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An Assessment of Medical Physics Knowledge of Undergraduate Physics Students

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ABSTRACT

Medical physics in an applied branch of physics in which physics principle applied in medicine. With the tremendous advancement in diagnostic and therapeutic site medical physics had taken more intention. In this study we assessed the medical physics knowledge of the undergraduate physics students. The study includes 2nd year (n=180), 3rd year (n=140) and final year students (n=70), studying physics as a major subject. The paper comprises of 12 MCQ's that covers radiology, radiation physics, radiation protection and physics of radiation therapy. The students were given 12 minutes to answer the questions. On average 56 (31.2%) students from second year answer the paper correctly. This value increased to 57(41%) and 35(50%) for the third and final year students. Only 33(17%) students of the second year gave the correct answer to the radiation oncology section. The results slightly increased to 23% (n=33) for the third year students. The final year students performed better and the passing score was 28.1% (n=19) in this section. All the students performed better in radiation physics section, where the overall scores for 2nd, 3rd and 4th year were 47.2%(n=85), 54.8%(n=77) and 55.7%(n=39) respectively. From this study we conclude that the final year students have significant knowledge in all four areas.

1. Introduction

Physics is the branch of science which deals with the interaction between matter and energy [1]. It has many branches and medical physics is an applied branch of physics, where concepts and principles of physics are applied to medicine [2]. The medical physics department is usually found in hospitals where radiology, radiation oncology and nuclear medicine facilities are available. The individual who provides clinical professional services in one of the above mentioned departments is known as a medical physicist [3, 4]. In recent years due to technological advancement in the fields of diagnostics and therapeutics, medical physicists emerged as highly valued professionals. Medical physicists are responsible for the proper functioning of the machines and optimum use of ionizing radiation. Their responsibilities vary with respect to the department they work in, with a common goal, i.e., to provide optimization and justification for the proper use of ionization radiation [5].

The qualification and training of a medical physicist are very important. It enables the individual to understand clinical scenarios and take appropriate decisions according to the situation. The eligibility criterion for a medical physics practitioner is either graduation in physics with a minimum six months clinical experience or MS degree in medical physics [6]. This requirement is set by the Pakistan Nuclear Regulatory Authority (PNRA). According to American Association of Physicists in Medicine (AAPM), medical physicist are those who earned master's and/or doctoral degree in physics, medical physics, biophysics, radiological physics, medical health physics, or equivalent disciplines from an accredited college or university; and has been granted certification in the specific subfield(s) of medical physics by an appropriate national certifying body [7]. In this study we assessed the medical physics knowledge of the undergraduate physics students of two different universities. This is because only to get idea how many students are familiar with this subject. The purpose of this study is to emphasize the importance of this subject and try to give very basic idea of this field.

2. Methods and Materials

Multiple choice questionnaire (MCQ) was distributed to undergraduate physics students of two different universities in September 2015. Both the universities belong to public sector and located in the same city. The study included 2nd year (n=180), 3rd year (n=140) and final year (n=70) students who had physics as a major subject. The questionnaire comprised of 12 MCQ's, covering radiology, radiation physics, radiation protection and physics of radiation therapy. The students were asked three questions from each area and given 12 minutes to answer the questionnaire. Correct answer received 1 mark, whereas incorrect or omission received zero mark.

There was no negative marking in this assessment. All questions had four choices and students were advised to mark a circle on appropriate answer only. More than one circle of one answer received 0 marks. The questionnaire is available in appendix. Data was entered and analyzed using statistical analyses software SPSS version 17.

3. Results

The study population includes a total of 390 students from two different universities. Among them, 208 (53.3%) were female and 177 (46.7%) were male. A questionnaire was distributed to all students. The mean number of second year students who gave correct answer was 56(31.2%) patients. This increased to 57(41%) and 35(50%) for third and final year students respectively. Table 1 shows the response to questionnaire for all 390 students.

Table.1: Mean score of all twelve questions of each year

Q. No	Second Year		Third Year		Fourth Year	
	✓ %	× %	✓ %	× %	✓ %	× %
1	39.9	61.1	64.3	35.7	75.7	24.3
2	34.4	65.6	42.1	57.9	58.6	41.4
3	31.6	69.4	39.3	60.7	61.4	38.6
4	50.0	50.0	57.1	42.9	60.0	40.0
5	61.1	38.9	67.9	32.1	72.9	27.1
6	31.6	69.4	39.3	60.7	47.1	52.9
7	28.3	71.7	34.3	65.7	41.4	58.6
8	26.7	73.3	47.1	52.9	51.4	48.6
9	21.1	78.9	28.6	71.4	45.7	54.3
10	19.4	80.6	25.7	74.3	32.9	67.1
11	17.8	82.2	22.9	77.1	27.1	72.9
12	15.0	85.0	20.0	80.0	24.3	75.7

✓= Correct Answers

×= Incorrect Answers

As expected, the frequency of correct answers was better for senior group of students. A comparison of their assessment is shown in Fig. 1. Only 33 (17.4%) students of second year give the correct answer to the radiation oncology section. The results slightly improved to 33(23%) for the third year students. The final year students performed better and the score was 19 (28.1%) in this section. All the students performed better in radiation physics section. The overall scores for 2nd, 3rd and 4th year were 85(47.2%), 77(54.8%) and 39(55.7%) respectively. Similarly, the 4th year students scored better in radiology and radiation protection sections as shown in Fig. 2. The fourth year female students performed better than their male counterparts and their scores were 4.3% higher (Fig. 3).

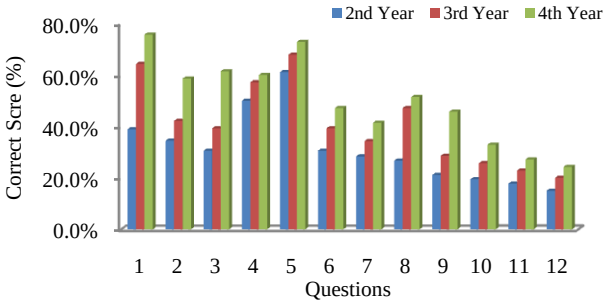

Fig. 1: Mean correct score in percentage of twelve questions

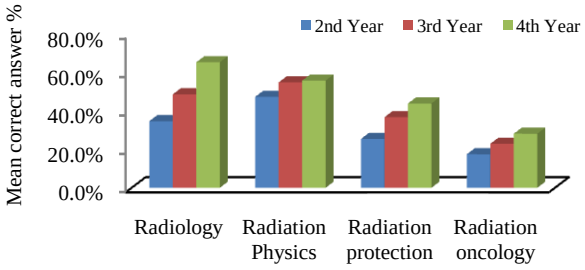

Fig. 2: Mean correct answer in each year of all four areas of medical physics

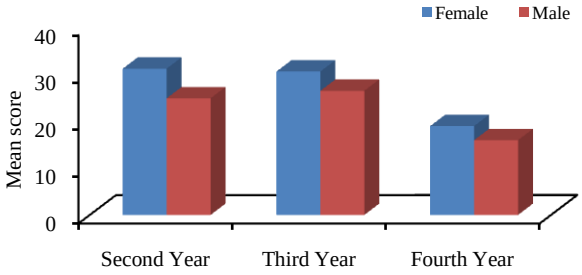

Fig. 3. Mean score comparison of female and male

4. Discussion

Medical physics is a growing field in our country due to rapid advancement in technology and increasing need of diagnostic and therapeutic facilities. The high demand of such professionals requires a better understanding of the subject at the level undergraduate education. The universities may devise ways and means to teach medical physics at the undergraduate level, so that the students would know this emerging field and groom their interest. In this study, we observed that second year students have some basic knowledge of radiation physics but are not aware of the other three areas of medical physics. The third year students were comparatively better than the second year students. They have better knowledge of radiation physics and radiation protection and 56%of students gave the correct answer of this section. Only 38% and 18%have knowledge of radiology and physics of radiation oncology, respectively. This can be due to the fact that some relative or friend required the use of

ionizing radiation for diagnostic or therapeutic purpose which might have triggered their interest to learn more about medical use of ionizing radiation. The final year students have superior knowledge in all the four areas. This may have been because of attending an academic activity like a seminar / workshop on medical physics of radiation protection. Interactions with physicist at this platform may increase their knowledge about these subfields. Electronic media, print media, social media and internet also plays a vigorous role to enhance the knowledge of our students. There are only two institutions in Pakistan which offer postgraduate education in medical physics. Pakistan Institute of Engineering and Applied Sciences (PIEAS), Islamabad and Islamia University, Bahawalpur [8]. PIEAS offer two years MS Medical Physics Degree, However Islamia University, Bahawalpur offers some basic courses in Medical Physics in their graduate as well as postgraduate level of education. This is good but not enough. However, we believe that medical physics education should also be offered at undergraduate level. There are two main reasons why this subject is still to be taught at undergraduate level: deficiency of competitive and trained professionals and unavailability of state of the art equipment. These problems may be addressed if universities collaborate with the hospitals where latest equipment and trained staff is available. This will help students to do research work during their attachment with these medical centers. Residency training programs may also help to advertise medical physics and produce new talent. The Aga Khan University Hospital offers a two year certificate program in medical physics. Similar programs, if initiated at other academic institutes, may open new opportunities for graduate students who wish to start their carrier in this field.

5. Conclusion

From the study it is concluded that the second year students possess minimal knowledge of medical physics. However they have some knowledge of radiation physics, which may probably be due to their previous modern physics courses. They do not have any exposure to the other three areas of medical physics. The final year students have significant knowledge in all four areas.

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