INTRODUCTION & AIM

Cancer treatment is individually tailored to both the tumor type and patient, and consists of surgery, radiotherapy, and/or systemic treatment, e.g., chemotherapy or immunotherapy. Radiotherapy is an essential part of cancer treatment and is at the forefront of effective treatment therapies offered to cancer patients (Abshire & Lang, 2018). With the advancement for radiation treatment planning, treatment planning itself as well as high-energy photon and proton radiation treatment, radiotherapy is a multidisciplinary field including physicians, medical physicists, and radiation technologists besides the patient. Moreover, treatment is offered on an in- or outpatient basis. Owing to this, radiotherapy departments have complex building layouts.

The floors of radiotherapy departments show a wide variety in size, structure, configuration, and position on the hospital premises. Due to the complexity of radiotherapy departments, their room variety, and multiple functions, it is not possible to directly compare all departments by their floorplans. To analyse the floorplans and derive typologies, various levels of abstraction and depth are necessary.

In the first step, rooms corresponding to the same function in the treatment process are sorted into one cluster. Clusters were defined according to the key functional areas in radiotherapy according to the International Atomic Energy Agency (IAEA, 2014) and refined by looking at the process (Müller-Polyzou et al., 2019) and user groups.

The defined clusters were used in prior comparative floorplan analysis, on the spatial patterns and adjacencies, typology and design of 27 radiotherapy departments in German hospitals. Due to their flexible and individual location, engineering, technical rooms are defined. To evaluate and develop the defined typologies into conceptual floorplans, the configuration and spatial relations between the rooms.

The following clusters were defined:

RECEPTION

arrival and admission of the patient rooms: reception, archive, offices for administration

OUTPATIENT

regular, additional and follow-up examinations and appointments with the radiation physician

IMAGING

Computed Tomography (CT) or Magnetic Resonance Imaging (MRI) scan for three-dimensional, highly conformal radiation therapy planning rooms: CT/MRI room, control room, anteroom, and changing cubicles

PLANNING

based on the CT scan and the treatment prescription from the physician, a treatment plan is developed by the medical physicists

THERAPY

multiple therapy methods and with different radiation therapy devices: therapy room, control room, anteroom, and changing cubicles

PROCESS & CLUSTERS IN RADIOTHERAPY

The floors of radiotherapy departments show a wide variety in size, structure, configuration, and position on the hospital premises. Due to the complexity of radiotherapy departments, their room variety, and multiple functions, it is not possible to directly compare all departments by their floorplans. To analyse the floorplans and derive typologies, various levels of abstraction and depth are necessary.

In the first step, rooms corresponding to the same function in the treatment process are sorted into one cluster. Clusters were defined according to the key functional areas in radiotherapy according to the International Atomic Energy Agency (IAEA, 2014) and refined by looking at the process (Müller-Polyzou et al., 2019) and user groups.

The following clusters were defined:

RECEPTION

arrival and admission of the patient rooms: reception, archive, offices for administration

OUTPATIENT

regular, additional and follow-up examinations and appointments with the radiation physician

IMAGING

Computed Tomography (CT) or Magnetic Resonance Imaging (MRI) scan for three-dimensional, highly conformal radiation therapy planning rooms: CT/MRI room, control room, anteroom, and changing cubicles

PLANNING

based on the CT scan and the treatment prescription from the physician, a treatment plan is developed by the medical physicists

THERAPY

multiple therapy methods and with different radiation therapy devices: therapy room, control room, anteroom, and changing cubicles

THE COMPARATIVE FLOORPLAN ANALYSIS

The comparative floorplan analysis was conducted with 103 Therapy Cluster floorplans of 27 radiation therapy departments in Germany. To conduct the analysis of the Therapy Cluster, the floorplans were compared in abstraction levels and summarized by three phases of typologies:

1) The Zoning Typology describes the structural configuration of the different room types starting with the hallway, which serves as the access point to the Therapy Cluster. The control room and the changing cubicles are summarized in the category of ‘function’. Followed by the anteroom, which connects all rooms of the Therapy Cluster. Last is the therapy room.

2) The second phase of typologies describes the room configurations in more detail and shows the relations towards each other.

3) With a further level of abstraction the floorplans were analyzed with a quantitative tool of Space Syntax (Hag & Luo, 2012) by looking at convex plans. These translate the floorplans into a diagram that reflects the configuration of selected properties and assists in the identification of spaces and connections from these architectural plans (Oswald, 2011). The properties interesting for this analysis are the configuration and spatial relations between the rooms.

RESULTS & CONCLUSION

The Zoning Typology 1 and its Therapy Cluster typology is one of the most frequently found Therapy Cluster in built radiotherapy departments. The choice of typology in planning a radiotherapy department is assumed to have various factors, e.g., depending on the typology of the entire department, the available area, and the relation to adjacent Therapy Clusters. To evaluate and develop the defined typologies, further analysis will be conducted on the adjacency of Therapy Clusters and by putting the defined typologies into context with workflow and individual travel paths of the user groups.