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# Utilization of 3D Printing in Surgical Oncology: An Institutional Review of Cost and Time Effectiveness

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### Abstract

Purpose

Use of 3D printed anatomical models by Surgical Oncologists is becoming more prevalent including at our institution. At our institution, 3D models of patient mandibles are used to prefit reconstructive metal plates prior to surgery. 3D printed cutting guides are also created to aid in bone reconstruction. We believe, 3D printing technology improves the quality of surgical procedures, while saving valuable operating room time and cost. Here, we explore the potential cost and time savings by utilizing custom 3D models in the operating room.

#### Methods

For the calendar year of 2014, at our center, we identified surgical procedures where 3D printing technology could have been utilized. An estimate was given by a plastic surgeon of time saved per operation when using 3D printer technology. Estimation of operating room costs were provided by department of surgery. Cost of labour and consumables for fabrication of 3D printed models was also calculated.

Estimated, total cost and time saved in the operating room was calculated. The cost of purchasing the consumer grade 3D printer, labour and consumable costs were subtracted from the operating room cost savings to calculate the final cost savings.

Results

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There were 54 surgical operations identified: 12 mandibulectomies requiring reconstructive metal plate, 12 mandibulectomies requiring cutting guides, 10 maxillectomies, 10 nasal lining flap procedures and 10 trauma related (non-oncologic) procedures.

Estimated time saved in the operating room per procedure was: 30 minutes per mandibulectomy requiring a reconstructive plate, 120 minutes per non-oncologic trauma and 60 minutes for mandibulectomy requiring cutting guide, maxillectomy and nasal lining flap procedure. Total estimated time saved was 3480 minutes. Based on estimated operating room cost of \$1500/hour; this would amount to saving of \$87,000.

Annual, cost of labour for fabrication of 3D printed models was, cost of consumables and capital cost of a basic consumer grade 3D printer was altogether estimated to be \$25,252.26. Therefore, final, annual estimated cost saving was \$61, 747.74.

#### Conclusions

By utilizing a consumer grade 3D printer, we estimate significant cost and time savings in the operating room. Note should be made, however, that there is uncertainty in many of the numbers provided above, as they are only educated estimates. Estimated annual operating room time saved was 58 hours which results in operating room cost saving of \$87,000.00. Final estimated cost saving would be over \$60,000.00 after taking into account the costs of creating 3D printed models.

Superior, medical grade 3D printers are available and the cost and time savings could be even greater than shown here. Further research is needed to analyze the cost and time effectiveness of utilizing 3D printer technology in surgical oncology.