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QUALITY EDUCATION AND HEALTH SCIENCE FOR PATIENT BENEFIT

The Dual Identity of Medical Physicists: Balancing Clinical Service and Research

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Medical physicists are vital members of modern healthcare teams, operating at the interface between science and clinical practice. They not only ensure safe and accurate delivery of radiation therapy and diagnostic imaging but also push the boundaries of technological innovation through research and development. However, the dual nature of this profession straddling clinical responsibilities and research aspirations poses challenges that institutions, professionals, and academic programs must address. This article explores the evolving role of the medical physicist, one mended between clinical and research commitments, and practical strategies for achieving a sustainable balance.

Clinical Service: The Unseen Backbone of Radiotherapy

In routine clinical settings, medical physicists are indispensable. Their primary duties include commissioning and calibrating radiation therapy equipment, performing patient specific quality assurance for radiation treatments, ensuring compliance with radiation safety regulations, routine treatment planning among many other works. These tasks are often time sensitive and demand meticulous attention. In radiotherapy departments, a physicist's role is crucial in ensuring the correct dose is delivered to the right location with high accuracy since deviations in a patient's plan or machine performance can lead to underdosing the tumor or over exposing healthy tissues. In high volume hospitals, especially in low- and middle-income countries, the clinical workload is always intense. A small team of physicists may be responsible for hundreds of patients per week, leaving little bandwidth for academic or research activities. This workload, while essential to patient care, can limit innovation if not managed effectively.

The Research Mandate: Driving the Future of Medical Physics

On the research front, medical physicists contribute to advancements in radiation oncology, imaging technology, dosimetry, artificial intelligence applications, and more. Research is the engine that drives improvement in treatment efficacy, patient safety, and workflow efficacy and efficiency. Medical physics is not static; each advancement in treatment hardware, therapy software, or computing power introduces new questions that physicists are uniquely qualified to answer. However, this progress depends on time, funding, and institutional support resources often scarce in busy clinical environments.

The Academic Medical Physicist: Bridging Two Worlds

Academic medical physicists play a unique and essential role. Positioned in universities or teaching hospitals, they are typically involved in:

- Teaching graduate students and residents
- Supervising clinical training programs
- Conducting original research
- Collaborating with industry and clinical partners

These professionals are often the linchpin connecting clinical insights with theoretical innovation. For example, a clinical problem such as image drift in MRI-guided radiotherapy can be studied in a lab, modelled mathematically, and solved through interdisciplinary research. However, academic physicists also face time pressure from teaching loads, grant writing, and administrative duties. Without structured support and funding, their potential impact on both patient care and scientific advancement may be underutilized.

The Challenge: Time, Workload, and Institutional Culture

One of the greatest obstacles to balancing clinical and research responsibilities is **time allocation**. In many hospitals, the emphasis is almost exclusively on immediate clinical service, with research viewed as an optional extra. This creates a culture where research may be deprioritized, even though it is essential for long term clinical improvement. This imbalance can lead to "a missed opportunity to exploit the full potential of medical physicists." It called for formal recognition of research as an integral part of a physicist's role, with corresponding adjustments in workload and performance metrics.

Strategies for Balance: Recommendations and Solutions

1. Protected Research Time

Hospitals and cancer centers should allocate defined blocks of time for research. Whether one day per week or 20% of total workload, this "protected time" allows physicists to engage in scientific inquiry without clinical pressure.

2. Dual Track Career Models

Institutions can offer parallel career paths, one with a clinical emphasis and another focused on research. This allows professionals to pursue their strengths while contributing meaningfully to the field.

3. Collaborative Research Models

Physicists can co-lead clinical trials or work with radiation oncologists, radiologists, and data scientists to address practical clinical challenges. Embedding research into clinical operations allows for real-world impact and greater feasibility.

4. Investment in Staff and Resources

In high workload centers, hiring additional staff or delegating non-specialist tasks (e.g., administrative reporting) can free up physicists for innovation. Using automation and AI for QA can also reduce repetitive burdens.

5. Academic Clinical Partnerships

Stronger ties between universities and hospitals can provide access to research infrastructure (e.g., labs, computing clusters) and students, creating an ecosystem where ideas move fluidly from bench to bedside.

The Way Forward: Recognizing Value Beyond Service

Medical physicists are more than simple clinical occupational workers, they are innovators, educators, and leaders in the fight against cancer. To fully harness their potential, both clinical institutions and academic centers must invest in integrated roles that value both clinical service and clinical research. As technology advances rapidly especially with the advent of AI in radiotherapy planning and radiomics in imaging the need for medically grounded physicists who understand both theory and practice becomes even more urgent. A culture that nurtures this dual identity is not only good for physicists, but also it is essential for patient centered innovation. With thoughtful support, flexible career paths, and strategic investment, medical physicists can thrive in both domains.

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