious RO-ILS safety events could have been avoided had there been appropriate E2E testing in place.

In summary, safety is a medical physicist's most crucial role in the clinic, or rather, it is indeed everyone's most important role. APEx makes this possible for everyone. ■

References

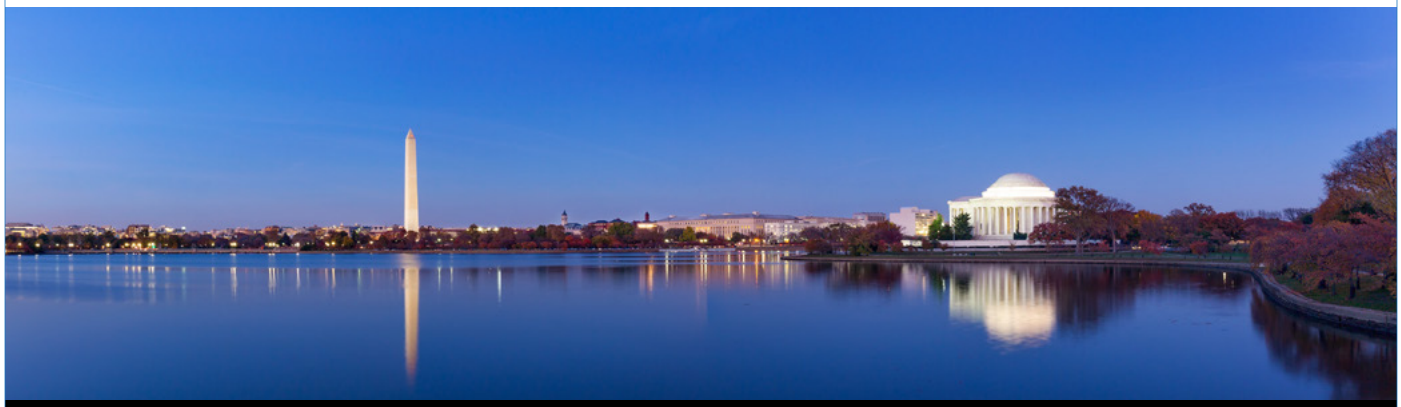
1. Demaria, Sandra, Encouse B. Golden, and Silvia C. Formenti. "Role of local radiation therapy in cancer immunotherapy." JAMA Oncology 1.9 (2015): 1325-1332.
2. Acharya, Sahaja, et al. "Online magnetic resonance image guided adaptive radiation therapy: first clinical applications." *International Journal of Radiation Oncology* Biology* Physics* 94.2 (2016): 394-403.
3. Huynh, Elizabeth, et al. "Artificial intelligence in radiation oncology." *Nature Reviews Clinical Oncology* 17.12 (2020): 771-781.
4. Pillai, Malvika, et al. "Using artificial intelligence to improve the quality and safety of radiation therapy." *Journal of the American College of Radiology* 16.9 (2019): 1267-1272.
5. Ezzell, Gary, et al. "Common error pathways seen in the RO-ILS data that demonstrate opportunities for improving treatment safety." *Practical Radiation Oncology* 8.2 (2018): 123-132.
6. Hong, David S., et al. "Accreditation Program for Excellence (APEx): A Catalyst for Quality Improvement." *Practical Radiation Oncology* 11.2 (2021): 101-107.
7. American Society for Radiation Oncology. (2019). Safety is no accident: A framework for quality radiation oncology care. https://www.astro.org/ASTRO/media/ASTRO/Patient%20Care%20and%20Research/PDFs/Safety_is_No_Accident.pdf
8. Walt Bogdanich, "Radiation Offers New Cures, and Ways to Do Harm" *New York Times*, 01-23-2010, https://www.nytimes.com/2010/01/24/health/24radiation.html
9. IHERO: https://www.aapm.org/IHERO/default.asp?od1n (Integrating the Healthcare Enterprise: https://www.ihe.net/)

AAPM 2022

JULY 10–14 | WASHINGTON, DC

64TH ANNUAL MEETING & EXHIBITION

CELEBRATING MEDICAL PHYSICS
TRANSFORMING HUMAN HEALTH



Reconnect with the global medical physics community
LIVE AND IN-PERSON
for five days of exciting content and engagement opportunities!

#AAPM2022 marks the long-awaited return to a ***live and in-person*** Annual Meeting promising to deliver outstanding scientific, professional, and educational content as well as much-needed time to reconnect with friends and colleagues — all in our Nation's Capital.

Featuring the theme of *Celebrating Medical Physics, Transforming Human Health*, #AAPM2022 will recognize the importance of coming together to share new ideas, innovative solutions, and the various ways advances in the field have improved patient outcomes changing lives worldwide.

Registering for in-person or virtual participation includes access to the daily live-streamed plenary session and on-demand content available 24 hours post-session.

IMPORTANT DATES:

- **March 9, 2022**
  Registration and housing available online
- **March 10, 2022**
  Deadline to submit proffered abstracts
- **April 19, 2022**
  Authors notified of proffered abstract disposition

AMERICAN ASSOCIATION *of* PHYSICISTS IN MEDICINE

#AAPM2022 | aapm.me/annual

2022 ANNUAL MEETING UPDATE

ANNUAL MEETING SUBCOMMITTEE REPORT

Ingrid Reiser, PhD | University of Chicago

Written on behalf of the AMSC

Just after Thanksgiving, RSNA was in full swing as an in-person event. That meeting was well managed: Proof of vaccination was required to obtain a badge. Testing and contingency plans were in place. Masks were worn throughout. And with that, it was exciting to be able to see colleagues and friends fully in 3D — listening to presentations in a real session room, sitting next to a *real* person (albeit the seat over) — and last but not least, having real conversations with a bunch of people (has this ever worked on Zoom or Spatial Chat?!?) Similar to those of you who attended ASTRO earlier this Fall, this meeting was a refreshing reminder of how an in-person meeting can be. Different now: Not everyone chose to attend in-person or was able/allowed to do so. On the horizon: Concerning news from Europe and South Africa.

What does this mean for the AAPM Annual Meeting? We are currently planning to hold an in-person meeting in Washington, DC, July 10–14. If the Summer of 2021 holds any clues, this should be doable with the proper precautions in place. If the Fall of 2021 holds any clues, always expect the unexpected.

Therefore, we are developing a new blueprint for 2022. The emphasis is on in-person attendance — we, the meeting organizers, feel that this is key to the meeting atmosphere. The goal is to have speakers on the podium rather than the computer screen, so we can have these invigorating discussions after the session, spilling into the hallway as the next session starts.

However, we understand that not everyone wants to or will be able to attend in-person, and there will be options for remote attendance. For those who choose to attend virtually, please do not expect reduced registration fees — remote viewing carries a double price tag: that of the brick-and-mortar in-person meeting, plus the virtual meeting platform! (RSNA charged extra for the virtual feature.) I've written about this before — the price tag of a virtual meeting platform can be higher than a convention center rental!

I know you will read this after the holidays. I hope you had a restful and safe holiday season in the midst of your loved ones. ■

Email: ireiser@uchicago.edu

Other Meeting Logistics:

With the in-person meeting, please be prepared that we will be instating a $50 e-Poster fee — similar to the cost of printing a hardcopy poster. During the last few meetings when e-Posters were first introduced, AAPM has supported the poster display at the cost of ~$100 per poster (display monitor rental, poster viewing platform). The e-Poster fee will help offset that cost.

As we go into Winter/Spring, we have an exciting program planned — as always on a wide array of topics. For the first time, we will have multi-disciplinary education sessions, bringing together therapy and imaging physicists into the same room, learning with and from each other!

AMERICAN ASSOCIATION of PHYSICISTS IN MEDICINE

DO YOU HAVE YOURS?

AAPM MERCHANDISE

Have You Noticed?

More and more AAPM Members are wearing this custom designed, signature merchandise with pride. Isn't it time you ordered yours?

Every creation is handmade to your order preference. These distinctive, high-quality pieces are made in America. Choose from:

- Neck ties
- Bow ties
- Scarves [rectangular, square, and infinity]
- Pocket squares

Shop for yourself, team members, or purchase as a gift for your favorite medical physicist.

ORDER YOURS TODAY!

www.aapm.org/merchandise

Because AAPM branded merchandise is made to order, please allow 4-5 weeks for delivery.

UPDATES FROM IROC HOUSTON IN 2021

IROC HOUSTON REPORT Stephen F. Kry, PhD | The University of Texas MD Anderson Cancer Center

This past year of 2021 was another year of defining new norms and working through them. This was true at the IROC Houston QA office which saw several changes:

Major Personnel Changes Occurred

- At the beginning of 2021, **David Followill, PhD**, retired as the IROC Houston director and IROC PI. He left after 28 years of supporting clinical trials and working tirelessly to ensure the quality of radiation oncology. His outstanding leadership and dedication will be missed.
- The roles of IROC Houston director and IROC PI were taken on by **Stephen Kry, PhD**, who has worked full time for IROC Houston for the past decade and served as its associate director.

COVID-Times Continued

- In wonderful news, patient accrual to clinical trials in 2021 showed no decrease over pre-pandemic levels, and institutional credentialing was just as strong. It is a wonderful testament to perseverance that the radiation oncology community was able to undertake full participation in trials during these times that remain difficult. At IROC Houston, more than half of our staff remain completely remote, and in that capacity, were able to meet the needs of the community.
- The only substantial restriction that has faced IROC Houston is the inability to travel. This is most critical for baseline proton approval, for which NCI guidelines have always required an on-site audit. Because we have been unable to travel, IROC and NCI created a joint conditional approval process. In this process, all steps that can be completed remotely are done remotely, and the site visit must be completed when travel resumes. The conditional approval process has been very successful, with six institutions completing this process. As we launch into 2022, travel has resumed, so we will be completing the on-site portion of the conditional audits and restarting our traditional site-visit process.

Technical Changes You May Have Noticed

- Historically, dose reporting in the NCI clinical trial network has been based on a dose-to-muscle framework. IROC's reported doses were therefore based on dose-to-muscle, and output checks and phantom results were reported relative to this medium. In more recent years, output checks were reported to the medium of specification by the institution: if the institution calibrated their linac as dose-to-water, IROC compared to a measurement in water; if the institution calibrated their linac as dose-to-muscle, IROC compared to a measurement in muscle; phantoms remained dose-to-

Email: sfkry@mdanderson.org

Looking into 2022, the IROC Houston office remains prepared to serve the radiation oncology community and adapt to the changing landscape of medical physics practice. Keep your eyes out for new programs that are currently being developed!

muscle. Moving forward, we have now adopted and begun implementing the AAPM TG-329 standards for medium of dose reporting. Using this framework, machine calibration should be done in terms of dose-to-water, while dose calculations in the treatment planning system should yield dose-to-muscle. Therefore, output checks will no longer be compared to the medium used by the institution but will be compared to a dose-to-water measurement. Phantom results, which are based on the treatment planning system, will continue to be reported in terms of dose-to-muscle. One complicated scenario is output checks for Tomotherapy and Gamma Knife; despite being called output checks, the output in these cases is determined in the treatment planning system, and therefore these calculations are compared to measurements in muscle.

- On phantom reports, you may also have noticed that the ROI used in the gamma analysis has changed. Historically we used the geometrical film area to define this ROI. We have now implemented a dosimetric instead of a geometric threshold to better focus our evaluation on the higher dose region. Our threshold is determined as the lower dose limit, which increases confidence in our film calibration curve. It is based on dose but is approximately 30% of the prescription dose. This change makes us more consistent with the AAPM TG-218 report. It does tend to reduce the percent of pixels passing gamma when there is dosimetric disagreement in phantom irradiation, but usually, this change is small and better describes the actual quality of agreement. ■

RSNA® AMERICAN ASSOCIATION of PHYSICISTS IN MEDICINE

Collaboration Between Radiologists, Medical Physicists Leads to Innovation

RSNA 2021 Opening Ceremony | Sunday, November 28, 2021
AAPM President ***James T. Dobbins III, PhD*** *offers words of welcome during the RSNA 2021 Opening Ceremony*

RSNA/AAPM Symposium | Thursday, December 2, 2021
"Together We Can Make a Difference" (left to right) ***Cynthia H. McCollough, PhD****; RSNA President,* ***Mary C. Mahoney, MD****; AAPM President,* ***James T. Dobbins III, PhD****;* ***Joel G. Fletcher, MD****;* ***Guang-Hong Chen, PhD***

MPLA CASE STUDIES: AN EDUCATIONAL TOOL TO DEVELOP LEADERSHIP SKILLS

MPLA SPOTLIGHT
Samantha Simiele, PhD | University of Texas MD Anderson Cancer Center

MPLA Medical Physics Leadership Academy
EMPOWER. INSPIRE. LEAD.

(Written on behalf of the Medical Physics Leadership Academy Marketing and Publicity Subcommittee with contributions from **Dongxu Wang, PhD** *and* **Jennifer Johnson, PhD**.*)*

Case studies are educational articles written to provide detailed information about an individual experience. In medicine, these studies are written to describe a specific clinical case. In business, these studies are an educational tool designed to encourage critical thinking, discussion, and the development of leadership skills. Historically, case studies have been used in MBA programs to facilitate student learning of key objectives, and only recently, through the efforts of the MPLA, have been developed and made available for medical physicists for the purpose of leadership education.

Case studies as a leadership development tool were introduced to the medical physics community in 2019 at the AAPM Spring Clinical Meeting. The session was successful and demonstrated case studies could be used by medical physicists, and this pilot experience motivated the creation of the MPLA Cases Subcommittee. This is one of the subcommittees under the MPLA umbrella and is led by Drs. **Dongxu Wang** (Chair) and **Leonard Kim** (Vice-Chair). The decision to form the subcommittee was made during the May 2019 MPLA retreat following the Spring Clinical meeting. Volunteers were solicited through internal inquiries within the MPLA community and committee classified postings. The subcommittee was formed in September 2019 following the AAPM Annual Meeting and has undergone some membership changes, including the addition of several residency program directors and individuals with formal creative writing experience. Today the subcommittee has 17 members, 12 voting and five nonvoting.

This group is responsible for developing and maintaining a case library for the MPLA and its program offerings in business administration and leadership development. To accomplish this charge requires the writing and dissemination of cases as well as providing guidance and support for users to properly implement the acquired skillset in their workplace or training environments.

Email: sjsimiele@mdanderson.org

The process of writing a case requires a delicate balance of creative writing and emphasis on at least one of the MPLA curriculum items. The subcommittee developed a standardized workflow to facilitate this process. Authors select an educational theme for the case and draft the piece. Once satisfied with the story, the authors submit the case to the subcommittee for review and editing. The subcommittee assesses the case based on creativity and clarity of the educational theme. The facilitator's note is drafted while the case is being developed. The facilitator's note provides commentary, key discussion points, and potential solutions to the described situation. The notes can be used by an individual for self-study or by the facilitator of a group training session.

Each case is designed and written to address specific leadership skills. The audience is case-specific and varies between cases. The variety in topics allows readers at all stages of their careers to benefit. Cases specific to graduate students, residents, and both junior and senior faculty members have been published or are in the development process. Efforts are underway by members of the subcommittee to implement the published cases in graduate and residency training programs to gather feedback and identify areas for improvement.

One challenge the subcommittee faces is deciding just how much controversy the community is comfortable digesting. For example, the second case study published by MPLA, "A junior physicist attempts to improve radiotherapy workflow [1]" was intentionally written to incorporate unconscious bias. The bias was noted by reviewers, both internal and external to the MPLA, and resulted in a considerable discussion. The question of what level of controversy to leave in an article is challenging. Readers are encouraged to contact the MPLA Cases subcommittee for a copy of the facilitator's notes if questions are related to content. The subcommittee reminds readers that the topics discussed in the cases are representative of real challenges faced in the workplace. These complex topics are being written about because they exist, and additional training is needed in these areas.

The authors of the case studies expect the content to be relatable. This is because the ideas for the cases come from the experiences of the AAPM membership. Some of the published cases are modified versions of situations experienced by the case writers, while others are from conversations between the writers and their colleagues, and others are topics solicited from the membership. All conversations are treated confidentially and shared only with permission, and the experiences are modified to maintain anonymity prior to publication. The cases are meant to teach methods and theories to analyze situations and find solutions. The authors hope readers realize their workplace challenges may not be unique and that a solution, even if imperfect, can be achieved.

Readers can find the published case reports in the *Journal of Applied Clinical Medical Physics (JACMP)*. The first case study reports appeared in the March 2021 issue of *JACMP* as part of a mini-series. The mini-series consisted of two Letters to the Editor introducing case studies [1] and providing information about the case-writing process [2], followed by two case studies published as Education Articles [3,4]. Since the publication of the mini-series, two additional case reports have been published [5,6], with four more under development. Absent from the publications, with the exception of Case 1, are the facilitator's notes. Readers are invited to email the SC at 2022.MPLACA@aapm.org to receive a copy of these notes and provide feedback.

MPLA encourages you to follow the reference links to explore this educational tool. We hope you will find a case that supplements your next graduate course, resident journal club session, or faculty retreat. ■

References

1. Introduction of Medical Physics Leadership Academy (MPLA) case studies. https://aapm.onlinelibrary.wiley.com/doi/10.1002/acm2.13187
2. A brief guide to writing a medical physics leadership case https://aapm.onlinelibrary.wiley.com/doi/pdf/10.1002/acm2.13186
3. MPLA Case 1: https://aapm.onlinelibrary.wiley.com/doi/epdf/10.1002/acm2.13185
4. MPLA Case 2: https://aapm.onlinelibrary.wiley.com/doi/epdf/10.1002/acm2.13188
5. MPLA Case 3: https://aapm.onlinelibrary.wiley.com/doi/epdf/10.1002/acm2.13334
6. MPLA Case 4: https://aapm.onlinelibrary.wiley.com/doi/epdf/10.1002/acm2.13211

EARLY CAREER INVESTIGATOR IN IMAGING TRAVEL AWARD RECIPIENTS' EXPERIENCES

AAPM TRAVEL AWARD REPORT

Megan Lipford, PhD | Wake Forest University School of Medicine
Adam Wang, PhD | Stanford University

M. Lipford

A. Wang

It seems like a lifetime ago, but back in February 2020, we were both awarded the Early Career Investigator in Imaging Travel Award from AAPM, sponsored by the Science Council. This secured our spots as members of the 2020 Council of Early Career Investigators in Imaging (CECI^2), a professional development program for early career investigators in medical imaging helmed by the Academy for Radiology & Biomedical Imaging Research (the Academy). A total of 35 early career investigators from across the country were a part of this program, a mix of physician-scientists and PhD researchers. AAPM is a founding member society of the Academy, an advocacy group bringing together radiologists and biomedical imaging researchers, supporting its mission since 1995. Under normal circumstances, participation as members of the CECI^2 Class of 2020 would involve travel to Washington, DC and, over the course of three days, meeting with Members of Congress to advocate for robust NIH and NIBIB funding, meeting with NIH Program Officers to learn about NIH funding and grantsmanship, participating in the Medical Imaging Technology (MedTech) Showcase to exhibit our research to congressional staff and Academy members, and finally participating in the Academy Leadership Research Roundtable, an annual discussion with industry partners, professional societies and government agencies. Due to the pandemic, the events were delayed until September 2021, becoming a hybrid in-person and virtual event.

In light of this delay, the Academy quickly pivoted to provide many more virtual events than offered to CECI^2 classes of the past. We had the chance to attend more than 15 "Ask Me Anything" events where senior academicians provided professional advice, including leadership from the ACR and NIH and many Radiology Department Chairs. These new events became a very popular part of the CECI^2 program and will be adopted for future years. We also had a dedicated Slack channel to message each other with questions, ideas and share challenges and successes. Through these interactions, our CECI^2 class got to know each other and developed a peer support network.

Twitter: @WakeForestRads
@StanfordRad

Email: mlipford@wakehealth.edu
adamwang@stanford.edu

The Council of Early Career Investigators in Imaging Recipients (2014-2021) In 2014, The Academy for Radiology & Biomedical Imaging Research Academic Council offered 12 travel awards for early career investigators from Member Departments to attend the annual Coalition for Imaging and Bioengineering Research (CIBR) Medical Technology Imaging Showcase in Washington DC. These awards created a unique opportunity for investigators to learn first-hand how to advocate for imaging research, discuss research with policymakers and visit the National Institutes of Health (NIH). Each travel awardee meets with NIH Directors and staff, their Congressional Representatives, and can display a research poster they design from their home Institution during the Showcase. Additionally, there are incredible networking opportunities with Academic Chairs, patient advocacy leaders, and Congressional staff. Each year, new early career investigators are selected and become a part of this prestigious Academy tradition.

AAPM TRAVEL AWARD REPORT, Cont.

During a two-week period in September 2021, we attended virtual events arranged by the Academy, including a presentation on grantsmanship from the NIBIB, small group meetings with NIH Program Officers, individual meetings with Congressional staffers from our respective states and districts, and the Academy Leadership Research Roundtable. The Roundtable featured many Academy leaders and the entire CECI^2 class discussing big-picture ideas. This year's topics were the Diagnostic Cockpit, point of care technologies, focusing on the point of care ultrasound, and theranostics. With more than 20 people in person and another 80 joining virtually, it was interesting and informative. Rarely is time set aside for so many people to discuss large-scale issues!

The meetings with Congressional staffers were also a very valuable experience, and in some cases, the Members themselves joined, including Congresswoman Anna Eshoo (D-CA), who is a leading and longtime supporter of the Academy and NIH. Though most of the staffers we met specialize in healthcare, they don't all have a science background and were very interested to learn about the research happening in their states and districts. We were also able to advocate for the continued solid support of NIH funding by explaining how impactful it is to our work and careers, as well as healthcare in general and the economy more broadly. Finally, as we also offered ourselves as resources in the future, these meetings were just the beginning of a relationship with the staffers who can now reach out to us if they have questions on issues related to medical research or healthcare.

Despite not traveling to Washington, DC for these events, it was a great experience and opportunity to be a part of the CECI^2 Class of 2020-2021. We owe an enormous thanks to the AAPM Science Council and the AAPM Education & Research Fund for sponsoring our participation in this program and the Academy for organizing the many valuable CECI^2 activities. We look forward to meeting the next CECI^2 Class of 2022 and wish them much success for (hopefully) their next in-person MedTech in DC! ■

EXPANDING HORIZONS: A BRIDGE BETWEEN MEDICAL PHYSICS AND PATHOLOGY

EXPANDING HORIZONS TRAVEL GRANT REPORT

Peter Jermain, MS | University of Massachusetts Lowell, and Massachusetts General Hospital

Written on behalf of Unit No. 63 - Expanding Horizons Review Board [UN63]

My name is **Peter Jermain**, and I'm a medical physics PhD student at the University of Massachusetts Lowell and physics assistant in Radiation Oncology at the Massachusetts General Hospital (MGH). In this Newsletter report, I relay my experience as a 2021 recipient of the AAPM Expanding Horizons Travel Grant (EHTG). The EHTG program sends medical physics graduate students and trainees to conferences not directly related to medical physics in an effort to increase our exposure to different areas of research.

The prospect of going to a research conference I haven't previously attended was very exciting. I know that medical physicists play an important role in radiotherapy, diagnostic imaging, and nuclear medicine. However, when applying to the EHTG program, I remembered that our education and training allow medical physicists to contribute outside of radiation oncology and radiology departments.

For example, the field of biomedical applications of optics and photonics is expanding rapidly. Our understanding of radiation interactions and transport positions us well to innovate in this emerging field. My doctoral research under Professor Anna Yaroslavsky, director of the UMASS Lowell Advanced Biophotonics Laboratory (ABL), is focused on developing novel optical techniques for cancer detection.

One of our projects at the ABL is "Quantitative Optical Cytopathology of Cancer." The current standard of care for biopsy assessment requires pathologists to identify cancer under the microscope by inspecting morphology visually. This is challenging because benign lesions often present atypical features that mimic carcinoma, and the result is widely varying diagnostic accuracy between institutions. Methylene blue (MB) is a common cytological stain approved by the United States FDA for human use. Our approach uses objective measurements of fluorescence polarization (Fpol) of MB to classify biopsy samples as benign or malignant. Previous work in our group has demonstrated that MB Fpol is an accurate cancer biomarker because it's sensitive to mitochondrial dysfunctions in malignant cells. Our next step is to learn what cancer types will benefit most from this technology (e.g., in thyroid cancer, about 30% of cytological evaluations yield indeterminate outcomes).

Twitter: @peter-jermain

Email: pjermain@mgh.harvard.edu

EXPANDING HORIZONS TRAVEL GRANT REPORT, Cont.

Another project at ABL is focused on skin cancer, the most common malignancy in humans. Identifying lateral boundaries of cutaneous tumors is challenging for dermatologic surgeons because the lesions usually exhibit subtle contrast relative to adjacent healthy skin. A new technology developed by our team called optical polarization imaging (OPI) can map tumor-induced disruptions in the dermal collagen network and improve skin cancer boundary recognition. A collaboration between the UMASS ABL and MGH Dermatology recently demonstrated the feasibility of this non-invasive imaging modality to guide skin cancer surgery accurately. Now we need to figure out how to optimize the integration of the technology into the current skin cancer treatment workflow.

The AAPM EHTG provided an opportunity to explore some of these important questions for my research. The American Association of Cancer Research (AACR) is the world's largest professional organization dedicated to cancer research, having more than 48,000 members worldwide, including clinicians, researchers, and cancer advocates. The association publishes nine leading peer-reviewed journals, including *Cancer Research* and *Clinical Cancer Research*. Using the travel grant, I was able to attend the 2021 AACR Annual Meeting (held virtually due to the Covid 19 pandemic). I chose this event because it's the society's flagship conference, showcasing new and exciting breakthroughs in cancer science, medicine, research, and advocacy.

The sessions and webinars I attended at the AACR Annual Meeting contributed several ideas to my research. I learned about the evolving role of pathology in cancer research, biologic and molecular imaging using machine learning, and other trends in the physical sciences approach to cancer diagnostics and therapy. Several presentations highlighted the increased use of radiomics and AI as a future direction for objective disease detection. In addition, hearing directly from physicians and clinical scientists about current challenges in the diagnostic testing ecosystem was invaluable because this type of feedback could guide the development of key features of our Fpol imaging and OPI technology. In between events, it was a pleasure to network with multidisciplinary professionals, engage with other attendees at various stages of careers, and participate in the social media hype surrounding the conference. Another advantage of the virtual format is having access to all content on-demand for one full year!

My favorite presentation was called "Radiomics and machine learning of breast cancer in diagnosis and therapeutic response," as it demonstrated the potential synergy between medical physics and pathology. It was delivered by **Maryellen Giger, PhD**, who is the A.N. Pritzker Distinguished Service Professor of Radiology at the University of Chicago, a past president of the AAPM and SPIE, and thought leader in the fields of computer-aided detection (CADe) and computer-aided diagnosis (CADx) of disease using artificial intelligence. "Virtual biopsy" is a technique where images of breast lesions are analyzed by a computer to yield a signature estimating the likelihood of malignancy. There is increasing utilization of this technology to evaluate breast pathology, breast MRI, and mammography images.

My long-term career goal is to complete a medical physics residency, attain board certification from the ABR, and bring some lateral perspectives from my background in optics to medical physics clinical practice. Attending the AACR Annual Meeting was pivotal for my research. It increased my understanding that we can leverage the synergy between medical physics and other fields such as pathology to improve outcomes for patients. I would like to thank the AAPM Workisng Group on Student and Trainee Research (WGSTR) for the privilege to attend this event and my doctoral advisor Anna Yaroslavsky, PhD, and mentor **Mahadevappa Mahesh, MS, PhD** for guidance in putting together this report. Please feel free to contact me via email or tweet if you have questions. ■

DIAGNOSTIC RADIOLOGY RESIDENT PHYSICS CURRICULUM: SURVEY REPORT

REPORT FROM THE DIAGNOSTIC RADIOLOGY RESIDENT PHYSICS CURRICULUM WORKING GROUP

The Diagnostic Radiology Residents Physics Curriculum (DRRPC) was first published in 2007. Since then, it has been reviewed and updated to maintain its relevance and incorporate many advancements in imaging technology that have occurred. The latest edition was published in 2018. The purpose of this curriculum is to outline the breadth and depth of medical physics knowledge underlying the practice of diagnostic radiology that will aid a practicing radiologist in understanding the strengths and limitations of the tools in clinical practice.

Currently, this curriculum is being reviewed by the Diagnostic Radiology Resident Physics Curriculum Working Group (DRRPCWG). To understand the current awareness and use of the curriculum and gather feedback and input from AAPM members regarding content and topics for future development, the DRRPCWG conducted a survey. The survey was approved by AAPM EXCOM and sent to members who indicated any percentage of their efforts in radiology, NM, MR, rad safety/health physics, or ultrasound. The survey period was from September 1 to October 4, 2021. 4,462 people viewed the survey during the survey period, and 418 responded. Of these, 178 completed the survey, with a completion rate of 42.85%. The average time was 5 minutes. 81.58% of the responses were from the USA and 4.07% from Canada.

This report updates members on the survey results and raises awareness of this curriculum. We include survey questions, response percentage, and comments/suggestions.

Q1: Do you use the diagnostic radiology (DR) resident physics curriculum to prepare or review your teaching materials?

Answer	Count	Percent
I was not aware of the curriculum	125	39.56%
I am aware of the curriculum and do not use it	48	15.19%
Yes, for diagnostic radiology residents	128	40.51%
Yes, for other trainees or staff	15	4.75%
Total	**316**	**100%**

If the responders chose Yes, two questions following Q1 were asked.

Q1A: Which component(s) of the curriculum do you find most useful?

Multiple choice, multiple options selectable

Answer	Count	Percent
Fundamental knowledge section	47	22.93%
Clinical application and problem-solving section	47	22.93%
Curriculum outline and scoring of topic importance	57	27.80%
Example Q & A	54	26.34%
Total	**205**	**100%**

Diagnostic Radiology Resident Physics Curriculum Working Group Members:

Jie Zhang, PhD (Chair)
Christina Brunnquell, PhD (Vice Chair)
Jon A. Anderson, PhD
Trevor J. Andrews, PhD
Richard H. Behrman, PhD
Bennett S. Greenspan, MD
Ping Hou, PhD
Kalpana M. Kanal, PhD
Hamid Reza Khosravi, PhD
Yun Liang, PhD
Megan E. Lipford, PhD
Adel A. Mustafa, PhD
Ashley E. Rubinstein, PhD
William F. Sensakovic, PhD
Sameer Tipnis, PhD

The purpose of this survey is to understand the current awareness and use of the Diagnostic Radiology Resident Physics Curriculum and to gather input from AAPM membership regarding content and topics for future development. This report includes survey questions, response percentage, and comments/suggestions. If you have any further suggestions, please feel free to reach out to us.

Overall, this survey provides some directions for the DRRPCWG with regards to updating the current curriculum.

REPORT FROM THE DIAGNOSTIC RADIOLOGY RESIDENT PHYSICS CURRICULUM WORKING GROUP, Cont.

Q1B: What approximate percentage of the topics in the curriculum do you cover?

Answer	Count	Percent
0-50%	15	14.15%
50-75%	26	24.53%
75-95%	42	39.62%
>95%	23	21.70%
Total	**106**	**100%**

Among 316 responses, approximately 45% use the curriculum for their teaching. Another 15% are aware of it but never use it. Approximately 40% were not aware of the curriculum.

Those who refer to the curriculum to teach indicate that all the components are almost equally useful. More than 85% of the users cover over 50% of the topics in the curriculum.

Other trainees for whom physicists use this curriculum in preparing teaching materials include radiologic and nuclear medicine technologists, cardiology fellows and residents, radiation oncology residents, physicians and clinicians, medical physics students in general (graduate and fellow), and physics associates.

Many other resources were mentioned to prepare for physics teaching of residents. These include RSNA Physics modules, ABR Core Exam Study Guide, various textbooks (e.g., The Essential Physics of Medical Imaging, Physics in Nuclear Medicine, Review of Radiologic Physics, and Nuclear Medicine Physics the Basic), NIIC-RAD (National Imaging Informatics Course – Radiology, for informatics teaching), Raphex, relevant Radiographics papers, ACR teaching files, NRC regulations and guidance documents, IAEA Training Course Series 47, and ABSNM Nuclear Medicine syllabus. Some teach residents based on their personal handouts and experience, while some mention that they collect general feedback from past residents on what topics were covered, refer to War Machine by Lionheart, or use various online resources.

Q2: Are there topic areas you feel the curriculum goes into too much detail for radiology resident education?

Answer	Count	Percent
Yes	39	29.32%
No	94	70.68%
Total	**133**	**100%**

Of 133 responses, approximately 30% think the curriculum goes into too much detail. The specific areas include but are not limited to basic science and physics, interactions, x-ray production, quantum material and energy states, radioactivity/atomic and nuclear structure, particulate radiation beyond electrons and positrons, general imaging, and informatics (statistics, not belonging to physics), 3D volume rendering and virtual fly-through (not physics), more complex imaging modality physics (CT and MRI), screen film, radiobiology, and antineutrinos.

A general comment suggested that a higher-level focus on physics but a more profound understanding of clinical applications, artifacts, optimization, etc., are warranted. Another observation was that the priority scoring is helpful but assigning scores should be reviewed to identify the most important topics for a practicing radiologist.

Q3: Are there topic areas you feel the curriculum does not go into enough detail or needs to cover more for radiology resident education?

Answer	Count	Percent
Yes	40	31.01%
No	89	68.99%
Total	**129**	**100%**

Contrary to Q2, about 31% of 129 responses felt that the curriculum needs to go into/cover more topics. These include MRI safety, advanced techniques (e.g., CBCT, parallel imaging, DWI, tissue-suppression and their principles behind CE-MRA, NM especially PET), Artificial Intelligence/Deep Learning/CAD (AI/DL/CAD), image segmentation, image artifacts and pitfalls, NM internal dosimetry/kinetic modeling, and ultrasound (e.g., the frequency dependence of the contrast between various key tissues). A couple of responders mentioned that radiopharmaceutical therapy should be included since there is a need to know how a radiologist and/or diagnostic imaging medical physicist would ever interface with radiation therapy. One suggestion was that the topics should emphasize identifying and fixing clinical practice problems such as artifacts, image quality issues, and radiation dose.

REPORT FROM THE DIAGNOSTIC RADIOLOGY RESIDENT PHYSICS CURRICULUM WORKING GROUP, Cont.

Q4: Do your radiology residents receive training in informatics?

Answer	Count	Percent
No	36	17.82%
Yes, from a physicist	64	31.68%
Yes, not from a physicist	43	21.29%
I don't know	59	29.21%
Total	**202**	**100%**

Informatics has become a significant part of radiology. Approximately 53% of residents receive training in informatics; however, only approximately 32% have physicists involved in informatics training.

Q5: Do your radiology residents receive training in image processing and/or AI?

Answer	Count	Percent
No	46	22.89%
Yes, from a physicist	75	37.31%
Yes, not from a physicist	16	7.96%
I don't know	64	31.84%
Total	**201**	**100%**

Here, we must point out that the question didn't separate image processing from AI. Based on the responses, currently, only approximately 45% of residents receive training in image processing, very unlikely to include AI education, according to feedback from DRRPCWG members.

Q6: Approximately how many hours does your radiology residency set aside for physics instruction of residents throughout their residency?

Answer	Count	Percent
None	13	7.69%
1-30 hours	30	17.75%
30-60 hours	49	28.99%
60-100 hours	49	28.99%
>100 hours	28	16.57%
Total	**169**	**100%**

The variation of physics instruction time is as expected. About 58% of the institutions allocate 30–100 hours, a little more than 16% have over 100 hours, while nearly one quarter have no or minimal (<30 hours) physics instruction. Since it was not specified per year or training period, some might input yearly hours for physics instruction. However, based on our understanding, the above results basically reflect the current situation.

Q7: How many physicists are involved in teaching radiology residents?

Answer	Count	Percent
0	14	8.14%
1	28	16.28%
2-4	80	46.51%
5-8	42	24.42%
>8	8	4.65%
Total	**172**	**100%**

It is no surprise that about 71% of radiology departments have 2–8 physicists involved in physics teaching of residents. Unfortunately, there are still 8% with no physicist involvement.

Q8: Do you have other questions or feedback about the curriculum?

We did receive favorable comments and good suggestions. In general, many respondents were interested in a curriculum more focused on key topics (e.g., less granular, less on the underlying hardware, and more on how to manipulate acquisition parameters to produce high-quality images), mainly due to limited time for physics teaching. Many suggested that the content be more highly clinically relevant to increase residents' engagement and deliver material in an accessible way. People did suggest adding Machine Learning and Deep Learning concepts.

Q9: Do you have suggestions for additional curriculum content (hands-on project examples, more Q & As, a list of open-access/non-textbook references, etc.) that could improve or ease your DR resident teaching efforts?

Hands-on guidance and more practice questions, especially visual/image-based questions, were mentioned many times. It was suggested that following each set of didactic lectures on a given modality; an actual hands-on laboratory should be considered. Creating a database of practice questions and images, an interactive site with questions, images, videos, lectures, artifacts, and their identification and cause, was also suggested. Again, AI was mentioned for inclusion in the curriculum. ■

AMERICAN ASSOCIATION of PHYSICISTS IN MEDICINE

A MOMENT OF THANKS...

From all of us at AAPM, we would like to extend our heartfelt thanks and appreciation to the dedicated exhibitors who joined us in delivering high-quality virtual meetings over the last two years. Your support and participation are key to the success of AAPM Meetings across the board.

We look forward to seeing you ***live and in-person*** in 2022 and beyond!

AAPM Medical Physics Leadership Academy
Accuray, Inc.
Akesis, Inc.
Alyzen Medical Physics, Inc.
American Board of Medical Physics
American Board of Radiology
American College of Radiology
American Institute of Physics
Bayer
Brainlab
C-RAD
Canon Medical Systems, USA
CDR Systems, Inc.
CIRS
CIVCO Radiotherapy
Conference of Radiation Control Program Directors, Inc.
Deepvoxel, Inc.
Delta4 by ScandiDos
DoseOptics
Elekta
Focused Ultrasound Foundation
GE Healthcare
IBA Dosimetry
IBA Proton Therapy
Image Owl, Inc.
Imagen Technologies
International Commission on Radiological Protection (ICRP)
International Organization for Medical Physics (IOMP)
IOP Publishing
iRT Systems
ISMRM
John Wiley & Sons, Inc.
Klarity
Landauer & RaySafe
LAP of America Laser Applications, L.L.C.
Medical Physics Publishing
Medscint
Mevion Medical Systems, Inc.
MIM Software, Inc.
Mirada Medical
Mirion Technologies
Modus QA
NELCO
Neurologica
Pearl Insurance
Philips Healthcare
Precision Xray, Inc.
PTW North America Corporation
QA Benchmark
QAELUM
Qfix
Quantek Systems
Radcal Corporation
Radformation
Radiological Imaging Technology, Inc.
RAPIDai
RaySearch Laboratories AB
RelfeXion Medical
RTI Group
Sensus Healthcare
Siemens Healthineers
Siris Medical
Standard Imaging, Inc.
Stryker
Sun Nuclear Corporation
The Phantom Laboratory
TheraPanacea
Varian Medical Systems
ViewRay
Vision RT
Wolters Kluwer

aapm.me/annual | aapm.me/clinical

STEPHEN BALTER, PHD, WINS IDMP AWARD

PERSON IN THE NEWS

Gerald A. White, Jr., MS | Colorado Associates in Medical Physics

Each year the International Organization of Medical Physics (IOMP) offers recognition of exceptional service and achievement in the profession through the International Day of Medical Physics Award. This award recognizes excellence in Medical Physics with a particular view of promoting medical physics to a larger audience and highlighting the contributions medical physicists make to patient care. The IDMP Award is linked to the International Day of Medical Physics (IDMP), from which it takes its name. The 2021 IDMP theme is "Communicating the Role of Medical Physicists to the Public," and the IOMP solicited nominations from its constituent organizations for candidates whose work exemplified this theme.

AAPM was pleased to offer **Dr. Stephen Balter** as our nominee for the award this year, and the IOMP selected him for the International Day of Medical Physics 2021 Award, an essential part of the 2021 IDMP activities.

Dr. Balter is best known for his outstanding medical physics work in interventional radiology and cardiology. His work related to patient dose considerations and staff radiation exposure has been foundational in setting current standards of practice. He is well respected among his physician colleagues nationally and internationally and has been a key contributor to the work of the International Electrotechnical Commission, as well as the National Council on Radiation Protection and Measurements, the International Atomic Energy Agency, and the International Radiation Protection Association as well as numerous AAPM Reports.

In Dr. Tim Ritter's 2017 AAPM History interview, Dr. Balter observed: "Our job is not to live in a silo, but to serve the patient the best way we can." His dedication to applying his considerable energy and skill to this end has been appropriately recognized by the IOMP. ■

Email: gerald.white@mindspring.com

Stephen Balter, PhD
2021 IDMP Award Recipient

CHRIS WILLIAMS JOINS NASA ASTRONAUT CANDIDATE CLASS

PERSON IN THE NEWS

Jennifer Pursley, PhD | Massachusetts General Hospital

On Monday, December 6, 2021, the United States National Aeronautics and Space Administration (NASA) announced a new class of 10 astronaut candidates, selected from a field of more than 12,000 applicants. This is the first new class in four years, and to the delight and surprise of the medical physics field, one of the 10 candidates is a clinical therapy medical physicist!

Christopher Williams, PhD, is an ABR-certified therapeutic medical physicist who most recently served as the lead physicist for the MR-guided adaptive therapy program at the Brigham and Women's Hospital and Dana-Farber Cancer Institute (BWH/DFCI) in Boston, MA. Chris grew up in Potomac, Maryland, graduating from Montgomery Blair High School in Silver Spring, MD, in 2001. He earned a bachelor's degree in physics from Stanford University in 2005 and a doctorate in astrophysics from MIT in 2012. Chris learned about medical physics during his doctorate and visited the BWH/DFCI Radiation Oncology department to shadow several physicists and physics residents (including this author, who was a resident at the time!) Chris was accepted into the 3-year Harvard Medical Physics Residency Program and completed the program in 2015, accepting a faculty position at the BWH/DFCI upon graduation.

During his time at BWH/DFCI, Chris excelled as a clinical physicist, focused on many clinically driven and innovative research projects, and, because he loved to teach, volunteered to teach classes and labs for both physics and medical residents. When the opportunity to start an MR-guided adaptive therapy program came to BWH/DFCI, Chris was an obvious choice to lead the project. Working with a team that included medical physicist **Elizabeth Huynh, PhD**, among many others, he initiated a safe and robust program that continued treating patients with adaptive therapy during the COVID-19 pandemic. But even while enjoying his career as a clinical medical physicist, Chris always had a dream of becoming an astronaut. During his residency, he learned to fly airplanes and earned his private pilot's license. He applied for both the NASA astronaut candidate classes in 2013 and 2017 but was not selected to interview for either of those classes. The third time turned out to be the charm, with the interview process lasting over 18 months due to the pandemic, and Chris is thrilled to be joining the class of NASA astronaut candidates in 2021.

This month, the astronaut candidates report for duty at Johnson Space Center in Houston, Texas, to begin training. For the next two years, Chris and his nine classmates will undergo training in five major categories: operating and maintaining the International Space Station's complex systems, training for spacewalks, developing complex robotics skills, safely operating a T-38

Twitter: @jenpursley_phd

Email: jpursley@mgh.harvard.edu

LinkedIn: jennifer-pursley-b8352926/

NASA Astronaut Candidate Christopher Williams, PhD | Credits: NASA

training jet, and Russian language skills. Upon completing training, they may be assigned to a variety of possible missions, including performing research aboard the International Space Station, launching from American soil on commercial spacecraft, or deep space missions to destinations including the moon. Chris is moving to Houston with his wife, Aubrey Samost-Williams, MD, and their daughter and is looking forward to whatever the future holds. I know many of us will be paying close attention to this class of astronauts, eager to see where Chris lands! ■

NOVEL APPLICATIONS DRIVE UPTAKE OF AI IN RADIATION ONCOLOGY

RESEARCH SPOTLIGHT Richard S. Dargan | Contributing Writer, AAPM

Recent years have seen the adoption of artificial intelligence (AI) in radiation oncology accelerate.

AI-based workflow tools are well established in many facilities, while a growing body of research supports clinical applications in treatment planning, dose conforming and other areas of the practice. A 2020 survey found that almost 70% of medical physicists are using or are preparing to use machine learning in the clinic.[1]

A confluence of developments has driven the trend; most notably, advances in computing hardware and software platforms and the growth of open source libraries for algorithms. This comes as the ever-increasing complexity in medicine and the push for individualized treatment plans have created a need for tools that can quickly and efficiently comb through the growing amount of data available for each patient.

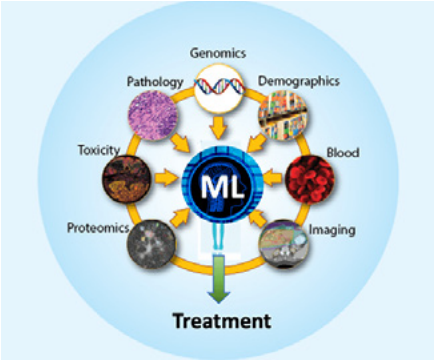
"It's become very difficult for an individual to make sense of all this information," says **Issam El Naqa, PhD**, Chair of Machine Learning at the H. Lee Moffitt Cancer Center & Research Institute in Tampa, FL. "That's where these algorithms come in. They can be trained with data to help physicists make better decisions."

"AI can retrieve information from big data and generate guidance for clinicians," adds **Steve Jiang, PhD**, Vice Chair and Chief of the Division of Medical Physics and Engineering Professor at the University of Texas Southwestern Medical Center (UTSW) in Dallas, TX. "It tells me the best approach for each patient."

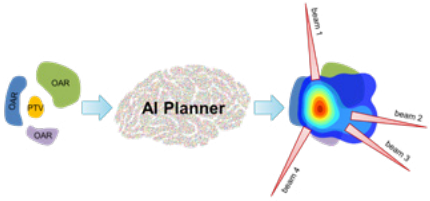
At UTSW, Dr. Jiang and colleagues have studied AI for rapid, automated treatment planning. Using data from cancer patients, they trained the AI to learn how to best distribute radiation in each patient. The algorithm showed that it could reduce the time spent on planning from days or weeks to a fraction of a second: a crucial attribute, since research has shown that delaying therapy can significantly increase the chance of cancer recurrence and spread.[2] Dr. Jiang's lab has also demonstrated how deep learning can optimize radiotherapy by recalculating dosages after each treatment session.

"There are a bunch of clinical implementations in place now, with many more to come," says Dr. Jiang.

Besides treatment planning, promising areas for AI implementation in the clinic include decision support and models for predicting radiotherapy outcomes. AI can automate complex tasks like contouring organs and tumors before treatment planning, a traditional source of bottlenecks in radiation oncology.



Machine learning is well-suited to process the vast amount of information available on a patient. (Courtesy: Issam El Naqa, H. Lee Moffitt Cancer Center & Research Institute)



AI-based treatment planning using the contours of the planning target volume and organs at risk (OAR). (Courtesy: Steve Jiang, University of Texas Southwestern Medical Center)

RESEARCH SPOTLIGHT, Cont.

"The main advantage AI offers is efficiency," says Dr. El Naqa. "It's going to give you similar results to what you would get if you applied a physics-based algorithm, but it will give you those results much faster."

While its clinical applications generate significant attention, AI's impact on workflow may be even more profound. AI can automatically triage scans, moving the most concerning findings to the top of the pile. It can comb through images for incidental findings, as shown in an AI tool at UTSW that automatically looks for signs of COVID-19 in the lungs on chest CT scans.

Applications to improve patient safety and security are already in use at some centers. A few years ago, UTSW launched a Real Time Location System (RTLS) that used Bluetooth technology to track patients, clinical staff, and equipment. The system proved to be inaccurate, Dr. Jiang recalled, as it had difficulty in locating patients sitting near or against a wall.

Dr. Jiang and colleagues developed an AI solution that learned from the data and was able to achieve 100% accuracy in locating patients.

Despite all the promising applications, AI faces headwinds in the form of a shortage of high-quality clinical data. In addition, many studies lack external validation, meaning the results are not necessarily generalizable to a large and diverse patient population. These problems were highlighted in a recent University of Toronto study on radiotherapy for prostate cancer patients that found that retrospective or simulated evaluation of machine learning methods may not translate to real-world clinical settings when patient care is at stake.[3]

"The challenge for clinical applications remains having high-quality clinical data you can use to develop trusted algorithms that can be deployed safely," says Dr. El Naqa, who wrote a commentary accompanying the study.

Psychological barriers also exist, as the predictable cycle of hype around medical AI has led to misconceptions about what it can and can't do.

"There is an inaccurate perception of how AI should be used in medicine," says Dr. Jiang. "AI is a tool to help doctors to take care of patients better and faster, not to replace them."

No matter what course AI takes in the future, medical physicists will play a vital role in its development and implementation, commissioning algorithms into the clinic, monitoring their performance, and helping develop modifications to suit future clinical applications.

"Medical physicists are in a unique position because they are used to working with software involved in treatment planning and development," said Dr. El Naqa. "AI could be thought of as an extension of that." ■

Sources:

1. Charlotte L. Brouwer, Anna M. Dinkla, Liesbeth Vandewinckele, Wouter Crijns, Michaël Claessens, Dirk Verellen, Wouter van Elmpt. Machine learning applications in radiation oncology: Current use and needs to support clinical implementation. *Physics and Imaging in Radiation Oncology*. Volume 16, 2020, Pages 144-148.
2. Xing Y, Nguyen D, Lu W, Yang M, Jiang S. A feasibility study on deep learning-based radiotherapy dose calculation. *Med Phys.* 2020 Feb;47(2):753-758.
3. McIntosh, C., Conroy, L., Tjong, M.C. et al. Clinical integration of machine learning for curative-intent radiation treatment of patients with prostate cancer. *Nat Med* 2021; 27, 999–1005.

1631 Prince Street, Alexandria, VA 22314 | p. 571-298-1300 • f. 571-298-1301 | **aapm.org**