What is Medical Physics 3.0?

Ehsan Samei: What is Medical Physics 3.0
Robin Miller: Leadership in decision-making
Mary Fox: Effective communication
Maryellen Giger: Scientific excellence
Erika Chin, Brendan Whelan: Educational excellence
Nick Hangiandreou: Quality-safety analytics in imaging
Eric Ford: Quality-safety analytics in therapy
Xiang Li: Personalization of pediatric imaging
Todd Atwood: Physicist patient consult
Dan Pavord: Process improvement in clinical practice

The seismic changes in healthcare today have the potential to rattle any medical professional. This is especially true in professions like medical physics where the bulk of our important work is performed after hours and out of view of the patients, whose lives and health depend on it, and the colleagues and administrators on whom we depend for our livelihoods.
**What and who?**
AAPM Ad Hoc committee, Jan. 2016

Dan Bourland          Bill Pavlicek
Erika Chin            Dan Pavord
Shiva Das             Todd Pawlicki (V-Chair)
Mary Fox              Ehsan Samei (Chair)
Nick Hangiandreou     Lisa Schober (Admin)
David Jordan          Bruce Thomadsen
Melissa Martin        Brendan Whelan
Robin Miller

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**Rationale**

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**Overarching need and presuppositions**

Medicine: Discerning and intervening in the health state of the patient with sufficient accuracy, precision, and safety for definitive clinical outcome

Healthcare is about the patient, not the particularities of the techniques – techniques are valued to the extent they benefit the patient
Reality check 1: Clinical practice
Heterogeneous, Compounded, Complex
• Varying technologies
• Varying technical parameters
• The patient factor
  – Limited dynamic adaptation of technology to the patient
• The human factor
• Competing interests
Variability in the quality of care

Reality check 2: Cultural shifts in healthcare
Evidence-based medicine
  Practice informed by science
Precision medicine
  Personalization of care in quantification terms
Comparative effectiveness - meaningful use
  Enhanced focus on actual utility
Value-based medicine
  Scrutiny on safety, performance, consistency, stewardship, efficiency (leaness), ethics

Key questions
• What is the role of medical physics in all this?
• How medical physicist can/should add value?
• How the physicist should (re)posture her/himself in view of the new realities?
• How can we live up to our potential?
  – (Re)define our value before others do?
Historical grounding
- Remember Roentgen!
- The foundational discipline behind Radiology and Radiation Oncology
- Physics applications to
  - Design technologies with superior performance
  - Ensure intrinsic performance of equipment
  - Ensure accurate therapeutic dosimetry
  - Claim compliance and accreditation

Medical Physics 1.0

Why 1.0 is not enough
- Impending healthcare tsunami?
- Clinical performance?
- Optimization of use?
- Consistency of quality?
- Expanding technologies?
- Lagging compliance vs needs and innovation?
- Physics not contributing its full potential?
- Medical Physics beyond radiation medicine?

Call to action!
Why Med Phys 3.0?

- The crucial role of Medical Physics has to be broadly claimed
- In the face of a challenge, it is crucial to understand the goals and set a standard that can define the trajectory and motivate the progression.

Why not 2.0?

- Alignment with ACR Imaging 3.0 movement
- Prior 2.0 imaging only focus
  - 2013-2015: 10s of 2.0 imaging sessions and RSNA and AAPM
Drive towards high-quality, consistent, patient-centric, evidential, precise, safe healthcare

What is the role of medical physics?
Innovative precision care through clinical application of physical sciences

Why precision care needs medical physicists?
• Our unique skillset
• Our unique perspective
• Our ethical mandate
  – Optimum care needs purposeful contribution of medical physics

What is Medical Physics 3.0
Redefining and reinvigorating the role of physics in modern medicine
An initiative to define and practice sustainable excellence in medical physics
A set of trajectories to grow, express, and enact the value of medical physics
To position physicists to have the **competence** and the **confidence** to fulfill their unique calling: scientific agents of **precision**, **innovation**, and **value** in the development and practice of medicine

**Future of our Profession**

1. Re-visiting our roots and re-envisioning our desired contributions to quality healthcare
2. Asking the question of whether we are fulfilling our potential, and if not, how can we
3. Fostering a culture of excellence
4. Seizing opportunities to engage proactively and meaningfully in patient care
5. Growing and building upon the unique skills of medical physicists.

**Medical Physics 3.0 foundations**

**Medical Physics Progression**

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<thead>
<tr>
<th>1.0</th>
<th>3.0</th>
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<tbody>
<tr>
<td>Equipment</td>
<td>Operation</td>
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<td>Specifications</td>
<td>Performance</td>
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<td>Quality check</td>
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<td>Actual utility</td>
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<td>Excellence</td>
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<td>Physics in Medicine</td>
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Does that apply to everybody?

- The clinic
- The academy
- The industry
- The government
- Research organizations
- Professional organizations
- ...

Multiple practice settings, one overarching goal

Advancing Human Health

How?
How are we going to get there?
Trajectories of MP3.0

1. Realizing who we are (or ought to be)
2. Extending the competencies of medical physicists
3. Actualizing the constituents of precision care
4. Developing sustainable models of 3.0 practice
5. Changing the expectations from medical physics
6. Extending the boundaries of medical physics

1. Realizing who we are (or ought to be)
Dealing with the subject:
1. **Scientist** in discovery AND application
   - **Scholarship**: evidence-based, methodical pursuit
   - **Quantitation**: measurement, numerical orientation, ‘value’
   - **Innovation**: agency of advancement
     - better understanding, practice solutions, care delivery,
     - technological solutions, education, regulations

1. Realizing who we are (or ought to be)
Dealing with the setting:
2. **Context-aware**:
   - **Dual-vision**: Myopic AND systemic visions
   - **Dual-calling**: Scholar AND healthcare provider
1. Realizing who we are (or ought to be)

Dealing with the goal:

3. Service-oriented

Care: Care and customer mindset
Clinic: Ultimate clinical application

2. Extending the Competencies of Medical Physicists: Leadership Skills

Dealing with:
- Self
- People
- Projects
- Finances
- Constraints, voids (ethics, regulations, ...)

Skillsets:
- Emotional intelligence
- Effective communication
- Leadership in visioning
- Management in orchestrating, execution

- Gain ability to articulate our essential and contextual value proposition
- Medical Physics Leadership Academy (MPLA)
2. Extending the Competencies of Medical Physicists: Education

- Deep medical physics competency
- Focus on actual effectiveness of education
- Context-aware clinical and leadership skills
- The actual process of critical thinking
- New hard skills: process engineering, optimization, bio-informatics, bio-statistics, ...

3. Actualizing the Constituents of Precision Care

1. Technology assessment
2. Prospective use definition
3. Retrospective quality audit

Precision by inference  
Technology assessment

Precision by prescription  
Prospective use definition

Precision by outcome  
Retrospective quality audit
4. Developing Sustainable Models of 3.0 Practice
- Devise and encourage pragmatic resources, smart tools for “busy clinical people”
- Clinically-relevant metrology and tools
- Automation and tracking tools

5. Extending the Boundaries of Medical Physics
- Claim and advance the profession beyond radiation medicine
  - Medical photonics, dentistry, surgery, 3D printing, virtual reality, nano-medicine, emerging medicine, radiomics, radiogenomics, data science, …
- AAPM FUTURE working group: The future of medical physics science

6. Changing the Expectations from Medical Physics
- Seek meaning beyond checklists
- Devise pathways for translation of science to practice
- Identify and encourage clinical growth where care can be excelled with physics contribution
- Own the quantification of value in value-based care
- Update the regulatory framework
MedPhys 3.0 Resources

- MP3.0 Booth @ AAPM’17
- 3.0 webpage (https://www.aapm.org/MedPhys30)
- Good practices
  - Videos
  - List of opportunities
  - Case example stories
- White papers and editorials

Conclusions

- Competent and effective medical physics is
  - Essential
  - About quality patient care
  - more than “doing medical physics”
- MP3.0: claiming our roles as scientists, care providers, and leaders aimed towards patient centric, value-based promotion of health