

Critical Review

What Do Medical Physicists Do? Leadership and Challenges in Administration and Various Business Functions



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Abstract

The goal of the present study was to investigate the primary role of medical physicists (MPs) in radiation oncology (RO) administration and key business functions, besides various challenges facing today. An experienced MP leader formulates a well-structured department administration and management system in RO. The essential role of MP team leaders in health care is not only limited to supervising routine department clinical works but also being substantially involved in key business functions such as leadership, operations, project management, decision making, and many more. Furthermore, leadership appointments are equally important for the department and the health care organizations to a significant extent; the right competitive leaders with the right education and ample experience are necessary to operate administration and to perform various related business functions. To improve leadership qualities for individuals, a structured formal education with intensive training is necessary because leadership positions are associated with several complex business-related functions. A structured education or training could be received from various premier academies or institutions in the nation. Structured university academic programs (certificate, degree, or doctoral) in health care administration or management are highly beneficial for MPs who aspire to future leadership positions in RO due to high business complexities in health care organizations; however, this element is currently not enforced for MP leadership positions in the United States.

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Introduction

Medical physicists (MPs) are playing a crucial role in scientific research, teaching, and radiation oncology (RO) clinical practices in health care organizations; they perform a leading role in developing novel treatment techniques, optimization of therapeutic procedures,

implementation of advanced imaging and treatment technologies, and they also ensure safe radiation administration for cancer therapy.¹ It is essential to provide high-quality radiation treatment delivery to patients with cancer promptly and consistently. Because of this, active physics leadership is necessary to ensure appropriate clinical services, improve patient satisfaction, and enhance department business functions. In 2006, Yukl^{2(p8)} defined leadership as “the process of influencing others to understand and agree about what needs to be done and how to do it, and the process of facilitating individual and collective efforts to accomplish shared objectives,” and in 2010, Northouse^{3(p3)} defined leadership as “a process whereby an individual influences a group of individuals to achieve

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a common goal.” MPs are facing many challenges with the involvement of department business functions and the effectiveness of leading team members.⁴ A significant transformation of the MP profession has taken place in the past couple of decades. The involvement of MPs in departmental administrative functions, staff management, project management, budgeting, and so forth is quite common today in health care organizations. It is well known that the health care sector is no longer conducive to big budgets, endless capital, equipment capital, salaries, and reimbursements; in addition, the costs, expenditures, and large projects are highly scrutinized. High efficiency and completion of projects on time without delays are expected at almost all times. Efficient team leaders with an unobstructed vision are necessary to overcome these challenges. Appropriate MP leadership can indeed support the bright future of the RO professional in terms of practice, safety, quality,⁵ and various major business functions. RO professionals have received distinctly different training compared with the MPs, and the RO community sincerely appreciates the inclusion of the wide skill set necessary to efficiently move the field forward. The changing world of RO benefits from the active participation of the MP leaders performing departmental administrative and business functions.⁴ Most MPs working at hospitals spend much of their valuable time dealing with tasks that involve clinical imaging and radiation treatments of patients, leaving very little time available to perform innovative research projects in the organizations. Therefore, it would be important to appoint people to leadership positions with the right education, training, and experience to run innovative projects to avoid frustrations.⁴ The goal of RO is to create the betterment of the human condition through a variety of methods, which may involve education, research, clinical practices, administration, and leadership support to develop better processes, procedures, tools, technologies, and teams for health care applications.⁶ Even though several medical physics-related documents mention the importance of leadership skills and taking on basic departmental business responsibilities in RO, in general, resources specifically targeted to major business functions for MP leaders in RO are scarce in the literature.

Leadership and Administration

MPs often lead small and large teams of medical professionals that may involve physicist colleagues, physicians, dosimetrists, engineers, radiation therapists, information technology professionals, nurses, and administrative employees in organizations for various projects.⁶ The performance of leadership is crucial for effective departmental functioning, administration, and management; therefore, it is incredibly important to develop major business management skills for team leaders

working in public and private health care organizations. Developing skills such as strong strategic planning,⁷ communication, operations, oversight of technical staff members, and overhead reductions in organizations is crucial to becoming successful in the leadership role. MPs currently dedicate most of their valuable time to patient-specific clinical activities (49%), quality assurance (22%), research (6%), administrative activities (10%), radiation safety (7%), and teaching (5%) based on previous literature,^{8,9} which considerably reduces the available time for innovative research projects; this may create frustration on medical physics teams. Therefore, it is critical to appoint the right MP team leaders in the leading positions with the right education, training, and experience to drive the innovation projects forward in organizations. The American Association of Physicists in Medicine (AAPM) ad hoc committee¹⁰ recognized the essential role of MPs in leadership and administration, and they encouraged organizations to use exceptional competency in RO administration and various business functions. They further encouraged the involvement of physicists in upper leadership roles in health care, academic, and governmental organizations to use advanced skills.¹⁰ Many administrative and leadership qualities, which include communication, collaboration, and leadership soft skills, are already recognized expectations for MPs.¹¹

The current leadership has the potential to influence the behavior of the health care practitioners, as they set up the core organizational culture in the organizations.¹² There are 6 basic leadership styles that are commonly used in the health care literature: transformational, transactional, autocratic, laissez-faire, task-oriented, and relationship-oriented.¹³ The most acknowledged definition of transformational leadership is as follows: “it is the leadership approach in which a leader transforms his followers, inspires them, builds trust, encourages them, admires their innovative ideas, and develops them.”^{14(p1),15(p256)} The transformational leadership style is most useful and can be applied in practice to achieve a higher level of patient care and to improve treatment quality and efficiency in health care. Active participation in leadership training programs and professional activities within the institutions or professional societies are key opportunities to develop leadership skills. Several university-based business schools offer certificate, degree, and doctorate level courses for actively working professionals; these are excellent venues for developing essential business knowledge for practice.¹⁶

Leadership and Decision-Making

MP team leaders are often directly involved in the decision-making process in collaboration with physician peers and opportunities are available to bring ideas from physics and related scientific disciplines to RO for the benefit of patients. Decision-making is one of the crucial

components associated with leadership positions and making everyday decisions is not always an easy task. MP leaders are considered key contributors in the decision-making process for most of the department's administrative and business functions. Complex decision-making requires careful attention to several relevant key parameters.¹⁷ Many of these decisions may be formulated by reshuffling the current departmental budget, delegating tasks, or implementing new strategies. One of the important steps to increase the likelihood of positive decisions is to involve team members in the decision-making process, as diversity leads to better decision-making. Team members are often gathered from diverse academic disciplines and cultural backgrounds, and working together can enhance creativity to gain fresh perspectives on tasks.¹⁸ Developing opportunities for critical thinking and promoting creative conversations among the team members are highly significant from the perspective of a team leader.

The role of MP leaders in the RO department is essential for decision-making for many reasons. Experienced employees or teams may fail to deliver proper results in the absence of good physics leaders, and such failures could lead to consequential degradation of the safety and efficiency in patient care. Most physics team leaders actively take part in the key decision-making processes in health care organizations that may involve consultation, budgeting, administrative oversight, grand capital purchasing, human resources management, and strategic planning, among others. There are several decision-making methods presented in the health care literature,¹⁹ and one of the most popular methods to assist in decision-making is conducting group decision-making sessions, which are also termed “team brainstorming sessions.” Brainstorming sessions offer a great opportunity to develop free-flowing thoughts and ideas shared by the team members; these meetings generally end with results of several potential ideas and numerous suggestions. The nominal group technique is another type of unique group decision-making strategy that brings brainstorming ideas one step forward by including a voting process. In the Delphi technique,²⁰ leaders can narrow down options for the team to choose from when making major decisions to reach a consensus from among the team members. The pros and cons of unsettled ideas can be listed on a sheet of paper or Microsoft Excel sheets, and whichever column ends up with the most items is usually selected from the list when making the final decision. Involving team members in the decision-making process has many advantages, such as changing default decisions to consensus, increasing employee engagement, enhancing collaboration and communication, detecting surface blind spots, and getting stakeholders involved in the project early.²¹ High-quality decisions can be formulated by involving the team members with the right mixture of skills and ability in the decision-making process.²² Currently, MPs are offering so much to health care, the scientific community, and

patient-related care; forward-looking MP candidates should acquire exemplary administrative decision-making skills and carefully cultivated future vision before moving forward to leadership roles in health care systems.

Research Program Leadership

MPs are currently leading various key developmental activities in organizations, such as research and development, education and training, informatics, equipment performance, quality, and safety.⁶ Large university academic centers are intensively involved in several scientific research activities and extensively promote scholarly publications²³; such institutions develop large laboratory infrastructure facilities, provide financial support, and set up special dispositions for encouraging research activities. The appointments of the department chairs, divisional, or group leaders are exclusively based on the current demand, requirements, suitability, scholarships, publications, and grant funding that leads to successes in research and innovation.

Team leaders often conduct innovation sessions. Innovation sessions and conference meetings continuously support the team members to generate ideas and tackle goals to accomplish together. Ideally, team leaders invite all team members and members of other teams and provide everyone a chance to participate in innovation sessions that support divergent thinking, questioning, observing, networking, brainstorming, and experimenting, and all such activities should be encouraged. Innovation is highly dependent on the psychological safety of attendees,²⁴ and that in turn depends on the team leaders and their engagement in discussion sessions. Excellent team leaders can multitask, be highly flexible, and be relationship-oriented²⁵; however, team members are more willing to share their knowledge openly in a collaborative environment. Leadership has a significant role in team selection and the team structure formation process,²⁵ as there are many advantages in using pre-existing relationships when forming a team that increases the probability of the team's success. A high proportion of new members within a team may create hesitation to collaborate openly for many new candidates compared with those with an already established relationship. Moreover, MP team leaders have a significant role in teaching, mentoring, coaching, and training the employees/team members in the department that directly influence the collective team behavior.

Department Operations

RO departmental operations are a strenuous task, which may involve regulating operational expenses, cost-cutting, strategic initiatives, generating road maps for tackling issues, employee evaluations, and making tough decisions related to keeping adequate staff,²⁶ along with

other roles. MP team leaders play a crucial role in the daily operations of the RO department, and they are fully aware of the necessary parameters to efficiently manage department operations. As a team leader, setting up long-term goals in the organization is particularly important because the requirements do not happen easily in the corporate world. There are many responsibilities associated with departmental operations, which may involve supporting adequate staff members, assigning staff members to the right job functions, supervising employees, addressing their training needs, and preparing employees for various emergency operating procedures in the department. Good team leaders know their team members very well; routine individual and staff meetings are very helpful to understand the members. Employee conflicts could arise anytime in the department and should be resolved as quickly as possible for the good of the team. Good MP team leaders are excellent problem solvers and can make solid decisions mostly by consensus.²⁷ When there are conflicts there can be whiteboard sessions, analysis of pros and cons, and generation of consensus among the members to resolve issues. MP team leaders are capable of effectively managing these essential routine departmental operations, which create comfortability in the health care organization's internal and external business functions.

MP team leaders play a prominent role in taking responsibility in budget quotes along with overall projects in the department. They are actively involved in the department budgeting process from the beginning and must understand organization expectations and strategic goals and develop a realistic timeline to accomplish them. It is essential to maintain excellent communication between the team members²⁶ and other team leaders²⁸ and to assign clear responsibilities to each team member for efficient department operations. A regular staff follow-up, knowledge exchange, discussions, estimation of currently available materials, discussion of how to get unavailable essential materials, and so forth are necessary for the proper functioning of the department. There are several other challenges associated with department operations, for example, developing correct methodologies, collaborations, knowledge sources, timelines, and many more. Experienced MP team leaders are capable of efficiently managing these important departmental operation functions.

Project Management

There are many large-scale projects often running in the RO department related to innovation, scientific research and development, machine installation projects, major software upgrades, and many more.²⁹ Naturally, the MPs are the leaders in technological innovation projects in the health care organizations, including most of

the soft and hard technologies used for disease diagnosis and treatments in the hospital departments, where they play a leading role in guiding clinical engineers, data scientists, and biomedical engineers. MPs will also continue the leading role of facilitating and implementing novel technologies in clinical facilities. This leading role in technological innovations has a wider reach in the hospital beyond RO, radiology, and nuclear medicine departments; therefore, the MP department should have some sort of autonomy with excellent leadership to tackle these projects. The role of MP team leaders in deciding major research projects and various departmental requirements to perform large-scale development projects is considered invaluable.²⁹ It is important to supply intellectual input from the physics point of view about the overall process, the various parameters of which could affect timelines, to the senior leadership for proper decision-making. Generally, the senior administration uses this timeline as a baseline for planning, acceptance testing, commissioning, training, and starting new patient treatments. It is significant to attend all the scheduled project meetings, as these meetings can help to avoid delays, serious mistakes, misunderstandings, and significant errors.

In project management, a high degree of collaboration among multiple teams is often necessary³⁰; several key factors need to be contributed in a higher dimension to formulate a better collaborative research plan in the organization. The success of team collaborations is mostly influenced by the philosophy of the top executive members of the organization. The behavior of senior executives and team leaders plays a significant role in finding collaboration and cooperation among organizations or departments. Team leaders have a great responsibility to ensure there are the right team members in the team with proper skills and training to run projects successfully. The underlying culture, behaviors, and habits of team members certainly affect the effectiveness of team collaboration. The team leaders make significant differences in the team's success that, in turn, depend on the level of the collaborative behavior.²⁸ Ideally, the entire team is responsible for executing a strategic plan; however, most project leaders do not include their team members in the entire project planning phase, which could lead to serious conflicts in the work breakdown and difficulties setting up project goals, deliverables, or milestone phases. A good team leader can avoid these dilemmas by bringing the entire team into the project planning phase early on. Fostering collaborative behaviors can lead to better decisions, more creative solutions, and higher productivity. The role of MP leaders in scientific research project management is crucial, especially when it comes to scientific publications, innovation, and the introduction of novel products and services.

Strategic Planning

Strategic planning has a significant effect on department performance in a health care organization,³¹ and the MP leaders play a key leadership role in the strategic planning process. To formulate a competitive strategic plan, the team leaders should properly find then align the products, services, and strategies throughout the organization. Generally, employees have their perspectives about the strengths and weaknesses of the department/organization, and as such an appropriate survey should be conducted to obtain a diversity of perspectives from the team members. A suitable design should be used to support the business with long-term strategic goals, and the design can be any of the following formats: Porter's five forces, Boston Consulting Group matrix, or strengths, weaknesses, opportunities, threats analysis.⁷

Performance Measures

The success of a team depends on several parameters that may include the involvement of the team members contributing different skill sets, control over the goals, ability to affect the bottom line, constructive feedback, and many more. It is important to find the role of the employees in the department either as outcome-focused (task-oriented functions) or more process-focused (maintenance-oriented functions) before preparing constructive feedback. Team behavioral assessment can be performed using a communication pattern questionnaire that helps to find the specific roles and functions of team members. Team leaders have the responsibility to select the correct performance measures for the department or organization.³² Most organizations require a balance of measures drawing from all 4 categories (financial, customer, internal processes, and learning and growth) but many organizations depend too heavily on measures of 1 type at the expense of others.

Educational Program Leadership

Experienced MP leaders head education programs, make major decisions, and prepare the organization to overcome unforeseen challenges. In the RO department, the MP leaders supervise clinical and nonclinical staff, teaching and nonteaching staff, and administrative staff members in health care organizations, so they have plenty of opportunities to set up educational programs associated with the RO department. Currently, several academic facilities in the United States are encouraged to formulate MP residency, master, doctoral, and postdoctoral level programs in academic clinical facilities for students to further improve educational standards, and this tendency

indeed supports leadership, teaching, and research opportunities in organizations. Additionally, several side-stream programs such as radiation safety and protection, radioactive material transport, medical imaging safety, radiation therapist training, dosimetry training programs, and other relevant current topics are always available besides these mainstream opportunities for leading.³³ It is also necessary to educate nonradiation working professionals employed in the department such as managers, administrators, and health care policymakers, in addition to the public, about the essential role of MPs in hospitals.⁴

Education and Training for Leadership Positions

MP leaders in the department not only supervise radiation treatments, but they are also substantially involved in the department's administrative business activities. Experienced MP team leaders successfully manage several business-related activities, such as project management of modern technologies, negotiation of capital purchases, motivation of team members, acquisition of capital equipment, staffing, budgeting, organizing operational activities, and talent acquisition³⁴ in health care organizations. To operate these higher-level business functions, extensive training and experience are necessary, although many of these responsibilities are associated with all medical physics career levels. Health care organizations should maintain the right competitive personnel in leadership positions with appropriate education and training; therefore, structured education and formal training in the multifaceted business components are highly desirable to become a successful leader in RO.³⁴⁻³⁶ A university administration/management qualification is presently not mandatory for physicist leadership positions in the United States; however, it is better to enroll in a formal specialist training program(s) or certificate program(s), as these programs would enhance leadership opportunities for MPs in a significant manner.

AAPM Report Number 249 has provided the required competencies for medical physics training and the specific recommendations to acquire essential business-related skills such as leadership training, communication, teamwork, staffing, budgeting, and billing during the residency period.^{37,38} Because leadership qualities and in-depth knowledge in administration are crucial for many businesses today, consummate leaders gain formal education in business or leadership in addition to rigorous graduate and residency training.^{34,39} Medical Physics Leadership Academy has initiated a leadership education and development program to address the needs for leadership development among AAPM members.⁴⁰ "MP professionalism and leadership" is a collective term used by AAPM to address the MP's ability to adapt, navigate, and succeed

in the complex workplace environment that exists in health care organizations. This leadership development training program supports MPs to enhance the necessary skills required in health care to navigate clinical environments, improve patient care, and advance the profession.⁴⁰ Comprehensive knowledge of other fundamental business functions such as health care change management, business negotiations, optimizing team dynamics, teaching skill development, and soft skills development (communication, negotiation, leading and participation in meetings, and supervision) are highly desirable to become a successful leader in the health care environment. A proper understanding of business elements such as mission, vision, values,⁷ goals, motivation, creativity, team building, risk taking, thoroughness, managing ability, learning the business language, and continuous improvements are essential to becoming a successful leader. Learning business/administrative software packages like KRONOS, PLUS, DOR, and Lawson for daily departmental operations and understanding business language such as productivity, proforma, man-hours/stat, billing,⁴¹ profit and loss, current procedural terminology codes, diagnosis-related group, bundled charges,⁴² and so forth are beneficial before handling leadership roles. A structured academic program significantly enhances business knowledge and helps candidates prepare for health care leadership roles. Formal university academic programs such as a master's degree in business administration,³⁴ a Doctor of Business Administration, or a Doctor of Philosophy degree in business administration with a specialization in health care would significantly enhance leadership roles in the RO department as well as in the health care organization.

Conclusion

Efficient MP leadership is vital for effective administration, management, and performance of various essential business functions in RO. The role of MP team leaders in health care is not only limited to supervising routine clinical tasks, but they also play a significant role in various crucial business functions, which include leadership, operations, project management, research program leadership, strategic planning, employee performance measures, educational programs leadership, and many more. Even though many MP team leaders are currently involved in several major business functions in health care organizations, many of them do not have formal education or training in administration or management topics. It is highly significant to maintain the right competitive leaders in leadership positions with the right education and experience to operate key business functions in health care organizations. Therefore, a structured education and intensive training in management, administration, and/or leadership topics is necessary to become a

successful leader in RO. Leadership education programs developed by Medical Physics Leadership Academy or other premier institutions in the nation would support improving leadership qualities for individuals. Structured university academic (certificate, degree, or doctoral) programs in health care administration would be highly beneficial for aspiring future MP leaders; however, this element is not presently enforced for MP leadership positions in this country.

Supplementary materials

Supplementary material associated with this article can be found in the online version at [doi:10.1016/j.adro.2022.100947](https://doi.org/10.1016/j.adro.2022.100947).

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