Linear accelerator downtime, scheduled and unscheduled, results in costs due to both the service intervention and the replacement of lost treatments. The latter category of costs can only be accurately identified if the actual treatment component (i.e. fractions) can be separated from other clinical activities, e.g. simulation or follow up. We have developed a sophisticated spreadsheet-based model for economically characterizing the major processes which comprise the radiotherapeutic treatment of cancer. Thus we can quantify the marginal cost of delivering extra fractions to replace those lost during downtime.

The cost of replacing lost treatments can be equal to the labour cost of the service intervention and is thus very significant for operational decision making. To obtain a cost-benefit ratio of less than one in a four megavoltage unit treatment facility, preventative maintenance must avert 15-25 days of downtime or save $34,000-$56,000 in premature component replacement per machine per year, or some combination of the two. The cost of unscheduled downtime for such a facility is relatively insensitive to the mix of in house and service company technical support for several typical scenarios. Finally, we have demonstrated quantitatively that flexibility in staff and patient scheduling which allows for preventative maintenance and unscheduled downtime, results in very significant cost reductions as treatments are no longer lost due to downtime but are postponed with their associated significant labor costs to another time.

The Northern Cancer Research Foundation is acknowledged for their financial support of this study.