

Costs and Benefits of 3D Printing in the Clinic

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There are many aspects of the radiotherapy treatment process where the personalisation achievable using in-house, point-of-care 3D printing can benefit patients and/or staff and/or the department's bottom line. Examples include patient-specific radiation bolus, as well as the use of optical scanning to create moulds for radiation shielding fabrication, the creation patient-specific immobilisation and tissue-displacement devices, and the creation of a range of sophisticated yet inexpensive measurement jigs and anatomical models with deliberately selected geometric features and radiological properties.

These 3D printed solutions have the potential to improve patient comfort, staff morale, treatment accuracy and therefore radiotherapy treatment outcomes. However, the reduced monetary cost of many 3D printed solutions (eg. the dramatically reduced cost of a 3D printed phantom compared to most generic commercial phantoms) should not be allowed to blind users to the less-direct costs of clinical 3D printing. These costs may include the environmental cost of switching to patient-specific and single-use plastic treatment accessories from (for example) generic multi-patient and multi-use commercial systems, the financial costs in terms of staffing and physical space required by the 3D printing service, and the potential health costs of bringing systems that produce volatile organic compounds, ultrafine particles, loud noise or vibrations, or even risks of explosion, into a clinical environment.

All of these costs may be minimised, mitigated, avoided or offset. For example: use of print modalities associated with explosion risks can be avoided; materials can be selected to minimise ultrafine particle production; print parameters can be selected to minimise waste and volatile organic compound production; in-house material recycling or reuse systems can be set up; care can be taken with the location of printers in the clinical department; and staffing requirements can be deliberately brought into the discussion of the financial benefits of using 3D printing for radiotherapy purposes. However, these costs will not be avoided at all if they are ignored. The full cost of bringing each 3D printing modality into the clinic needs to be investigated as part of the implementation process of the 3D printing service, so 3D printing in radiotherapy can truly be a net benefit for all of us.