WHICH CRITERIA SHOULD WE USE TO DETERMINE AN ADEQUATE NUMBER OF LINEAR ACCELERATORS IN EMERGING ECONOMY COUNTRIES?

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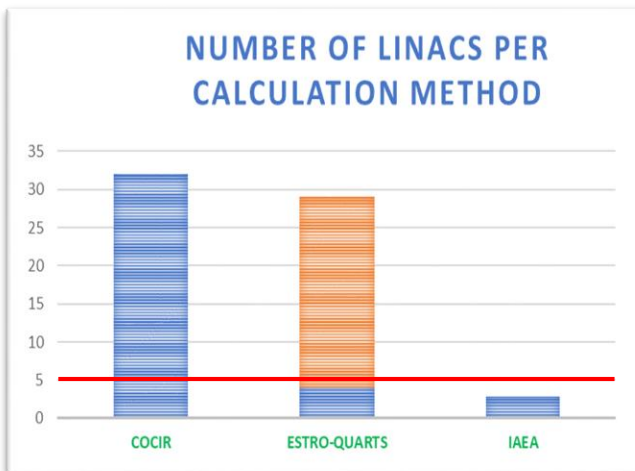*Muscat, Oman*

Purpose

In the age of limited resources, knowing the number of linear accelerators (LINACS) is paramount for designing and planning comprehensive coverage for a given population. In Oman, we have a stable population with minimal rates of immigration/emigration. The current needs of LINACS are met so we have a unique opportunity to test some of these guidelines. The results should help emerging economies use a similar approach in estimating their needs. This study was conducted to estimate the demand for radiotherapy services in Oman, using the most common methods and recommendations available in the literature.

Materials/Methods

The following calculation methods were analyzed: COCIR - targets a density of 7 radiotherapy units/ million persons; ESTRO/QUARTS - 1 LINAC per 400 patients/year or 1 LINAC per 180,000 persons; and IAEA method that utilizes a combination of cancer incidence, number fractions per cancer type, and machine workload. Population demographics with cancer incidence were extracted from the latest Oman Cancer Registry data, 2019. For the density of LINAC, we used the 2019 population of 4.603 million. Workload considered 4 fractions/hour, 8-hour shift, 248 working days. Calculations included the total number of cancer cases, average number of fractions/year, machine workload, rate of patients receiving radiotherapy per cancer type, the optimal number of fractions per treatment course, reirradiation rate, and radiotherapy utilization rate per cancer type.

Results

Based on the 10 most frequent cancer incidence (1,437 cases), the total number of fractions/years was 22,920. The workload of machines was 7,936 fractions/year. Calculations included total cancer incidence (2,039) and an average of fractions/patients based on the average of fractions per cancer site. The total number of fractions was 27,715. The reirradiation ratio increased by 25% in the number of fractions and resulted in a total of 34,644 fractions. For the COCIR, ESTRO/QUARTS, and IAEA recommendations, the range was 2.8 to 32 of LINACS for adequate coverage in Oman (respectively 32; 4 to 25; and 2.8).

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Conclusion

The analysis of the recommended guidelines for calculating the required number of LINACS in Oman showed a wide range. While in practice we know currently the number of LINACS required for our population is 5, for emerging economies the ESTRO/QUARTS recommendations of 1 LINAC per 400 patients/year, or the IAEA calculation methods are the closest approximation to the actual needs.

References

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