Analysis of medical dosimetry graduates’ self-perceived level of preparedness when entering the workforce

Alecia Eliason, B.S., R.T.(T), Holly McConnell, B.S., Alexandra Murray, B.S., R.T.(T), Ryan Pohl, B.S., R. T.(T), Nishele Lenards, M.S., C.M.D., R.T.(R)(T), FAAMD, Ashley Hunzeker, M.S., C.M.D.

Abstract

The purpose of this study was to analyze aspects that affect a medical dosimetry student’s degree of self-perceived preparedness upon graduation. The following factors were evaluated: prior experience as a certified radiation therapist (RTT), satisfaction with clinical internship education, and job placement following graduation. These factors were deemed significant or insignificant based on impact to graduates’ perceived level of confidence. Retrospective survey data were collected from graduated cohorts of the University of Wisconsin-La Crosse (UWL) medical dosimetry program. Comparative graphs were created to display how the factors evaluated affect self-perceived preparedness. Findings indicated that RTTs have higher levels of self-perceived confidence upon graduation, but take longer to feel comfortable transitioning to the role of a medical dosimetrist. A positive correlation existed between clinical satisfaction and self-perceived preparedness when entering the workforce. Additionally, factors associated with relocating after graduation had a negative impact on time required to feel comfortable at one’s first medical dosimetry job.

Introduction

Medical dosimetrists come from a wide variety of educational and professional backgrounds. Historically, medical dosimetrists were classified as physics personnel who were mainly responsible for performing dose calculations and creating dose distribution maps.\(^1\) Candidates were primarily radiation therapists with a strong mathematical background and interest in treatment planning procedures. The field of radiation oncology has experienced many technological advances and, consequently, designing treatment plans has become increasingly complex. As a result, the Medical Dosimetrist Certification Board (MDCB) decided that beginning in 2017, all candidates must graduate from a Joint Review Committee on Education in Radiologic Technology (JRCERT) accredited program and hold a bachelor’s degree to be
eligible for certification. The premise of this report is that the education a graduate received from accredited programs affects confidence as a new medical dosimetrist.

For the safety of radiation therapy patients, it is of utmost importance to ensure medical dosimetry students receive adequate education. Medical dosimetry educational programs are responsible for producing competent graduates who are capable of designing high-quality treatment plans. To successfully do so, these programs must focus on improving areas where graduates feel most unprepared. Analyzing the way in which graduates acquire high levels of self-perceived preparedness can be beneficial to future aspiring medical dosimetrists as well. Knowing the educational background of the most confident medical dosimetry graduates will help prospective students plan clinical and didactic pathways.

Currently, there is a lack of published data regarding medical dosimetry students’ self-perceived levels of preparedness upon entering the workforce. Baker et alrecommended investigating the relationship of previous work experience as a radiation therapist and its effect on success of a medical dosimetry student. Analysis of a survey conducted by Mills indicated that sufficient training in both the academic and clinical setting is crucial for medical dosimetrists, but does not explore the factors that influence this training. In addition, Lenards provided evidence supporting the need for student confidence at the completion of a medical dosimetry program.

The University of Wisconsin - La Crosse (UWL) offers a master’s degree in medical dosimetry and was the fourth program in the nation to receive JRCERT accreditation. Admissions into the program considers candidates from two tracks; Track A for bachelor’s degree recipients with radiation therapy certification (RTTs) and Track B for bachelor’s degree recipients without radiation therapy certification. Since students are separated into individual internship sites, each has a unique clinical experience. Retrospective survey data were used to provide insight into factors that affect a new medical dosimetrist’s confidence level. The purpose of this study was to assess how different aspects of a student's education impacts the level of self-perceived preparedness when entering the workforce.

**Methods and Materials**

Retrospective surveys were used from UWL medical dosimetry master’s degree graduates between 2012 to 2015. As years progressed, the program grew, yielding varying and increasing cohort sizes from which to sample. A total sample size of 43 graduates (n=43) was
employed for this retrospective cohort study. Though each survey covered a variety of topics, this study concentrated on factors that could potentially influence the level of self-perceived preparedness when approaching the first medical dosimetry job. These factors were deemed significant or not significant based upon influence on the graduate’s confidence.

The first research goal of this study was to determine if experience as an RTT had a statistically significant impact on graduate’s self-perceived level of preparedness. Currently, most medical dosimetry programs only consider credentialed radiation therapists for admission. Surveying UWL graduates was advantageous because the population consisted of RTT and non-RTT students. Prior RTT experience, for the purpose of this study, was defined as an individual holding a position as a radiation therapist for any given time. Those with a valid RTT degree, but no clinical application of the degree, were not included in this subset. Graduates were asked to rate their levels of self-perceived preparedness using a scale from “poorly” to “very well”. Additionally, the time required to become comfortable independently performing medical dosimetry duties was compared. Due to the fact that prior RTT experience was not a question for each cohort survey, this factor was reviewed in terms of individual responses from the cohort that graduated in 2015 only.

The second research goal of this study was to assess whether satisfaction of a graduate’s clinical experience had an effect on self-perceived preparedness. Questions were posed to determine if confidence in one's learning environment transfers to self-efficacy. Graduates were also asked to rate their level of confidence in treatment planning procedures set as program competencies. Responses to this question could identify opportunities for improvement of medical dosimetry clinical instruction.

The third research goal was to discern post-graduation factors that can affect self-perceived preparedness for medical dosimetry students. Whether new graduates received a job at the internship site was recorded to determine if confidence levels of graduates were affected by the adjustment period associated with relocating. The effect of relocating to a site with a different treatment planning system was considered to see if adapting to a new treatment planning system decreased self-perceived preparedness. Additionally, the time that lapsed between graduation and the start of the first medical dosimetry job was examined to determine whether a hiatus could produce a lack of confidence in planning abilities.

Results
Of the total respondents, 37.21% felt comfortable or trained in the new position after 1 month (Figure 1). Over 90% of the population felt comfortable or trained within 6 months of beginning the position. Therefore, only 9.3% of the population (4 respondents) required more than 6 months to feel comfortable or did not feel properly trained when the survey was conducted. Half of the individuals surveyed felt very well prepared for a job after graduation (Figure 2). The number of responses per answer selection choice (i.e. “Very well” or “Adequately prepared”) decreased in a linear fashion, terminating with no responses of “poorly prepared”.

Of the 16 students enrolled in the graduating class of 2015, 9 students had previously worked as a radiation therapist (Figure 3a, b). The amount of experience ranged from 4 years to 20 years with the average number of years working as a radiation therapist of 8.5. The responses from this cohort served as a basis for the evaluation of how RTT experience affects preparation for a career in medical dosimetry.

Exactly half of the students in the class of 2015 were employed by the same clinical internship site upon graduation (Figure 4). When the survey was collected, 15 graduates were operating the same treatment planning system used during the clinical internship (Figure 5). Of the 36 survey responses regarding current employment status, 33 were working full time as medical dosimetrists (Figure 6). Within the remaining 3 responses, there was exactly one individual in the residual options of working part time, per diem, or not in the field of medical dosimetry.

The average level of confidence for the competency procedures performed during clinical internship resulted in 85.39% of respondents able to perform the designated task with confidence (Figure 7). The procedure with the highest level of confidence, 95.19%, was prostate Intensity Modulated Radiation Therapy (IMRT) planning. The procedure with the lowest level of confidence, 29.21%, was brachytherapy planning. Brachytherapy planning is not a daily practice for all students and is not a job requirement for the majority of medical dosimetrists.

**Discussion**

The purpose of this retrospective cohort study was to analyze factors that affect a medical dosimetry graduate’s self-perceived level of readiness when entering the workforce. The first factor examined was whether experience as a radiation therapist affected either the time required to feel comfortable or the perceived level of preparedness in medical dosimetry school graduates.
The degree of confidence attained while enrolled in an educational program was also related to time required for the graduate to become comfortable as a working medical dosimetrists. Then, satisfaction level of an individual’s internship experience was compared to the degree of comfort sensed upon graduation.

Mills reported that the majority of medical dosimetrists thought that entrance to a medical dosimetry program should require a radiation therapy certification as well as a bachelor’s degree. However, Baker et al. reported no statistical significance between prior RTT experience and successful completion of a medical dosimetry program. Analysis of UWL surveys showed that graduates with prior RTT experience required a longer amount of time to feel comfortably trained at a new job than those without RTT experience (Figure 8, 9). The adaptation of a new role, and consequently a different identity, within the radiation oncology team may demand a longer period of adjustment. In an analysis of registered nurses’ transition to nurse practitioners, Barnes stated that the shift from expert status to novice status results in a loss of confidence in one’s ability. She asserts that this transition can delay successful role development within the first year of practice. Another possible explanation for the increased adjustment time for RTTs is that RTTs need more time to become proficient critical thinkers in the field of medical dosimetry. A dissertation by Greener concluded that non-RTTs with a bachelor’s degree had significantly higher critical thinking skills than RTTs. She suggested that RTTs critical thinking skills diminished with time away from formal education. Consequently, these skills need to be re-acquired during the RTTs formal medical dosimetry education which may hinder initial level of comfortability.

Somewhat contradictory, UWL surveys also indicated that those with prior RTT experience felt more prepared for their medical dosimetry jobs than those without RTT experience (Figure 10, 11). Of the 9 RTTs surveyed from the 2015 cohort, 6 (66.7%) responded that they felt “very well” or “well” prepared upon graduation. Of the 7 non-RTT graduates surveyed, only 3 (42.8%) responded that they felt “very well” or “well” prepared upon graduation. This increased level of self-perceived preparedness of RTTs may correlate to shorter training times required upon graduation. In a study by Lenards, 66.7% of employers that hired both RTT and non-RTT program graduates agreed that non-RTTs required more initial training than RTT. It is important to note, however, that employers also stated they only noticed a difference between RTT and non-RTT up to about 9 months.
After completing medical dosimetry school, those who felt very prepared required a shorter amount of time to become comfortable in the new medical dosimetry position (Figure 12). Preparation included competence in skills necessary for the job, meaning medical dosimetry graduates who felt prepared were confident performing medical dosimetric tasks. Katowa-Mukwato et al. found that confidence (in medical students) directly correlated with how often a skill was performed and practiced. Therefore, in order to become competent, graduates must have experienced these procedures several times throughout the medical dosimetry education program. If a graduate receives more practice performing certain procedures, proficiency increases. According to UWL surveys, the two competency procedures graduates felt most confident performing were prostate IMRTs and intact breast tangents with scores of 93.56 and 95.19 respectively. It is likely that graduates were exposed to these treatments most often because prostate cancer has the highest incident among men and breast cancer the highest incident among women in the United States. Consequently, it can be inferred that graduates who practiced medical dosimetric tasks most often felt comfortable in a shorter amount of time than those who did not practice the necessary skills repeatedly.

Those who felt very well-prepared for medical dosimetry jobs were also satisfied with the clinical experience (Figure 13). Consequently, a positive correlation existed between those satisfied with the clinical experience and the amount of time required to feel comfortable in a medical dosimetry position (Figure 14). Florin et al. suggested capability beliefs of nurses upon graduation are influenced during undergraduate studies, including both knowledge and skill obtained during training. This concept can be applied to other competency-based health education systems such as UWL’s medical dosimetry program. Therefore, medical dosimetry students with perceived adequate training levels (while in school) had higher capability beliefs (or confidence) upon graduation. This ultimately led to a shorter time frame needed to achieve comfortability in the medical dosimetry profession.

Graduates who received medical dosimetry jobs at their internship sites felt comfortable with the position in a shorter amount of time than those who received jobs elsewhere (Figure 15, 16). According to the 2015 cohort UWL surveys, all 8 of the graduates who received a job at their clinical internship site felt comfortable within a 6-month time frame. Of the 8 graduates who received a job somewhere besides their clinical internship site, 7 (87.5%) also felt comfortable within a 6-month time frame. However, 1 graduate from this cohort reported not
feeling comfortable at all at the time this survey was conducted. The prevalence of peer-reviewed journals and annual meetings within the radiation oncology community has produced tremendous strides in the sharing of best practices. Nevertheless, this field is far from standardized and different clinics can treat similar cancers in a variety of ways. Continuing work at a graduate’s internship site allows for familiarity with the attending physicians, treatment planning systems, and work flow of the department. The necessary time required to become comfortable at the same location of a student’s clinical internship would have already passed upon transition to the new role of staff medical dosimetrist.

Conclusion

The field of medical dosimetry is constantly evolving and entrance into this profession is becoming more stringent; the MDCB now requires both a bachelor’s degree and completion of a JRCERT accredited program for certification eligibility. As the standards of the medical dosimetry profession increase, it is prudent to find the optimal way of educating aspiring medical dosimetrists. A lack of published data concerning the self-perceived preparedness of medical dosimetry graduates entering the workforce created a demand for additional investigation. This study was conducted to determine what factors affect a graduate’s confidence level and ultimately the degree of preparedness when encountering the first job opportunity. With the aid of retrospective post-graduate surveys, significance of radiation therapy experience and formal dosimetry education was assessed for ability to produce confident graduates.

Prior RTT experience made a positive impact on a medical dosimetry graduate’s perceived degree of preparedness when entering the workforce. However, the time required for prior RTTs to feel comfortable or trained in the medical dosimetry position was longer than non-RTT graduates. Experience working within the realm of radiation oncology and understanding intricacies involved with successful treatment of cancer patients may account for this increased level of confidence. On the contrary, adopting a new position within a radiation oncology team could require extra effort from the graduate and initially lead to a longer adjustment period.

Qualitative data analysis and comparative graphs indicated several factors in a student’s education that positively influenced confidence as a newly employed medical dosimetrist. Students satisfied with the clinical experience required less time to feel comfortable in a medical dosimetry position than those who were somewhat satisfied with the clinical experience. A high degree of internship satisfaction also correlated to increased levels of self-perceived
preparedness. Furthermore, receiving a job at the students’ clinical internship site made graduates feel more comfortable as a new medical dosimetrist compared to graduates that had to get acquainted with a different environment.

Based on the study results, further research evaluating factors affecting a graduate’s level of preparedness should be conducted. It would be beneficial to provide the same survey, following the same amount of post-graduation time, to a larger sample size. Perhaps the survey can be issued to graduates of other medical dosimetry programs to validate trends observed in this study. An increased sample size allows for more in-depth statistical analysis and accurate comparison of the factors. The reason that experienced RTTs required more time to feel comfortable as medical dosimetrists can also be investigated. With a correlation between RTT experience and increased levels of preparedness, additional studies to determine the optimal amount of radiation therapy education for medical dosimetrists could be useful. Additionally, the idea that RTTs have an advantage over non-RTTs because of exposure to radiation oncology for a longer period of time should be considered. In order to verify the benefits of RTT experience, additional studies to compare treatment plan production quality of RTT and non-RTT medical dosimetrists with similar exposures to radiation oncology could be performed. Specifics regarding the reason certain internship sites received higher satisfaction scores than others must also be explored. The results of this study are not conclusive, but serve as a good starting point and basis for further research.
References

1. Dehghanpour M. An Evaluation of the Medical Dosimetry Program at the University of Texas MD Anderson Cancer Center School of Health Professions [dissertation]. Houston: University of Houston; 2011.


7. Greener, A. Critical Thinking Skills and Medical Dosimetry Education. [dissertation]. South Orange: Seton Hall University; 2013.

8. Lenards N. Do you have to be a RTT before a CMD? The ongoing question. Paper presented at: American Association of Medical Dosimetrists Annual Meeting; June 13, 2017; Indianapolis, IN.


Figure 1. Graphical representation of responses (n=43) for question one, “How long did it take for you to feel “comfortable” and “trained” in this position?”

Figure 2. Graphical representation of responses (n=34) for question two, “How well prepared do you think you were for your job?”
Figure 3a. Graphical representation of responses (n=16) for question three, “Did you work as a radiation therapist before entering into the Medical Dosimetry program?”

Figure 3b. Graphical representation of the responses (n=9) for the second part of question three, “If yes, for how long?”. The average number of years of prior RTT experience is 8.5 years.
**Figure 4.** Graphical representation of responses (n=16) for question four, “Were you employed by your clinical internship site after graduation?”

**Figure 5.** Graphical representation of responses (n=16) for question five, “Is your current treatment planning system the same as what you used during clinical internship?”
Figure 6. Graphical representation of responses (n=36) for question six, “Are you currently working in dosimetry full time, part time, per diem, or not at all?”
Q7: Please rate your level of confidence in planning the following procedures early in your medical dosimetry career (after graduation), 100 being the most confident and 0 being not confident.

Figure 7. Graphical representation of responses (n=16) for question seven, “Please rate your level of confidence in planning the following procedures early in your medical dosimetry career (after graduation), 100 being most confident and 0 being not confident.”
Figure 8. Graphical representation (n=9) of an individual’s comfort level time frame with prior RTT experience.

Figure 9. Graphical representation (n=7) of an individual’s comfort level time frame without prior RTT experience.
**Figure 10.** Graphical representation (n=9) of an individual’s self-perceived preparedness when they have prior RTT experience.

**Figure 11.** Graphical representation (n=7) of an individual’s self-perceived preparedness when they do not have prior RTT experience.
Figure 12. Graphical representation comparing answer responses to “How prepared do you think you were for your job?” (n=34) and “How long did it take you to feel comfortable or trained?” (n=43).

Figure 13. Graphical representation comparing answer responses to “How prepared do you think you were for your job?” (n=34) and rating of clinical satisfaction (n=35).
Figure 14. Graphical representation comparing answer responses to “How long did it take you to feel comfortable or trained?” (n=43) and rating of clinical satisfaction (n=35).

Figure 15. Graphical representation (n=8) of an individual’s comfort level time frame when they did receive a job at their clinical internship upon graduating.
Figure 16. Graphical representation ($n=8$) of an individual’s comfort level time frame when they did not receive a job at their clinical internship site post graduation.