НАВЧАННЯ ТА ПІДГОТОВКА МЕДИЧНИХ ФІЗИКІВ
EDUCATION AND TRAINING OF MEDICAL PHYSICISTS

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MENTORING FOR MEDICAL PHYSICISTS: WHEN AND HOW?

Education programs for medical physicists can be limited by local teaching resources and available technologies. Furthermore, modern imaging and therapy technologies continue to evolve at a rapid rate and require continuous learning support for their safe and effective implementation in the clinic. Mentorship provides an important resource in support of filling the educational gaps and the knowledge updates required for the development of new techniques and the implementation of new technologies. A structured mentorship process can be a useful resource at any point during a medical physicist's career, although the specific purpose of the mentorship will likely vary depending on when in one's career this occurs. This review provides a description of the various stages of a structured mentorship program along with some guidance on how to implement a sustainable and successful mentorship activity. Seven mentorship stages are described including 'defining the purpose of the mentorship', 'finding mentor / mentee partners', 'setting the scene', 'engagement', 'evaluation', 'redefinition', and 'separation'. Some etiquette guidelines are proposed including some suggested dos and don'ts. In some regions, there may be a dearth of nearby appropriately experienced mentors. Mentoring virtually using internet technologies may provide a good alternative. The results of an on-line global survey related to virtual mentoring are summarized. In conclusion, structured mentorships may provide a very useful resource for medical physicists at any stage of their careers. Understanding how best to navigate such mentorship programs will maximize their benefits.

K e y w o r d s : ***mentorship, medical physics, stages in mentoring, etiquette in mentoring, virtual mentoring, dos and don'ts in mentoring.***

Introduction

The dictionary definition of "mentor" as a noun is "a trusted counselor or guide" and as a verb "to serve as a mentor for". (Merriam-Webster, 2024). Mentoring can be a means of professional development through two people working in partnership in which one person has more experience or knowledge in a specific area (the mentor) who helps or guides a less experienced individual (the mentee) in that area. Mentoring can occur at any stage of an individual's career, be it at the graduate student level, during a residency which involves 'hands on, on the job' training, or during one's career advancement, whether in the clinic as one advances from a junior physicist, to a senior physicist, or the head of a department, or at the university as one advances from assistant professor to full professor, or department chair. The

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mentor-mentee relationship depends on the knowledge and experience of the individuals and not necessarily on age or position. Mentorship can be structured as in formalized mentoring programs, or it can be unstructured simply by being influenced by one's supervisor, superior, boss, or colleague. Mentoring can have two specific functions: (1) as in career and professional development, and (2) as in psychosocial development where the mentor serves as a role model and provides a support system for the mentee (American Psychological Association, 2024a). In some situations both functions can apply. The former addresses professional and career related issues and the latter addresses more broadly-based life-related issues, as, for example, in work-life ballance.

Mentoring stages. The stages of mentoring depend on the type of mentoring that is being considered. For informal mentoring, there really is no structured process. By way of example, I consider my graduate student supervisor, John C.F. MacDonald, as well as my first bosses, Harold E. Johns and John R. (Jack) Cunningham, of the book *The Physics of Radiology* fame (Johns, & Cunningham, 1983), to be mentors simply by being role models and examples in terms of guidance, leadership, and decision making. Informal mentoring evolves naturally without any defined or formal structure. Such informal mentoring has no formally defined roles for the individuals involved; it just evolves organically, primarily from the mentee's perspective. The mentors may not even recognize that they are providing a mentorship role. A limitation of informal mentorship is that not everyone has such mentors in their circles. Thus, it is very happenstance with this working for some but not for others. Seeing that informal mentorship is stochastic, it is useful for most individuals to be involved in more formalized mentorship programs (Afya Bora Fellowship …, 2018; Alberta Mentorship Program, 2020).

Various authors have described various stages in a mentorship process. This is my summary of these stages based on what I have seen described by others and my personal experience. Clearly, there will be a variation on these stages, dependent on the specific circumstances. This also varies with the nature of the organizational structure behind the mentorship program. For example, is it self-organized by the mentee or is there an organization (e.g., a university, or a medical physics society) that is providing a structured mentorship program in which help is provided in matching mentors and mentees and guidance is provided for the entire process? I summarize these stages as follows: (1) Defining the purpose of the mentorship; (2) Finding mentor/mentee partners; (3) Setting the scene; (4) Engagement; (5) Evaluation; (6) Redefinition; (7) Separation.

***1. Purpose of Mentorship*.** For both the mentee and the mentor it is important to understand at the outset what the purpose of the mentorship is. Examples could include: (a) to improve the employee's skill level; for medical physicists this could include anything from enhancing treatment planning skills to advancing radiation measurement skills, or more generally, enhancing all practical skills relevant for a practicing clinical physicist; (b) to developing leadership capability; (c) to act as a role model for addressing life skills, e.g., work-life balance, or career development considerations; and (d) to build self-confidence in, for example, public or local

presentations. At this stage, it also helpful to define some endpoints that describe the success of the mentoring activity.

2. Finding Mentor/Mentee Partnerships. The mentor/mentee matching process depends on the organization behind the mentorship program. For informal mentoring, this process can evolve through professional or social interactions. Potential mentees can search for experienced or successful people whom they admire as role models. Formal mentoring programs, likely will use some form of questionnaire or survey to guide the matching, using demographic, knowledge, and experience variables. For example, if radiation therapy equipment commissioning and quality assurance is a major focus of the mentoring, then one might want to use one component of the matching process as the nature of the equipment in both the mentor's and mentee's departments. The more aligned the departments are from a technology perspective, they more detailed the discussion can be between mentor and mentee.

3. Setting the Scene. The first step by the mentor and mentee is to jointly develop a written mentorship agreement, which clearly outlines (University of Iowa, 2021): (1) the purpose and expectations, (2) frequency, length, and format of meetings, (3) review process, (4) length of time of mentorship commitment, and (5) rationale for termination.

4. Engagement. This is the mentoring stage of learning and development to accomplish the goals established at the outset of the process. The mentor teaches the mentee lessons gained from the mentor's experience. In turn, the mentee might teach the mentor lessons related to new technologies, methodologies, or emerging issues in medical physics.

5. Evaluation. As part of the development of the mentorship process, clear objectives along with definable and measurable endpoints provide guidance as to the success of the mentorship program. Thus, the evaluation should assess whether the mentorship is meeting its objectives. Successes and limitations should be discussed at predefined intervals and adjustments should be made as appropriate.

6. Redefinition. This is directly related to the evaluation. At this stage, the review addresses the successes and weaknesses of the mentoring process, and whether the process should continue as is, or whether the purpose should be redefined, or whether the engagement process should be altered. In other words, this might be a renegotiation of the original agreement to establish a modified mentorship agreement, or to bring the mentorship to a close. Frank, open and professional discussion will decide how to proceed with or finish the mentorship.

7. Separation. The separation stage occurs when the mentorship ends, possibly because the mentorship has accomplished its goals, or because the individuals no longer want to continue with the process. Note that ending the relationship is not a sign of failure; it could simply mean that the original purpose of the mentorship has been fulfilled.

Etiquette of mentoring. Note that mentors and mentees will have had different backgrounds and experiences. Because of the variations in mentoring processes, some broad suggestions can be considered as guidelines to make the relationship feel comfortable and valued. Table 1 gives some broad dos *and* don'ts to consider in this context.

Table 1

Example mentor and mentee dos and don'ts as etiquette guidelines (adapted from (American Psychological Association, 2024a,b; National Society of Professional Engineers, 2024))

Mentor Dos	Mentor Don'ts
Do provide mentorship only in your areas of expertise. Suggest other mentors as resources outside your expertise or when the attempted mentoring relationship is not working.	Don't take on more mentees than is realistically manageable.
Do indicate openness to being a mentor. Be accessible to the mentee.	Don't treat mentees as free labor.
Do maintain clear, distinct boundaries with the mentee. Set clear expectations.	Don't make personal requests of the mentee.
Do treat the mentee professionally and in an ethical fashion. Be thoughtful and sensitive about the mentee's feelings and time.	Don't gossip about the mentee. Maintain total confidentiality.
Do model professional behavior.	Don't micromanage the mentee. Provide advice and counsel, but do not direct the mentee to take specific actions.
Do respect your mentee's time as much as your own.	Don't assume that your schedule always has priority.
Do be explicit about the 'norms' for your meetings and your own needs and limits (e.g., time, style of interfacing, etc.).	Don't make your mentee guess or learn by trial and error, about the ground rules for your meetings.
Do always ask if you can make a suggestion or offer feedback.	Don't automatically give advice or criticism.
Do set specific goals and expectations for the mentoring relationship. Clearly communicate what you want from the relationship. Maintain distinct boundaries and understand what the mentor expects.	Don't expect the mentor to make decisions for you. Learn to resolve problems and issues independently of the mentor.
Do be proactive. It is the mentee's responsibility to maintain contact with the mentor and schedule future interactions.	Don't take advantage of the mentor. Respect the mentor's time and help.
Do treat the mentor professionally and in an ethical fashion. Be thoughtful and sensitive about the mentor's feelings and time.	Don't gossip about the mentor.
	Don't take rejection or termination of a mentoring process personally.

Virtual mentoring. Matching mentor and mentee from the same institution is not always possible, especially in contexts where departments are small, or where available expertise is limited. In this case, virtual mentoring might provide a solution, where the mentoring takes place using information communication technologies (ICTs). Medical Physics for World Benefit (MPWB) has recently undertaken a

global survey of medical physicists to determine the preferences and needs for virtual mentoring especially in the context of resource limited environments. The survey had nearly 400 responders (68 % male, 32 % female) from 76 countries with 66 % from high-income countries and 32 % from low- and middle-income countries. Data were obtained on experience level both as mentors and mentees. Eighty-three percent were interested in participating in a mentorship program either as a mentor, mentee or both. The results of this survey provided important considerations to inform the development of a successful and sustainable virtual mentoring program for medical physicists. Nearly all respondents agreed that it is important to have clear expectations formalized at the initiation of the mentoring process. Preferences were given to meeting once every 2–4 weeks for 30–60 minutes to discuss and help solve specific problems, to address clinical questions and detailed clinical implementation procedures. A regular review process should be established as part of the mentoring agreement. Mentorship training was considered important for both mentors and mentees. MPWB will be implementing a formalized mentorship program in support of advancing medical physics especially in lower income contexts. If interested, keep an eye on the MPWB website (www.mpwb.org).

Discussion and conclusions

Mentoring can be a useful process for advancing the knowledge and experience of individual medical physicists for the safe and effective implementation of technologies and techniques for imaging and therapy. While mentoring has often been performed with little structure, this review provides relevant considerations for the implementation of a more rigorous mentorship program leading to an efficient structured mentorship activity.

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НАСТАВНИЦТВО ДЛЯ МЕДИЧНИХ ФІЗИКІВ: КОЛИ ТА ЯК?

Освітні програми з медичної фізики можуть бути обмежені локальними викладацькими ресурсами та доступними технологіями. Сучасні технології візуалізації і терапії розвиваються швидкими темпами, що потребує постійної підтримки навчання для їх безпечного й ефективного впровадження в клініці. Наставництво надає важливий ресурс для заповнення цих освітніх прогалин та оновлення знань, що необхідні для розробки нових методик і впровадження нових технологій. Структуроване наставництво може бути корисним ресурсом на будь-якому етапі протягом кар'єри медичного фізика, хоча конкретна мета наставництва, імовірно, буде різною, залежно від моментів кар'єрної послідовності. Описано сім етапів структурованої програми наставництва та деякі вказівки до стійкої й успішної реалізації його діяльності: визначення мети наставництва; пошук партнерів для наставника / підопічних; створення умов для проведення; згода сторін; оцінювання; перевизначення; відокремлення. Запропоновано рекомендації з етикету і надано певні пояснення до них. Оскільки у деяких регіонах може спостерігатися дефіцит наставників із належним досвідом, то віртуальне наставництво з використанням інтернет-технологій може стати прийнятною альтернативою. Узагальнено результати глобального онлайн-опитування щодо віртуального наставництва. Структуроване наставництво може стати корисним ресурсом для медичних фізиків на будь-якому етапі їхньої кар'єри. Правильне розуміння якнайкращого спрямування в таких програмах наставництва збільшить їхні переваги.

Ключові слова: ***наставництво, етапи наставництва, етикет у наставництві, віртуальне наставництво, що можна і чого не можна робити в наставництві, медична фізика.***

Член програмного комітету Я. Ван Дайк заявляє про відсутність конфлікту інтересів та невтручання в процес оцінювання цієї статті відповідно до міжнародних стандартів публікаційної етики. Спонсори не брали участі в розробленні дослідження; у зборі, аналізі чи інтерпретації даних; у написанні рукопису; в рішенні про публікацію результатів.

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