An Insider's Perspective on Proton Therapy Investment

What We Didn't Know, But Know Now | Error Repeaters

A Brief History and Review – The Early Days

In November of 2001, with the opening of the new Massachusetts General Hospital ("MGH") Proton facility, IBA had their first USA implementation of proton therapy. Prior to this the two main facilities treating patients with protons were Loma Linda University Medical Center ("Loma Linda"), a consortium technology solution largely funded by grants, and the Harvard Cyclotron Lab at MGH, which had been running since the early 1960's. At this time there was no track record for "modern" proton systems and any planning was simply an educated guess. The IBA installation at MGH formed the basis for the next phase of growth. A phase focused on the big iron systems, as they became to be known, with multiple rooms to defray costs, increase efficiency/throughput and build revenue. However, at this point there was little information regarding key clinical and business assumptions. Loma Linda was treating largely prostate and hovered around 900 patients per year and MGH had focused on more complex cases with two focused treatment rooms and one research room and never anticipated treating more than 400 to 500 patients per year. While these centers formed the basis for clinical acceptance of proton therapy, the next generation of centers is where we need to look to evaluate what set the stage for the coming decade. The discussion presented here will focus on four distinct "tiers" of industry growth:

- The Initial Centers
- The Early Adopters
- The Mid Term Centers
- The Evolution of the One Room Center

To better understand how these phases of center growth impacted the industry it is important to have a basic understanding of some key concepts.

Key Factors in Proton Therapy Center Business Plan Development

First: A Clinical Strategy

What was initially well understood, and then lost in the "Excel spreadsheet induced" gold rush to protons, was the critical importance of recognizing what was to be treated and how it was to be treated. Loma Linda focused heavily on prostate, a reasonably simple procedure, while MGH focused on much more complex cases and case mix and kept volumes low and within the capability of MGH's existing patient base. What they both had in common was a clear understanding of their clinical capabilities and therefore focused the centers on their respective clinical expertise.

- Who are your partners and why are they here? This is perhaps one of the most important questions to clearly evaluate and understand. Early centers were very clearly focused on science, research, and the evolution of the best use of the particle. This established a small but dedicated cadre of clinicians, physicists and scientists that would drive the evolution of the technology. This resulted in a clear and concise understanding of the clinical levers that matter and exactly how the proton center would be used.
- How will your partners use the technology? Fraction schema? Throughput requirements? Comparison to standard therapies; is there a compelling advantage to proton therapy?
- What do they expect to treat? What diagnoses will show clinical value, otherwise known as the therapeutic ratio. Ultimately the way a Radiation Oncologist measures effectiveness is by increasing this ratio of outcomes/complications. Either the outcomes are better or the complications are fewer.
- What is the facility's clinical fraction schema? Determining the dose needed for the patient based on tumor location has significant impact on the resource intensity, or lack thereof, of the facility.

Second: A Business Plan Strategy

As proton therapy projects are evaluated, a clear and concise understanding of the business levers are critical. It should be clearly stated that the Field of Dreams strategy of "build it and they will come" was widely discussed and adhered to in the early to mid-2000's. And while the promise of protons was evident, there were only two centers in the country that were full with waiting lists. There are obvious elements one must consider in any business plan, but in proton therapy each of the key elements are multivariate.

- Absolute numbers of patients expected?

No one in the last two decades of proton center development in the big centers has ever hit a budgeted number of patients treated for the year. As the early adopters were planning for their centers in 2000-2007, it was widely promoted and discussed in business and academic settings that these developing centers would be able to treat 2,500 patients or more in four treatment rooms. Major academic centers and their consultants, presented these kinds of numbers as seen at the International Particle Therapy Co-Operative Group Assembly in Zurich, Switzerland in 2006. With little to no experience in the referral patterns of proton therapy, and without understanding the politics of referrals, the industry just accepted aggressive projections that were largely based on a simple calculation of hours in the day, and equipment vendor statements on how many patients could be treated per hour. In 2005, a new startup company, ProCure, entered the market and in an effort to be conservative, reduced four room volume projections from over 2,000 to 1,500. What the industry saw over time was that none of these, even the "conservative" estimate of 1,500, were attainable.

- Where will patients come from?

What was not well understood by the Early Adopters was exactly where these patients would be coming from. With only two operating proton centers in the United States with waiting lists, and only three being developed, it continued to be widely assumed that a large percentage, as much as 50%, would come from OUTSIDE OF the primary service area, and the balance from the existing hospital or clinical partner WITHIN the primary service area. While these assumptions made sense in 2005, what was not understood was the key impact of the referring physician who was ill informed of proton therapy and had competing issues to consider. Up until now the Radiation Oncologist was simply a referral source; no one referred for IMRT or Brachytherapy or any particular modality. Referring physicians simply referred for radiation not a particular form of radiation. Physicians referred patients for radiation based on their trusted referral patterns and left the decision regarding how to treat to the Radiation Oncologist. This was soon to change given the very public controversy over healthcare cost and value and competition over competing modalities in prostate cancer. Instead of just sending patients for radiation, referring physicians were questioning the use of protons. Early in the evolution of proton therapy, it was marketed as a unique and separate technology. This created controversy in the referral stream. The focus should have been on treating patients with radiation and leaving the decision regarding type of radiation up to the expert Radiation Oncologist. In the future, successful centers will offer all forms of radiation, including proton therapy, but not touting it as an independent and unique technology.

What was clear, in the industry's early days, was no one expected that there may not be enough patients, that demand would become an issue, or that referring physicians would not respond to the new modality. The biggest change that occurred was unlike the Initial Centers (Loma Linda and MGH), who understood that the clinical model had to drive the center; the industry was now creating proton centers based on Excel spreadsheets and revenue expectations. Plans for big expensive centers were pushed by vendors who had developed the technology and substantiated by over aggressive financial projections. What was completely missed was once you took the clinical realities out of the equation, the spreadsheets were just a group of inconsequential assumptions. The prime driver of the industry was not about the appropriate and effective use of proton therapy, but about cash flowing these huge four- and five-room $250 million dollar facilities. Suffice it to say business strategies were implemented at the peril of reasonable clinical approaches.

- What are the expected diagnoses to be treated?

The treatment profile of what will be treated is one of the primary requirements of understanding the operating metrics of a facility. This is largely because what is to be treated will not only drive reimbursement but it most clearly drives resource intensity for a proton center. In the industry, the Initial Centers (Loma Linda and MGH) understood this but with few exceptions the next wave of facilities seems to have missed this criterion. A patient's total radiation dose, given over several weeks, is made up of daily patient treatments or fractions. When all fractions are added together the patient receives the total dose. Many in the industry take a simple but flawed approach to this evaluation by using the following formula.

$$\frac{\text{Max Treatment Hours}}{\text{Minutes per Treatment}} = \text{Total Volume of Patients per Day}$$

Unfortunately, this simple approach leaves out the most important variable of all in radiation therapy: how many fields do I have to treat to make up this one daily dose? Based upon the clinical strategy of the treating physician and the diagnosis and the location of the tumor the daily fraction of radiation can be given in one field, and or multiple fields. For example, a simple prostate patient may have one field of treatment to get the entire fraction, another prostate patient may require two based on the physician strategy, same diagnosis but double the resource and time needs. Other diagnoses, for example a complicated brain tumor may require 4 fields, or 4 times the resource intensity.

- What technology is going to be used and how does that technology support the requirements of the business strategy?

The use of various approaches and technology platforms can and do have major impacts on the ability to treat these patients, how many fields are required, how long it takes to treat a patient, and even if proton therapy is going to be as effective as traditional therapy. Technology selection also impacts clinical capability as some equipment vendors have advanced intensity modulated proton therapy ("IMPT") technology which is critical and others do not. This alone will impact the viability of a facility.

Third: An Efficient Financing Strategy

To refer to the phases of center development mentioned in the opening paragraph, the Initial Centers were largely developed with grant funds, were very inexpensive ($20-30 million) and had no debt service to concern themselves with. The next two groups, the Early Adopters and the Mid Term Centers, were the first to use more traditional market based financing approaches. These financing approaches, while appearing to be useful to the industry, ultimately when combined with slow patient demand and revenue growth, proved to be short term, covenant heavy and too expensive.

Financings for the Early Adopters and Mid Term Centers included a combination of bank debt and equity. The bank debt rates, covenants, amortization and security features were all based upon meeting hyper aggressive projections without enough cushion for deviation. As a result, the financings drove the success or failure of a given center.

Typical attributes of financings for the Early Adopters and Mid Term Centers:

- Bank Debt / Equity: 80% / 20%
- Interest rates: 11% - 15%
- Short to intermediate term final maturity
- Equity investment or financial support from equipment vendors, a for-profit developer and in some cases the clinical partner

Fourth: What Did the Industry Miss?

Finally, the clear and present danger that was missed in the industry among the Early Adopters and Mid Term Centers was the political backlash from current partners and referring physicians. In many instances, referring and treating physicians within the sponsoring institution did not support the center as expected. This was primarily due to the extra burden working in the facility and/or the proximity of the facility to the physicians. Furthermore, outside referring physicians did not refer patients to the centers as freely and openly as expected.

Physician to physician referrals are a complex and intriguing area of study, however at least some complicating variables include:

- Lack of understanding of proton therapy
- Perceived lack of clinical value
- Patient cost
- Competing modalities and loss of revenue that the referring physician benefits from
- Specific to other Radiation Oncologists, jealousy, loss of revenue, inability to admit to their patients that they do not have the best to offer

All of these physician referral issues contributed to a slower uptake in patient volume for the centers. The Early Adopters fared better as there were only five proton centers in the country, however, the real issues began to arise with the Mid Term Centers.

Why have some projects not performed or underperformed?

Before a brief review of some specific projects, it is important to look at a macro view of the industry as it developed over the period from 2001 to 2010. Loma Linda and MGH were the only two modern and high volume operating proton centers in 2001. There were at least two other particle centers operating at the time, but they were limited to very few patients and were not relevant to this discussion. As previously mentioned, Loma Linda had pioneered a strong clinical niche in prostate treatment and MGH was operating their new modern facility and focused only two rooms on clinical care and largely devoted the third room to research. These facilities, being the only two in the country and having decades of operating history, had no volume issues. As the Mid Term Centers began to open, MD Anderson and Florida were the first to open in 2006. At this time there were very few centers in the U.S., there had been little attention on proton therapy in the media, and the cost control dialogue had not really hit the conversation around proton therapy. Among the four operating centers, the volumes and absolute patient reimbursement costs were minimal. However, the initial cracks were beginning to appear. Florida was somewhat behind volume projections, but was able to refinance out of the short term project financing within the first two operating years. MD Anderson accomplished this as well but with more issues and problems than Florida had. Both centers saw some early growth issues related to the complexity of using protons, both had proton campuses away from the home radiation department and were seen in the early years as somewhat of a problem child. However, they were able to grow and do fine, but never achieved the kinds of initial forecasts expected and settled at around 900 patients per year.

The real industry wakeup call would happen with the first ProCure Center in Oklahoma City ("OKC") opening in 2009. This was the harbinger that these early project finance structures, that relied heavily on meeting growth targets to refinance, would not be able to meet the patient volume standards. As OKC began to operate, the growth to 50 patients per day was dramatic and all seemed to go well. However, as growth stalled and cash flow lagged it became apparent that the center would have to make some significant changes to manage this slow growth pattern. As the rest of the Mid Term Centers developed (Chicago, Seattle, New Jersey and Scripps to name a few) this exact same pattern emerged. Centers that needed to grow into their capital and debt structures were all falling behind. **The issue was not one of clinical capabilities, operations, reimbursement or technology, but simply a lack of patients to treat.** No center had a problem getting to 50 to 70 patients per day, but all centers fell short of the absolute volume of patients projected and the speed of patient volume ramp up. This then triggered events of default, debt acceleration, forbearance agreements and other financial issues that have plagued these Mid Term Centers.

The biggest question in the Industry, looking back, is why the shift away from these large-scale, high cost, high breakeven facilities did not occur faster. In fact, even in the direct and public face of the complications ProCure was facing with patient volume and demand, another developer (Advanced Particle Therapy) would enter the space and develop even larger and more expensive centers. One key reason is the long lead time for center development and opening. Many of the larger centers were well underway before the demand issue was completely understood, and there was also the "gold rush" component to the industry; if four rooms look good, then five rooms look even better. Perhaps the most important characteristic of the change from the Initial Centers to the Mid Term Centers, was the movement away from the clinical focus to an almost exclusive business focus.

So what is the story and what can we learn from each example? Each facility will be reviewed in the context of history and described based upon the key factors outlined earlier in this white paper.

- The Initial Centers
  - MGH, Loma Linda and Indiana University

Massachusetts General Hospital

MGH has been continuously operating a proton center since the old Harvard Cyclotron lab in the 1960's. After opening the new modern facility in the fall of 2001, the center had the goal of treating about 500 patients per year and continuing heavy involvement in proton therapy research. This facility was largely paid for by grants, generated most of its volume from within the Institution and the Boston area and continues to do very well. And most importantly this facility is, and has always been driven by clinical needs first and foremost. The treatment focus is complex and related to the interests and expertise of the faculty and heavily weighted to the classic proton therapy indications and the emerging treatment sites. Interestingly enough the basic tenets of success for MGH are essentially the same as those present in all of Proton International's projects and as evident in current industry trends:

Facility:	Massachusetts General Hospital
Year Open:	2001
Rooms:	3
Total Cost:	N/A

Clinical Focus	✓
Low capital cost	✓
Reasonable volumes	✓
Appropriate and modern technology	✓
Lack of burdensome capital structure	✓

Loma Linda University Medical Center

Loma Linda was developed from grant funding and the Federal National Accelerator Fermi Lab. It has been operating since 1992 and has established itself as the highest volume continuously

Facility:	Loma Linda University Medical Center
Year Open:	1990
Rooms:	4
Total Cost:	N/A

operating center in the industry. Similar to MGH, it has a strong clinical focus. It shares similar characteristics as MGH which continue to contribute to the success of the center.

Clinical Focus	✓
Low capital cost	✓
Reasonable volumes	✓
Appropriate and modern technology	✓
Lack of burdensome capital structure	✓

Indiana University

Indiana University ("IU") was developed by the Indiana University Cyclotron facility as an offshoot of the internationally famous physics laboratory. As grant funding was disappearing, the facility looked to find ways to repurpose the existing cyclotron and beam lines and establish a clinical program. Once again the facility was scientifically and clinically focused and was able to keep costs down due to the existence of most of the technology. This facility only needed the treatment room equipment and software keeping the total expenditures in the low to mid $20 million range. The center opened and grew to 40 to 50 patients per day, however, being over 80 miles away from the medical school and not having the political and clinical support of the medical school grew to be problematic. Furthermore, as this was based on very old technology from the accelerator lab, the need for costly upgrades and technology enhancement became evident. The IU School of Medicine relied on an outside report of consultants to close the center. The consultant's report, though, did recommend that IU build a one-room center close to their Children's Hospital in Indianapolis.

Facility:	Indiana University
Year Open:	2004
Rooms:	3
Total Cost:	N/A

As this paper and the experience of the Initial Centers has borne out, the key variables for success in proton therapy are clinical focus, low cost, appropriate technology, attainable and reasonable patient volumes and a reasonable capital structure. IU failed to have two of the key five variables: appropriate technology and an efficient and available capital structure.

Clinical Focus	✓
Low capital cost	✓
Reasonable volumes	✓
Appropriate and modern technology	X
Lack of burdensome capital structure	X

Let's begin to bring our focus now to the Mid Term Centers which continue to be the large iron four and five room centers.

- The Mid Term Centers
  - MD Anderson, Florida, ProCure Centers, Hampton University and University of Pennsylvania

MD Anderson and Florida

MD Anderson and Florida can be evaluated in a similar manner; the timing, size, financing, clinical focus and experience are interestingly similar. Both facilities were the first modern proton centers to utilize forms of private project finance. They both installed appropriate technology and had a clear and dominant clinical focus. As they opened, while they grew a bit slower, they overcame internal political and resource based struggles to finally reach the patient volume levels they needed to refinance as operating entities and escape any real capital structure issues. They are able to operate under reasonable capital structures, have clinical focus, good patient volumes, and appropriate technology.

Facility:	MD Anderson	Florida
Year Open:	2006	2006
Rooms:	4	4
Total Cost:	$125,000,000	$125,000,000

Clinical Focus	✓
Low capital cost	✓
Reasonable volumes	✓
Appropriate and modern technology	✓
Lack of burdensome capital structure	✓

ProCure Centers

The ProCure experience was instructive as they were the first real private development group that was able to establish multiple proton centers. The key approach was to assume fewer patients per year (1,500) than MD Anderson or Florida had planned for, and to build replicable four-room centers to reduce cost and operate with the efficiencies of a network. The planning for these centers was occurring in 2005 and well before any real data on the growth and patient volumes from Florida and MD Anderson became available. ProCure opened four centers staring with Oklahoma City which opened in 2009, Chicago which opened in 2010, New Jersey which opened in 2012, and Seattle which opened in 2013. Initially the centers seemed to be meeting projections and each facility had no problem growing to 50+ patients per day. Clearly the concern and difficulty came with reaching and sustaining the levels of patient volume needed to meet debt service. Each facility needed to be in the 100+ range of patients per day to meet all obligations and had to stay on an aggressive growth trajectory to meet the goal. The original plan was to refinance out of the onerous and expensive project finance structure once there was an operating asset, as such, the growth curve was critical. Initial growth was promising as all the facilities were able to grow to 50+ patients per day easily. The growth **past 50 patients per day** was problematic and slower than expected leading to the inability to make debt payments and either the sale and refinance or the implementation of forbearance agreements with the centers. Today, Chicago has been sold and refinanced and operates as the Northwestern University Proton Center, Seattle is operating independently and ProCure still operates Oklahoma City and New Jersey pursuant to forbearance agreements with the creditors.

Facility:	ProCure-OKC	ProCure-NJ
Year Open:	2009	2012
Rooms:	4	4
Total Cost:	$130,000,000	$160,000,000

If we evaluate the ProCure experience against the key criteria suggested in this paper, of the specific elements that made the Initial Centers successful, we see that they were lacking in four of the five instances.

Clinical Focus	X
Low capital cost	X
Reasonable volumes	X
Appropriate and modern technology	✓
Lack of burdensome capital structure	X

Hampton University

As this facility was developing it was clearly a mission from the University based on all of the right reasons and would be built leveraging the strength of physics programs and support from Jefferson Labs, a National Accelerator Laboratory. The facility was built with five treatment rooms and, at the time, became the largest proton center ever opened. The story, though, was similar to that of the ProCure centers; too few patients and a lack of clinical focus. The clinical team was from a local radiation practice as the University had no medical school. The University was able to restructure the debt so they could meet operating and debt requirements on lower volumes and cost controls, but the facility has not performed as expected. In this case the center was missing four of the five variables as well.

Facility:	Hampton University
Year Open:	2010
Rooms:	5
Total Cost:	$225,000,000

Clinical Focus	X
Low capital cost	X
Reasonable volumes	X
Appropriate and modern technology	✓
Lack of burdensome capital structure	X

University of Pennsylvania

This was another very large facility with five treatment rooms that opened in 2009. This facility was able to reach its growth goals and has been operating as a big success in the proton industry. It is very clear to see that it met all of the key variables so it elicits little downside discussion and the successes are clear. This facility is in the heart of the University and Medical School and has one of the strongest and most focused clinical faculty of all proton centers. This fact together with the facility's ability to pay cash and not have a burdensome capital structure are critical elements to evaluate. This facility met four out of five key criteria.

Facility:	University of Pennsylvania
Year Open:	2010
Rooms:	5
Total Cost:	$144,000,000 (Whisper reports of up to $200,000,000)

Clinical Focus	✓
Low capital cost	X
Reasonable volumes	✓
Appropriate and modern technology	✓
Lack of burdensome capital structure	✓

The Second Wave of the Big Centers: Error Repeaters

This brings us to the most difficult to understand phase of industry development and perhaps the final step of proton center development by Excel spreadsheets where key decisions were more financial focused rather than clinically focused.

This group of facilities is largely evidenced by the development of four projects under Advanced Particle Therapy, which no longer exists and is the focus of bankruptcy and litigation. This group came into the industry at a time where ProCure was already experiencing problems associated with patient volumes and capital structure and appeared to ignore some of the most important volume lessons of the industry, namely do not plan on large centers or if you do, learn from Penn, the number one priority should be a strong clinical focus that drives patients from the clinical partner.

Scripps

Scripps opened the proton center in 2014, however, the seeds for concern were planted much earlier. Advanced Particle Therapy started the project based solely on the raising of an equity round that would allow the facility construction to begin and would follow up with a debt round in the future. When Advanced Particle Therapy was unable to secure the follow on debt, a last minute save was constructed by the technology vendor and a consortium of others to provide the debt package to finish construction. Inherent in the plan was to partner with Scripps, to secure a clinical partner. However, Scripps was simply paid to provide some clinical and other services but had no material investment. The physician recruited to lead the facility was tremendous and of the highest caliber, however, the rest of the clinical picture, a strong, committed and robust department with a stable base of traditional radiation patients that needed proton therapy, was not present. This was clearly a business play, with unreasonable demand expectations, that carried the Scripps name, but little else. Ultimately it was the same issue that plagued the ProCure Centers, too much debt, too high of a cost, and too few patients. As with the ProCure Centers, the Scripps facility was beautiful, offering high quality and appropriate care, it just had too few people to offer it to. The project has only met two of the key variables.

Facility:	Scripps
Year Open:	2014
Rooms:	5
Total Cost:	$220,000,000

Clinical Focus	✓
Low capital cost	X
Reasonable volumes	X
Appropriate and modern technology	✓
Lack of burdensome capital structure	X

Maryland

This was the second project for Advanced Particle Therapy and was faced with the same structural issues as Scripps. However, in this case key interested parties intervened and reestablished the program and commitment from The University of Maryland. Currently this program is showing promise, while early in the ramp up phase it has shown the ability to produce

Facility:	Maryland
Year Open:	2016
Rooms:	5
Total Cost:	$200,000,000

patient numbers. It will be important to see, as all rooms and shifts open, if it be able to sustain the patient volumes needed to service the debt. In this case, the project has two of the key variables and time will tell if they are strong enough to overcome the other issues.

Clinical Focus	✓
Low capital cost	X
Reasonable volumes	X
Appropriate and modern technology	✓
Lack of burdensome capital structure	X

Dallas Proton Treatment Center

Perhaps the easiest and most extreme example of the lack of guiding principles for development. The final Advanced Particle Therapy project started construction on some limited equity, as is alleged, moved over from another project. As the issues and problems of Advanced Particle Therapy became apparent, this project stalled and filed bankruptcy. In this case the project failed on four of the five key variables.

Facility:	Dallas
Year Open:	N/A
Rooms:	5
Total Cost:	$225,000,000

Clinical Focus	X
Low capital cost	X
Reasonable volumes	X
Appropriate and modern technology	✓
Lack of burdensome capital structure	X

Current Industry Approach

Having learned from the previous decade and the various projects reviewed in this document, we are pleased to see that recently, over the past two years, at least three one-room centers have opened and are operating well. The keys are the same as those we have outlined here. These centers were lower cost, ramped up to reasonable patient volumes (30 to 40 per day) within the first few months of operations and have been able to successfully meet all obligations. One of these centers has met all five of the previous key criteria, while two have met four of the five.

	Jacksonville	Orlando	Willis-Knighton
Clinical Focus	✓	✓	✓
Low capital cost	✓	✓	✓
Reasonable volumes	✓	✓	✓
Appropriate and modern technology	X	X	✓
Lack of burdensome capital structure	✓	✓	✓

What have we learned from industry experience?

While proton therapy is clinically efficacious, and is clearly indicated as a modality that can improve the therapeutic ratio, it remains a complex endeavor to successfully develop. There is no doubt that the treatment modality is now well accepted and is currently offered or is in the process of being implemented in many of the top tier cancer programs in the country. The following comments will focus on how we can turn the development focus from a financial equation to first and foremost a clinically focused process that results in an efficient and reasonable financial solution.

To summarize it in one sentence...it is back to the future. In the future, successful proton centers will turn the most recent process on its head and make sure the clinical focus, not the financial focus, will drive the questions to create financially feasible and financially successful proton centers.

The Clinical Partner – Why are we doing this?

First and foremost, one must address the "Why"? The focus must be simply on the clinical need and interest in the particle. The key medical sponsors of the facility must have a passion to obtain proton therapy for the improvement in patient care and the ability to offer multiple modalities in a way that will be better for the patient. Proton therapy projects are complex and, at the core, must have strong clinical passion just as many have had for other modalities that have offered increased precision and conformal treatment while reducing integral dose and co-morbidities.

Next, one must consider the risks related to project development and consider the experience of your partners and others offering to "help". As anyone following the industry knows, that experience is truly being able to recognize what to do and what not to do. Positive experience is important but perhaps one should consider that experience and solutions borne from complications and issues are more valuable. The key question one should ask after making the clinical decision is how can we mitigate our overall project risk?

One Room or Multiple Rooms

If current industry examples have taught us one thing to be focused on, it is being acutely sensitive to the demand side of the equation. Some of the existing facilities that have had some issues are clinically excellent, are run to the highest of standards, with efficiently operating technology and are still struggling. This is simply because it is very difficult to identify enough patients. This is the key to understanding the clinical side of the equation and how the technology will be used. By reducing the project size, you create a series of benefits. One room will breakeven at many fewer patient visits which assures you will only be treating clinically relevant cases. By assuring the facility is focused on clinically relevant patients all other aspects of facility operations are strengthened including reimbursement.

Cost

Cost is a major factor in building a proton treatment center. Most of the multi-room centers operating or under development in the United States have cost upwards of $200 million. A one-room center can be built in an existing hospital or cancer center for much less, in the range of $40 to $60 million (depending on the overall scope of the project) plus financing costs, if any. Many hospitals fail to evaluate all costs. This is one area where projects and their sponsors are easily misled. You must evaluate all costs, not just equipment. Building costs

are critical. Will this be a stand-alone or can you identify a location that leverages existing radiation infrastructure? Other costs that must be considered are additional equipment such as CT and other items, facility furnishings and miscellaneous equipment. If not paying cash, there will be approximately two years of capitalized interest on the debt during construction and installation. One must have a full understanding of all costs not just the obvious ones. What is the impact of reduced cost? The center is less exposed to volatility of reimbursement, patient volume and operational expenses.

Financing

As mentioned previously one of the key issues for some centers today has been the financing methodology. As discussed, many of the Mid Term Centers have been developed with short-term funding at over double-digit cost of capital. When this was combined with the slower than expected ramp up of patients this caused significant cash flow issues for some of the four- and five-room centers. This has not been an issue for the one-room facilities that have opened. Certainly it is also important to understand what financial guarantees are required of the sponsor. Are there off balance sheet options, non-recourse options and how does this relate to required sponsor ownership and guarantees. This is one area that is second only to the clinical understanding of the sponsor. The financing approach and structure will clearly make or break the feasibility of the project and this is an area where many say they have solutions and few actually do.

Technology and Equipment Solutions

It is very important to have the ability to deploy intensity modulated proton therapy using scanning technology. The clinical improvements and throughput efficiencies gained using this updated technology are critical. This technology combined with imaging improvements have made one-room facilities extremely efficient and have shown that you can easily reach required throughput levels supporting clinically relevant and financially efficient facilities.

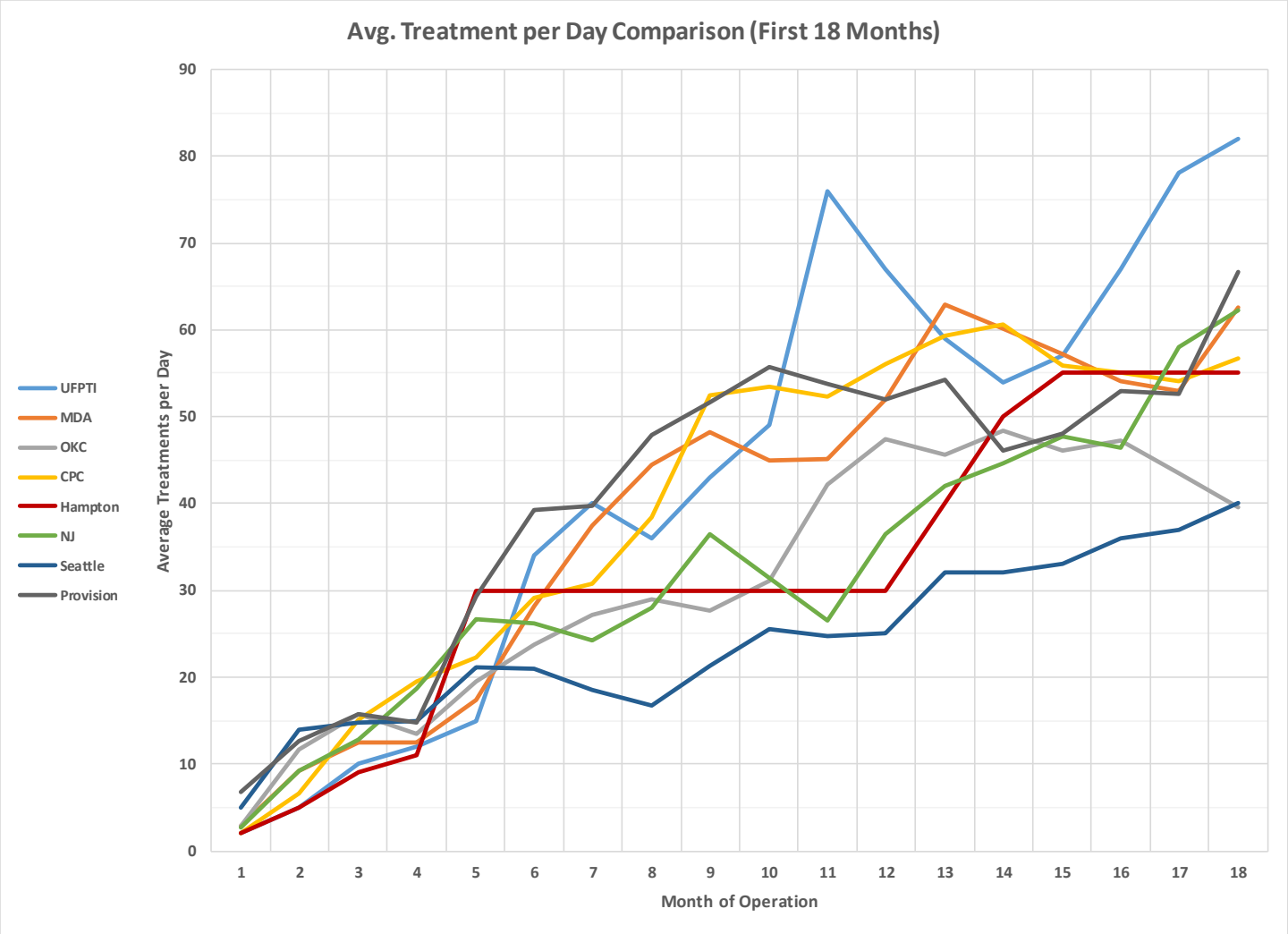
The Final Diagnosis and the Rise of the One-Room Center

Based on this brief review of the industry we have been able to see some emerging trends and lessons. The early centers were successful and they all shared similar aspects including strong clinical capabilities and focus, they had low cost projects, they were able to do well with limited numbers of patients, they had effective technology and they were not operating under a burdensome capital structure. Together these centers did fine, as the industry moved forward many of these variables were lost and difficulties arose. Today the industry stands poised and is executing on the promise to deliver proton therapy in the next generation. Projects that use improved and lower cost technology, that allow proton therapy to be more affordable, and within the reach of more Institutions and communities. However, we cannot afford to lose site of the lessons that have been so costly to learn.

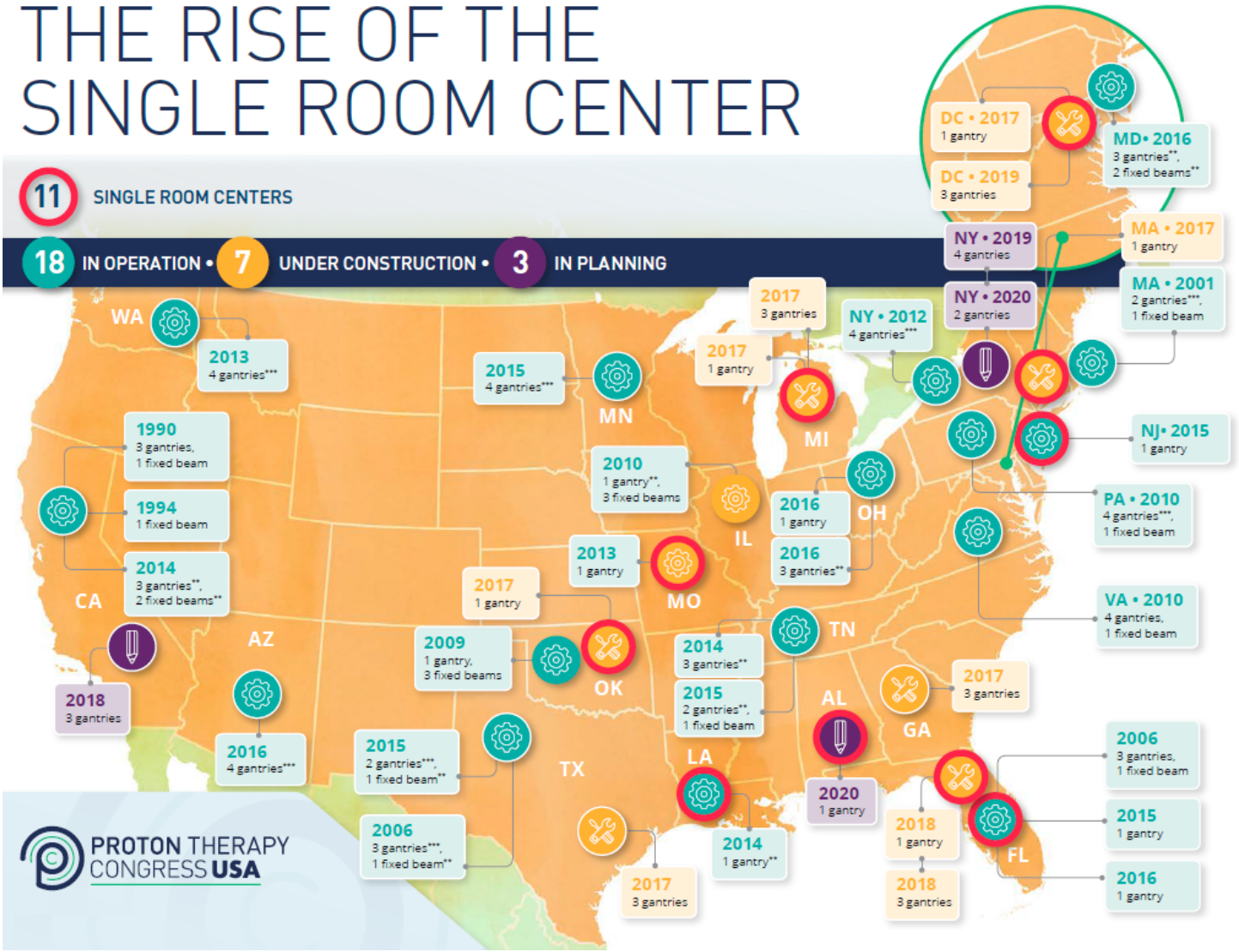
- Projects must maintain a strong clinical capability and focus
- Projects must not be driven by spreadsheets with no understanding of referral politics, patient availability and reasonable expectations
- Projects must be based on real experience now that there are plenty of centers in the industry
- Projects must cost less and be financed with efficient low cost and long term solutions

- Project must not rely on the ability to treat unrealistic numbers of patients

The following chart shows the actual patient ramp up of existing centers. It is very instructive to notice that had each of these centers been one-room centers and had they respected the industry learned tenets above, every one of them would have been a financial success.



The Industry Is Booming



Proton Therapy Centers

Proton Center	Year Open	Rooms	Equipment	Total	Financing Method	Debt Ratio	Debt Term	Debt Interest Rate	Current Status
Loma Linda J. Slater Proton Therapy Center	1990	4		NA	Government				Operating - Full
MGH Francis H. Burr Proton Therapy Center	2001	3	IBA	NA					Operating - Full
Indiana University Health Proton Therapy Center	2004	3	IBA gantry	NA	Use existing cyclotron Government Funding Fund raising				Closed
MD Anderson Cancer Center	2006	4	Hitachi	$125,000,000	Investors ($30.5 million) Loan Land ($2.5 million)				Operating - Full
UF Health Proton Therapy Institute	2006	4	IBA	$125,000,000	Debt ($80 million Jacksonville Economic Development) State funds private donations				Operating - Full
ProCure Proton Therapy Center - OKC	2009	4	IBA	$130,000,000	Integris Physician group Loan Insure debt	80%	10 years		Operating; Default
UPenn Roberts Proton Therapy Center	2010	5	IBA	$144,000,000 (whisper reports of up to $200MM)	$15 million - Roberts Penn Government Debt				Operating - Full
Chicago Proton Center	2010	4	IBA	$157,600,000	CDH ROCL Loan Insure debt	80%	10 years		Operating
Hampton University Proton Therapy Institute	2010	5	IBA	$225,000,000	Tax-Exempt ($54 million) Subdebt ($120 million) State funds Insure debt				Operating; At Risk
ProCure Proton Therapy Center - New Jersey	2012	4	IBA	$160,000,000	CentraState PRO Loan Insure debt	80%	10 years		Operating; Default
SCCA Proton Therapy Center	2013	4	IBA	$150,000,000	SCCA Loan Insure debt	80%	10 years		Operating; Default
S. Lee Kling Proton Therapy Center at Siteman Cancer Center	2013	1	Mevion	$25,000,000					Operating
Provision Center for Proton Therapy	2014	3	IBA	$132,000,000	Senior Tax-Exempt Provision ($5 million)				Operating
Scripps Proton Therapy Center	2014	5	Varian	$220,000,000	Investors Loan	80%			Operating; Ch. 11
Willis Knighton Proton Therapy Cancer Center	2014	1	IBA	$40,000,000					Operating
Mayo Clinic Proton Beam Therapy Center (MN)	2015	4	Hitachi	$180,000,000	Mayo fundraising Tax exmpt bonds 2012				Operating
Ackerman Cancer Center	2015	1	Mevion	$40,000,000					Operating-Full
Laurie Proton Therapy Center at Robert Wood Johnson	2015	1	Mevion	$23,600,000	Self funded Equipment: $11.0 mlllion Facility $12.6 million				Operating

Proton Center	Year Open	Rooms	Equipment	Total	Financing Method	Debt Ratio	Debt Term	Debt Interest Rate	Current Status
Texas Center for Proton Therapy	2015	3	IBA	$105,000,000	McKesson Debt?				Operating
St. Jude Red Frog Events Proton Therapy Center	2015	3	Hitachi	$90,000,000	Fund Raising: Red Frog Events ($25 million)				Operating
Mayo Clinic Proton Beam Therapy Center (AZ)	2016	4	Hitachi	$180,000,000	Mayo fundraising Tax exmpt bonds 2014A&B				Operating
Maryland Proton Treatment Center	2016	5	Varian	$200,000,000	Investor Maryland Loans incl $35 million (Varian)		Portions: < 10 years		Operating
UF Health Marjorie and Leonard Williams Center for Proton Therapy	2016	1	Mevion	$25,000,000					Operating
University Hospitals Seidman Proton Therapy Center	2016	1	Mevion	$30,000,000					Operating
Cincinnati Children's Proton Therapy Center	2016	5	Varian	$120,000,000					Operating
Dallas Proton Treatment Center	NA	5	Varian	$225,000,000	Investor Attempt to obtain loan				Partially Built; Ch. 11
Emory Proton Treatment Center	NA	5	Varian	$200,000,000	Investor Attempt to obtain loan				Partially Built; New Ownership

	Factors				
Proton Center	Clinical Focus	Low Capital Cost	Reasonable Volume	Appropriate & Modern Technology	Efficient Capital Structure
Loma Linda J. Slater Proton Therapy Center	✓	✓	✓	✓	✓
MGH Francis H. Burr Proton Therapy Center	✓	✓	✓	✓	✓
Indiana University Health Proton Therapy Center	✓	✓	✓	X	X
MD Anderson Cancer Center	✓	✓	✓	✓	✓
UF Health Proton Therapy Institute	✓	✓	✓	✓	✓
ProCure Proton Therapy Center - OKC	X	X	X	✓	X
UPenn Roberts Proton Therapy Center	✓	X	✓	✓	✓
Chicago Proton Center	X	X	X	✓	X
Hampton University Proton Therapy Institute	X	X	X	✓	X
ProCure Proton Therapy Center - New Jersey	X	X	X	✓	X
SCCA Proton Therapy Center	X	X	X	✓	X
S. Lee Kling Proton Therapy Center at Siteman Cancer Center	✓	✓	✓	X	✓
Provision Center for Proton Therapy	X	X	X	✓	X
Scripps Proton Therapy Center	✓	X	X	✓	X
Willis Knighton Proton Therapy Cancer Center	✓	✓	✓	✓	✓
Mayo Clinic Proton Beam Therapy Center (MN)	✓	X	X	✓	✓
Ackerman Cancer Center	✓	✓	✓	X	✓
Laurie Proton Therapy Center at Robert Wood Johnson	✓	✓	✓	X	✓
Texas Center for Proton Therapy	✓	X	X	✓	X
St. Jude Red Frog Events Proton Therapy Center	✓	X	X	✓	✓
Mayo Clinic Proton Beam Therapy Center (AZ)	✓	X	X	✓	✓
Maryland Proton Treatment Center	✓	X	X	✓	X
UF Health Marjorie and Leonard Williams Center for Proton Therapy	✓	✓	✓	X	✓
University Hospitals Seidman Proton Therapy Center	✓	✓	✓	X	✓
Cincinnati Children's Proton Therapy Center	✓	X	X	✓	✓
Dallas Proton Treatment Center	X	X	X	✓	X
Emory Proton Treatment Center	✓	X	X	✓	X

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