New cancer cases are on the rise worldwide, heading toward an annual projection of 24 million by 2030. It is estimated that about half of cancer patients can benefit from radiotherapy as part of their treatment, yet access to advanced radiotherapy isn’t keeping up with the need in most of the world, due in large part to barriers of complexity and resource limitations. Making safe, effective, and ultimately personalized radiotherapy simpler and easier to plan and deliver is essential to closing the gap between mounting need and constrained access.

The solution lies in intelligence. Intelligence that automates routine and repetitive tasks. Intelligence that helps machines and software learn and adapt to new information. Intelligence that makes systems satisfyingly easy and efficient to use, as well as more cost effective. Varian is working closely with partners around the world to discover and develop the smartest ideas in cancer care because we are committed to bringing intelligence to the point of care—all along the journey from diagnosis to survivorship.

We are at a moment of extraordinary innovation acceleration and we look forward to broadening the scope of our advances in intelligent cancer care.

Kileen Kennedy
President
Proton Therapy Solutions and Chief Growth Officer at Varian
Clinicians have long wanted the ability to adapt radiotherapy treatments to changes in patient anatomy over time. Adaptive treatment up to now has required time-consuming re-planning between treatment sessions, or, more recently, keeping the patient on the table and monopolizing a delivery system for an extended period of time while new plans are generated. Neither of these alternatives is practical and affordable at scale. The process is long and complex. Clinics often don’t have the resources even if they have the tools. However, the barrier to adaptive therapy is about to be leveled.

Varian plans to introduce a new intelligent adaptive therapy that would involve the use of artificial intelligence and machine learning to create contours and generate adapted plans for physician review within minutes, while a patient is on the treatment couch. The Varian solution is designed to allow a physician to choose which plan to deliver, and the treatment, from beginning to end, would be deliverable within a regularly scheduled appointment time slot.

Another key contributor to bringing personalized intelligent adaptive therapy into the mainstream is that it would use an efficient platform designed for fast delivery of image-guided treatment via a simple, intuitive workflow. To advance the worldwide adoption of intelligent adaptive therapy, Varian supports the work of an Adaptive Intelligence™ Consortium, a community of clinicians and scientists from leading cancer clinics across the globe. The consortium will lead clinical trials to develop evidence-based clinical protocols for Varian’s intelligent adaptive therapy solution in order to minimize the need for individual clinics to develop their own methods and practices.

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FLASH proton therapy makes progress

While applying intelligence to make the most effective radiotherapies more accessible today, Varian is also working on a new and promising direction to treat cancer. FLASH therapy is the delivery of high doses of radiation at ultra-high speed in one to three sessions. Preclinical experiments in mice recently presented at the 2019 AACR Annual Meeting in Atlanta, Georgia showed significantly reduced toxicities to healthy tissues along with excellent tumor control. Varian’s technology platform, the ProBeam 360° system, is capable of delivering FLASH dose rates required for research and, ultimately, for evidence-based clinical use. This compact proton solution makes proton therapy more accessible, with a 30-percent smaller footprint than with previous systems. In addition to a compact design that saves vault costs, ProBeam 360° is built on the ProBeam technology platform capable of delivering ultra-high-dose rates with a 360-degree gantry. “For FLASH therapy, we expect to be in the range of 40 to 100 Gray per second to deliver clinical doses,” said Bill Hansen, director of strategic initiatives at Varian.

Varian is simultaneously developing FLASH therapy with research partners and envisioning how to incorporate intelligence while leveraging knowledge-based planning and adaptive radiotherapy. These steps will make FLASH proton therapy easier to deliver. Hansen concluded, “We are stepping on the accelerator to move this promising therapy forward faster.”

Today, the mechanisms by which FLASH proton therapy works are not yet fully understood. To drive FLASH research, Varian has fielded a translational science team and established the FlashForward™ Consortium of more than 15 treatment centers around the world. The mission of the consortium is multifold: to design studies for discovering how and why FLASH delivery works; assist with regulatory and advocacy efforts; and develop and share protocols for the introduction of safe, quality clinical treatment.

“FLASH therapy could be a game-changer in cancer treatment,” said Hansen. “We see some early indications that FLASH therapy may enhance the immune system, which could be magnified in combination with immunotherapy. Research into the most effective combinations could add to the knowledge base that will contribute to intelligent cancer care. The way we have designed the FLASH program seeks to allow us to discover and deliver effective therapies and to track outcomes.”

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Varian is breaking down those barriers through intelligent design and automation of manual processes. The touchscreen on the afterloader brings patient information right to the clinicians in the treatment room. Color-coded LED lights guide them through the process of connecting transfer guide tubes; a green light signals proper connection, while yellow and red signal the need for correction.

A customizable pre-treatment checklist that includes e-signatures and a time-out for patient safety was built into the Bravos system to enhance efficiency and safety.

The afterloader is designed for easy maneuverability in small spaces, with four freely rotating wheels and handles that wrap around the machine for easy grasping regardless of operator height or strength.

“After spending time talking with treatment teams in clinics around the world, we saw the opportunity to create a system that is easy to use and creates greater efficiencies, allowing clinicians to spend more time with patients,” said Ed Vertatschitsch, Varian’s vice president, Global Portfolio Solutions. “Bravos is a big step forward for brachytherapy treatments.”

Varian’s Halcyon™ radiotherapy system is superb for most treatments delivered daily in radiation oncology departments everywhere. “The impetus behind Halcyon is to make high quality cancer care more accessible,” said Anne Razavi, director, Halcyon product portfolio at Varian. “To accomplish that, we conceived a system that is easy to learn, install, and use, so that small clinics can deliver a high quality of treatment.”

Every aspect of the Halcyon system has been designed for clinician confidence, operational efficiency, and patient safety and comfort. The quiet, compact system is quickly installed and ready for clinical use within about two weeks. All treatments are image-guided and delivered quickly to minimize intrafraction motion. The efficiency of the system comes from the synchronization of a fast gantry rotation, high dose-delivery rate, and a new-generation multileaf collimator (MLC) that moves much faster than previous MLCs.

Halcyon brings intelligence to the point of care through its elegantly simple user interface. Standardized intensity-modulated radiotherapy (IMRT) and RapidArc® radiotherapy treatments can be completed in a short series of consistent, well-thought-out steps that are clearly signaled by a color-coded, follow-the-light workflow displayed at the console and on the screen in the treatment room.

These are a few of the many factors that make Halcyon a transformational system with the potential to improve access to care around the world.

“According to one study, adding brachytherapy to external beam radiotherapy for cervical cancer has shown a 12.8% increased survival rate at four years,” explained Thomas Pollatz, director of brachytherapy solutions at Varian. “In addition, the Rijkmans study showed that image-guided, state-of-the-art brachytherapy can increase survival rate 35% at three years.” However, the complexity of brachytherapy has been a barrier to wider adoption, it is often considered something difficult, and thus just for specialists.

The same attention to intelligent design that went into Halcyon informed Varian’s new Bravos™ HDR afterloader system for brachytherapy. Brachytherapy is an important modality for treating some cancers, and in some cases has been shown to increase patient survival rates when combined with external beam radiotherapy, as outlined below.

### Bravos removes barriers to wider use of brachytherapy

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“The combination of very short treatments and high quality is unprecedented. Our patients are coming into the hospital, receiving treatment on the Halcyon system, and leaving in 15 minutes.”

Arun Shiva BalaSubramanian, PhD
General Manager and Corporate Head of Medical Physics at Sterling Group, Gujarat, India

### Halcyon advances cost-effective cancer treatment worldwide

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Noona mobile solution brings the point of care home

As the volume of data for evidence-based cancer care grows, one key source of data has been largely missing—patient-reported outcomes (PRO). The Noona® platform from Varian fills that gap. This cloud-based, mobile PRO solution is an intelligent online tool that connects patients to their care teams and extends the point of care from the clinic to patients’ homes and beyond.

A primary goal of Noona is to improve patient outcomes. “Randomized trials have shown that the implementation of electronic patient-reported outcomes tools in cancer care can result in survival benefits for patients,” said Jani Ahonala, global head of life science solutions at Varian and can result in survival benefits for patients,” said Jani Ahonala, global head of life science solutions at Varian.

Another goal is to advance research. “Patient-reported outcome apps represent a growing and significant enable of evidence-based clinical care and translational research,” said Ahonala. With the acquisition of Noona, Varian has gained new partnerships with life-sciences and pharma companies, as the tool is used to engage patients in their care, collect PRO data, and enable pre- and postapproval studies that will test the efficacy of treatment modalities and protocols. “Electronic PROs like Noona may be the only viable strategy to reliably obtain high-quality data from a large number of patients in a cost-effective manner,” observed H. Kim Lyerly, MD, a professor of cancer research at Duke University in North Carolina who tested early prototypes of the Noona platform.

Varian’s vision is to make this oncology-specific PRO technology accessible, easy, and engaging to use for everyone. In the hands of patients with cancer, clinicians, and researchers, Noona has the potential to profoundly impact a disease that affects many millions of people. Another goal is to advance research. “Patient-reported outcome apps represent a growing and significant enable of evidence-based clinical care and translational research,” said Ahonala. With the acquisition of Noona, Varian has gained new partnerships with life-sciences and pharma companies, as the tool is used to engage patients in their care, collect PRO data, and enable pre- and postapproval studies that will test the efficacy of treatment modalities and protocols. “Electronic PROs like Noona may be the only viable strategy to reliably obtain high-quality data from a large number of patients in a cost-effective manner,” observed H. Kim Lyerly, MD, a professor of cancer research at Duke University in North Carolina who tested early prototypes of the Noona platform.

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IDENIFFY guides verification of patient, device, and positioning

Radiotherapy has become continually safer and more accurate through the application of intelligence and automation to remove sources of variability and the risk of human error. One remaining vulnerability that Varian has had in its sights is the problem of reproducibility in patient set-up and positioning over the course of treatment delivery.

The IDENTIFY™ guidance system, a recent Varian acquisition, addresses the problem of set-up reproducibility and more. It takes a comprehensive approach to assuring that the right patient is treated with the right devices in the right position throughout every session. It is one more way that Varian brings intelligence to the point of care.

With IDENTIFY, the arriving patient is quickly verified by palm-based biometric ID. The correct immobilization device is recognized by radiofrequency identification (RFID). The setup and positioning of the device and the patient are guided by a 3D visual display and a simple interface with lights that turn green when accurate positioning is achieved. Then, during treatment delivery, the system monitors for changes in position that may affect accurate targeting.

The integrated IDENTIFY end-to-end technology provides a new layer of confidence to clinicians as they manage the patient’s journey from CT through treatment.

References

Intended Use Summary
Varian Medical Systems’ linear accelerators are intended to provide stereotactic radiosurgery and precision radiotherapy for lesions, tumors, and conditions anywhere in the body where radiation treatment is indicated.

Important Safety Information
Radiation treatments may cause side effects that can vary depending on the part of the body being treated. The most frequent ones are typically temporary and may include, but are not limited to, irritation to the respiratory, digestive, urinary or reproductive systems, fatigue, nausea, skin irritation, and hair loss. In some patients, they can be severe. Treatment sessions may vary in complexity and time.

Radiation treatment is not appropriate for all cancers.

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Welcome to a new era in oncology

Intelligent Cancer Care

It’s been said that the next wave of progress in oncology will come from an increased ability to harness the power of technology—collecting and analyzing data to enable better, faster decision-making in clinical care and business processes.

That next wave is here. We call it Intelligent Cancer Care™.

Learn more at varian.com/intelligent and at ASTRO Booth #1405.