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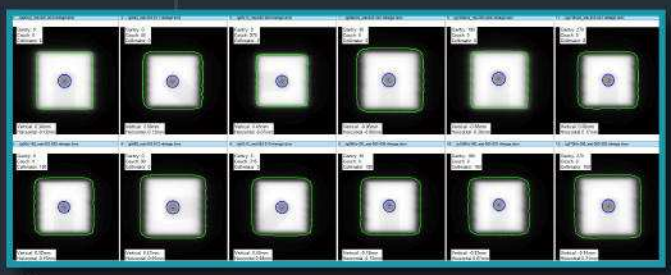
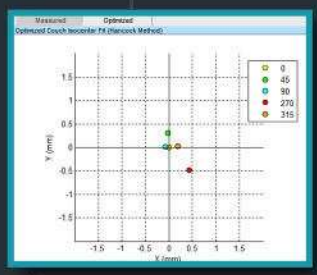
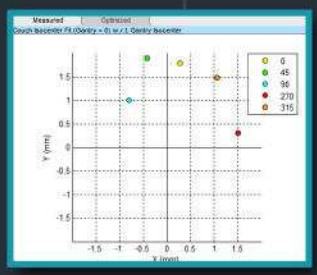
3D Stereotactic Alignment Isocenter Analysis

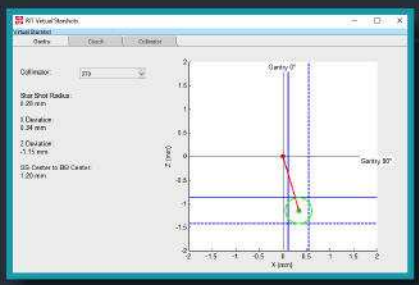


Updated 3D Winston-Lutz analysis interface makes relevant measurements more visible.

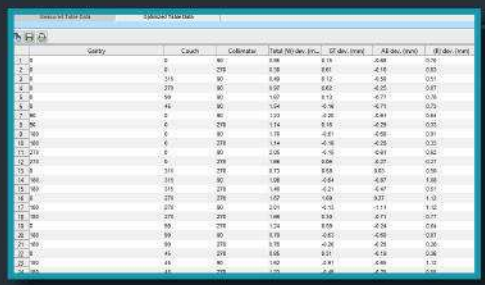




Couch optimization routine includes tabs for intuitive visualization of adjustment outcome.

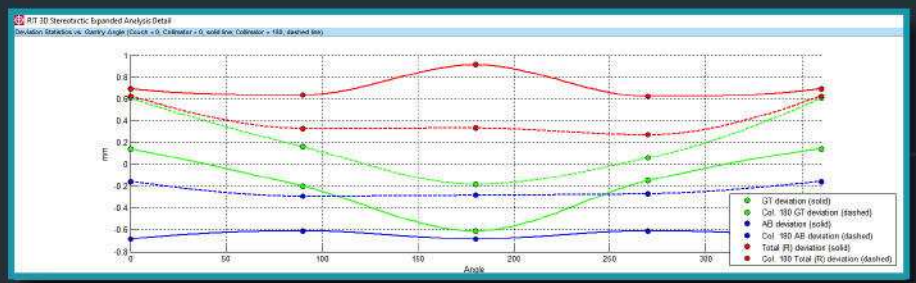


Use Virtual Star Shot* with ANY combination of angles in a new, dedicated window.



Organize measurement table results to pinpoint minimum and maximum values.

Analysis automatically determines ball setup error.



Intuitive plots help to visualize mechanical instabilities during your radiation delivery.

*US Patent 9192784, JP Patent 6009705, CA Patent 2918045 and other International Patents pending.

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POINT/COUNTERPOINT

Suggestions for topics suitable for these Point/Counterpoint debates should be addressed to Colin G. Orton, Professor Emeritus, Wayne State University, Detroit: ortonc@comcast.net. Persons participating in Point/Counterpoint discussions are selected for their knowledge and communicative skill. Their positions for or against a proposition may or may not reflect their personal opinions or the positions of their employers.

Future qualification as a qualified clinical medical physicist should be restricted to doctoral degree holders

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OVERVIEW

According to the AAPM,[1] a qualified medical physicist (QMP) shall be board certified and have earned a master's degree (M.S.) or doctoral degree. Some, however, believe that future qualification as a QMP should be restricted to doctoral degree holders. This is the premise debated in this month's Point/Counterpoint.

Arguing for the Proposition is John D. Hazle, Ph.D. Dr. Hazle is Professor and Chairman, Department of Imaging Physics, and Bernard W. Biedenharn Chair in Cancer Research, The University of Texas MD Anderson Cancer Center, Houston, TX. He obtained his M.S. Degree in Medical Physics from the University of Kentucky, Lexington, Lexington, KY, and his Ph.D. in Biophysics from The University of Texas Graduate School of Biomedical Sciences, Houston, TX. He is certified by the American Board of Radiology (ABR) in Therapeutic Radiological Physics and Diagnostic Radiological Physics, and in MRI Physics by the American Board of Medical Physics. Dr. Hazle has served the AAPM in numerous capacities, including Associate Editor of Medical Physics, President and Chairman of the Board. He also served as Chairman of the Commission for the Accreditation of Medical Physics Education Programs (CAMPEP).

Arguing against the Proposition is David W. Jordan, Ph.D. Dr. Jordan is Assistant Professor in the Department of Radiology, University Hospitals Case Medical Center, Cleveland, OH. He obtained his Ph.D. in Nuclear Engineering and Radiological Sciences from the University of Michigan in 2005 and is certified by the American Board of Radiology in Diagnostic Radiological Physics and Medical Nuclear Physics, by the American Board of Medical Physics in MRI Physics, and by the American Board of Science in Nuclear Medicine in NM Physics and Instrumentation. He has served on numerous AAPM committees and is currently Chairman of the Insurance Subcommittee.

FOR THE PROPOSITION: John D. Hazle, Ph.D.

Opening Statement

The qualifications for clinical practice are evolving for healthcare professionals. Historically, most physicians did not pursue residencies, and now it is a standard practice. When my father practiced as a pharmacist, they had Bachelor's degrees, now a Pharmacy Doctorate (PharmD) is the standard. In nursing, both research Ph.D. degrees and professional doctorate degrees (Doctorate of Nursing Practice or DNP) are becoming common. Other professions, like veterinary medicine and dentistry, have traditionally required professional doctoral degrees (DVM and DDS, respectively) to practice. If medical physicists wish to maintain their status as professionals in the

changing healthcare environment, they should address these degree expectations and require a terminal doctoral degree, either a Ph.D. or a Doctor of Medical Physics (DMP) for professional clinical practice.

Part of the motivation for recommending this now is because residency training for ABR eligibility and QMP status is now required. Currently, ABR eligibility and QMP status require at least a M.S. and a 2-yr residency. This opens M.S. graduates to the risk of not being accepted into a residency at the completion of their graduate degrees. While Ph.D. applicants face this too, they are typically stronger candidates because of their additional experience. The AAPM should be promoting the 4-yr DMP degree, where the didactic and clinical training are bundled, like other professional degrees, resulting in ABR eligibility at the end of the program. The AAPM also recognizes the need to reduce the numbers of graduate students (~250/yr) to better align with available residency slots (~125/yr) and manpower needs (~125/yr). Requiring a doctoral degree aligns those graduates (~150/yr) to residency slots.

Further, the DMP is the most financially sustainable model for professional education. It is financially competitive with other professional degrees when initial salary is considered. For example, in the USA, the average cost of veterinary school is about $35 000/yr, dental school about $40 000, and medical school about $50 000. Most DMP programs are in the $25 000–$30 000 range. In 2014, starting salaries for veterinarians were ~$70 000, for dentists ~$80 000, for pharmacists (with PharmD) ~$90 000, and for physicians ~$190 000. Starting salaries for clinical medical physicists with doctoral degrees were ~$120 000. For the investment made, DMP graduates are in a good financial situation compared to our healthcare professional peers. Further, the income for a 4-yr DMP (debt of $100 000–$120 000), followed by 3 yr of professional practice income at $118 000/yr, results in a 7-yr income of $254 000. During this same period, a Ph.D. student with an income of $25 000 for 5 yr and a 2-yr residency at $50 000 has a total income of $225 000. At the end of 7 yr, the financial status of the DMP and Ph.D. is approximately the same!

To summarize, in order to maintain our professional stature, the AAPM should be moving to require a doctoral degree to become a QMP. This in no way implies that current holders of M.S. degrees are any less qualified than their Ph.D. peers; it simply acknowledges that the requirements for medical physics clinical practice are changing and that we need to move forward and be consistent with our healthcare professional peers. This also brings us in line with the requirements for clinical practice of other American Board of Medical Specialties professionals, where doctoral level credentials are generally required for certification.

AGAINST THE PROPOSITION: David W. Jordan, Ph.D.

Opening Statement

The future pathway to becoming a QMP should not be restricted to individuals holding doctoral degrees. Today's QMP is defined by the AAPM as being board-certified; the pathway to qualify for the board exams is controlled by CAMPEP. To create such a restriction in the future would likely require affirmative effort by AAPM to convince either the ABR or CAMPEP to disqualify individuals with master's degrees from the QMP pathway. Such effort is not justified by needs of the profession or the public nor by shortcomings of the Medical Physics M.S. degree as a foundation for clinical training and practice.

CAMPEP requirements reflect our profession's selfregulation of training pathways. To permit QMP status to a DMP but deny it to a residency-trained M.S. is illogical, since the CAMPEP requirements for both are identical. To state that QMPs of the future will require the training in research that differentiates the Ph.D. from the M.S. is also illogical, because the DMP does not contain this element either. The DMP and M.S./residency pathways differ in their typical funding structures, but one cannot credibly differentiate the content of the training. Based on the way we have defined our training via CAMPEP, there is no basis to require a doctoral degree for the QMP.

Employers and, by extension, patients and the public, are not looking for the QMP bar to rise. The October 2015 AAPM Placement Services listed 44 permanent positions, of which only two clinical jobs required a doctoral degree. The other 23 clinical jobs, including those in academic institutions, specified that a master's degree was acceptable. All of the clinical positions required candidates to be ABR-certified or -eligible, and only five clinical positions accepting M.S. candidates stated or implied preferences for doctoral-degreed individuals. Meanwhile, other jobs requiring doctoral degrees included duties such as research, teaching, or administrative roles in addition to clinical. This small snapshot of the clinical job market suggests that employers find the "M.S., DABR" suitable for their needs. This situation is virtually unchanged from a similar snapshot taken in 2011.[2]

Our physician colleagues do not seem to be clamoring for their clinical physicists to have doctoral degrees. On the contrary, a recent *ACR Bulletin* cover story discussed the clinical contributions of two prominent M.S. medical physicists, highlighting their strong working relationships with radiologists.[3]

There is no question that M.S. graduates face difficult competition for residency slots at present, but the situation is neither hopeless nor permanent. We would help no one at this time by creating additional artificial barriers to their attainment of clinical careers as QMPs.

Finally, such a change would risk damaging the reputation and credibility of our established M.S. QMP colleagues. We have a hard enough time keeping the public aware of who we are and what we do. We have not succeeded in convincing States to uniformly recognize and adopt the existing QMP definition and requirements. Creating more confusion and "grandfather clauses" will surely detract from our profession's public and government relations goals.

Rebuttal: John D. Hazle, Ph.D.

As I pointed out in my Opening Statement, my position is forward looking, not historical. There is no doubt that M.S.

(and in fact some B.S.) medical physicists have made substantial contributions to our profession—and many do it every day! However, I will suggest that Dr. Jordan's last two paragraphs in *his* Opening Statement actually support the position that going forward we should have a more uniform degree standard for QMP—a doctoral degree (Ph.D. or DMP). This is not about research, but about how the profession of "clinical medical physics" is valued by healthcare institutions in the future.

The risk of failure in maintaining medical physicists as "professional peers" to our physician colleagues is higher when trying to justify that several degree levels are equally acceptable. While the roles of some nondoctoral degree holders have been accepted for "professional status" in the past, the contrary trend dominates. The current standard in healthcare (academic and private practice) is that doctoral degree holders are "professional" and everyone else is "staff." Not setting the standard for medical physics practice at the doctoral level, consistent with the standards for professional status in other healthcare professions, will put us at risk of losing our current status as professionals.

Rebuttal: David W. Jordan, Ph.D.

Restricting medical physics practice to those with doctoral degrees is not necessary to maintain the status of our profession. We should not concern ourselves with trends in other health professions; our profession is selfregulating, and we have done plenty to improve education and training via CAMPEP oversight of graduate programs and residencies. The 2012–2014 ABR changes closed significant gaps between medical physicists and other ABR and ABMS diplomates; is it already time to declare that we have not yet done enough?

The current mismatch between graduates, residency slots, and jobs is a logistical issue, not one of professional practice. If there were more jobs (and residencies) for graduates, this concern would cease to exist. It would be unwise to impose strict new constraints on the training pipeline, as we would be unable to react to unforeseen future increases in demand for medical physicists. We probably have not seen our last "boom."

Nor are we likely to have seen our last "bust." Present tuition and salary figures suggest that a residency-trained Ph.D. and a DMP graduate will reach financial break, even after several years of practice, but we do not know the future trajectory for medical physics salaries or how DMP salaries will compare with residency-trained Ph.D. salaries. If all M.S. programs converted to DMP, we could end up with many DMP graduates unable to find clinical jobs, carrying significantly more debt than M.S. graduates.

The question remains whether it is truly fair to expect DMP students to come into the clinic and do the same work at the same level as medical physics residents, but to pay tuition for the privilege rather than being paid a modest salary. We owe those who will become the future of our profession better than a facile or oblique answer to this question.

[1]AAPM, PP 1-H: Definition of A Qualified Medical Physicist, 2016, available at http://www.aapm.org/org/policies/details.asp?id=316&type=PP.
[2]M. D. Mills, H. R. Elson, and C. G. Orton, "The terminal M.S. degree is no longer appropriate for students interested in a career in clinical medical physics in the United States," Med. Phys. **38**, 1737–1739 (2011).
[3]J. Jones, "The physics of imaging," Am. Coll. Radiol. Bull. **70**(6), 10–12 (2015), available at https://acrbulletin.org/54-quality-and-safety/225-the-physics-of-imaging.