



# Radiation Dose to the Closest Critical Organ during External Beam Radiotherapy of Head & Neck, Breast and Cervix at the University College Hospital, Ibadan, Nigeria



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## Introduction

Radiotherapy is the use of ionizing radiation for treatment of diseases, mostly malignant and non-malignant. Its goal is to deliver maximum radiation dose to tumour cells while minimizing dose to the surrounding normal cells. Studies have shown that patients who underwent radiotherapy usually receive highest scattered radiation dose to organs closest to the treatment sites due to inevitable exposure and making them susceptible to cancer induction. This study aims at quantifying scattered radiation dose to closest critical organs during external beam radiotherapy of the head & neck, breast, and cervix at the University College Hospital, Ibadan, Nigeria.

## Materials and Methods

Seventy-nine patients living with cancer in the region of head & neck, breast or cervix, who gave permission to participate were considered. The closest critical organs of interest are the eye lens, thyroid and femur head respectively. Thermoluminescence dosimeters (TLDs) were used to measure scattered radiation dose to these reference organs during radiation therapy of the target organs. After each treatment session, the exposed TLDs were taken to the department of Physics and Engineering Physics, Obafemi Awolowo University, Ile-Ife for processing with manual TLD reader system, HARSHAW, model 3500.

The treatment session for all patients ranged from 6 – 12 sessions (two fields per session) while the prescribed dose ranged from 24 – 45 Gy.

## Results

The mean scattered radiation doses to reference organs during the treatment of head & neck, breast and cervical cancer cases were  $110 \pm 77$  cGy (Eye lens),  $211 \pm 83$  cGy (Thyroid), and  $319 \pm 103$  cGy (Femur head) respectively.

**Table 1. Patients' demographic information**

Parameter	Patient
Sex: Female	58 (73%)
Male	21 (27%)
Age, years	
Mean $\pm$ Std. deviation	48 $\pm$ 14
Weight, Kg	
Mean $\pm$ Std. deviation	71 $\pm$ 14
Height, m	
Mean $\pm$ Std. deviation	1.66 $\pm$ 0.08

**Table 2. Number of patients with respect to the treatment site and field size**

Treatment site	Number of patient (%)	Mean field size, cm <sup>2</sup>
Head and Neck	20 (25.3%)	93 $\pm$ 50
Breast	30(38.0%)	166 $\pm$ 26
Pelvis	29 (36.7%)	346 $\pm$ 64

**Table 3. Mean distance of reference organ from the central axis of the treatment site**

Reference organ	Head and neck	Breast	Pelvis
Eye lens	15 $\pm$ 4 cm	-	-
Thyroid	-	15 $\pm$ 2 cm	-
Femur Head	-	-	15 $\pm$ 2 cm

**Table 4. Mean scattered dose to reference organ with respect to the prescribed dose per session and the treatment site**

Parameter	Head & neck	Breast	Pelvis
Dose per Session, cGy	341	393	367
Dose to the Eye lens, cGy	110 $\pm$ 79 (32%)	-	-
Dose to Thyroid, cGy	-	211 $\pm$ 84 (54%)	-
Dose to Femur Head, cGy	-	-	320 $\pm$ 109 (87%)
Application of lead shielding	Yes	No	No

## Conclusion

In conclusion, it was observed that the scattered radiation dose received by all the reference organs considered in this study were above (110 – 320 cGy) the threshold dose (10 cGy) for cancer induction. Although dose rate and fractionation between treatment sessions employed during radiotherapy may influence DNA repair and lower the overall cancer induction, adequate care must still be taken to ensure appropriate shielding of critical organs that are very close to the treatment volume during external beam radiotherapy of cancer patients.

The scattered radiation doses are of clinical relevance and potential significance for long term risk-assessment.

## Temitope Adenuga's Profile

Temitope Adenuga is a masters student of the Radiation and Health Physics unit, department of physics, University of Ibadan (UI), Nigeria. She had her first degree in Physics from the same institution. Her passion for Medical Physics motivated her to carry out her thesis at the oncology department, University College Hospital (UCH), Ibadan.

She is committed to promoting the education and wellbeing of young people. She teaches physics and further mathematics and also mentors high school students. Through her initiative; Teach her foundation, she raises girls for a purposeful living.

She led The Smart School, Ibadan as a Vice-principal and initiated her first leadership summit for girls. She volunteered as a program coordinator for The STEM Belle for an academic year to increase female representation in STEM.

She serves as a class leader to 2017/2018 UI Physics M.Sc. students. She loves travelling and visiting new places.

