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Session: Optimizing the Treatment Planning Process

Maintain the Quality of Treatment Planning for Time-Constraint Cases

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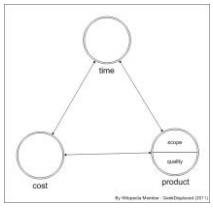
Project Management Triangle



Cost: no. *plans per planner per day*
Time: no. of days
Product: no. of plans per planner

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Project Constraints

- For the same *Scope,*
  Quality = *Time* × *Resources*
- For the same *Quality,*
  Scope = *Time* × *Resources*
- The values are not unbounded: “one planer can finish one plan in one day” doesn’t mean “Four planners can finish a plan in a quarter day.

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Time-Constraint Cases in RT

- Time constraint: planning time < 2 days
- Cases might include:
  - SRS/SBRT using complex IMRT/3D plans
  - Chemo RT: must start at the same time as chemo
  - Emergency palliation using simple 3D plans.

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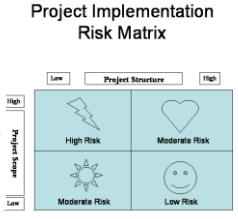
The scope must be reduced for time-constraint cases

- We want the highest quality
- For the same quality, *Scope = Time × Resources*
- Time is constrained: 1-2 days



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Can the scope of the plan be reduced?

- SRS/SBRT: YES
  - Palliative IMRT or 3D plans
  - Hypofractionation
  - Ablative dose for each fraction
  - Target is usually small
  - Palliation in nature
- Chemo RT: NO
  - Curative IMRT plans using multiple beams
  - The plan is generally complicated with large PTV
  - We will bite the bullet to get the plan done.
- Emergency palliation: Not really since the plan is already very simple.

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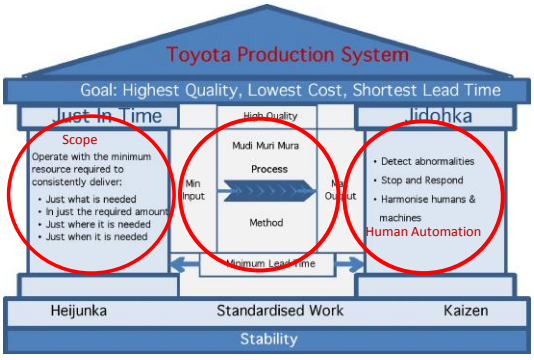
Solution: a lean process



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Build a lean process for time-constrained SRS/SBRT cases requires

- Level the production
- Planners with the right mentality
- Minimize the scope of the plan
- Every plan must be as simple as possible, but not simpler.
- Linear, not convoluted

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The Toyota Production System (TPS) points out two major flaws in mass production

- Producing components in large batches result in large inventories, and a high number of defects.
- Mass production is unable to accommodate consumer preferences for product diversity.

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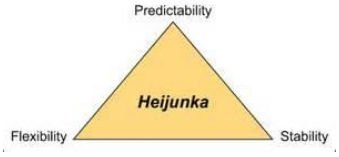
TPS level the production fluctuation by

- Producing and receiving components and parts in small lot sizes.
- Optimizing and shortening the changeover procedures to produce a growing variety in smaller lot sizes.



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RT is a production line but mass production doesn't work in most places

- Mass production model
  - Every site is responsible by a group of planners
  - Hypothesis: Every planner in a group is an expert for the site and should maximize the productivity
  - Problem: waste when demand fluctuates
- Lean model:
  - Every planner should be able to plan every site
  - There is a go-to planners for each site
  - Problem: difficult plans not always done by the best planners

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For time-constrained SRS/SBRT cases, the planner must

- Have the right mentality:
  - Keep cool under stress
  - Not a perfectionist
  - Understand that computer does most of the planning job. The planner mainly plays the supervising role
  - Trust other colleagues in the process
- Equipped wit mixed skills:
  - Be able to plan multiple sites: doesn't have to be the "go-to" person for a specific site
  - Fluent with the multiple planning systems
  - Know the limitations of treatment planning system
  - Can identify/fix problems at the first sign

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Is a perfect plan necessary?

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Forget about the perfect plan, get a reasonably good plan first

- A perfect plan usually
  - Takes forever to achieve or might not even exist
  - Can be undeliverable (e.g., too many modulations)
  - Requires longer deliver y time
  - Doesn't make a significant difference clinically
- Instead, try to get a reasonably good plan
  - Quickly
  - Simple
  - Meets most, if not all constraints

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Reduce the scope for SRS/SBRT

- Conformality index?
- Technique: 3D or IMRT?
- No. of beams/arcs?
- Single isocenter vs. multiple isocenters
- FFF beams or not?

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Don't kill yourself driving down the conformity index (CI)

- CI>2 is bad
- In most cases, it is relatively easy to make CI <1.6 but
- You might need a few more hours to drive CI < 1.2
- Suggestions: when time is constrained
  - Do not spend too much additional time once CI < 1.6
  - If CI is really important, use IMRT

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Which technique one is better?

- 3D
  - Static
  - Conformal arc
  - Circular arc
  - Dynamic arc
- IMRT
  - Step-and-shoot
  - Sliding window
  - VMAT/rapid arc

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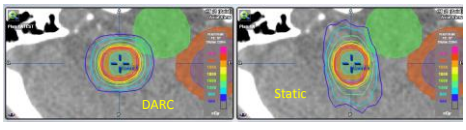
For 3D, the plan quality is generally similar

- Arc beams take the least amount of time for planning and delivery
- Static beams have an advantage while trying to avoid OARs.
- Conformity index is not an issue except for targets with a very irregular shape



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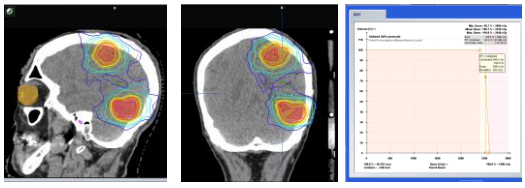
IMRT plans can achieve better dose conformity and uniformity but

- Take longer to plan, check and delivery
- Will require IMRT QA
- Not easy to produce traditional SRS non-uniform (max 125%) dose distribution
- Low dose bath can be a problem



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Technique Selection for SRS/SBRT

- IMRT
  - If the target is irregularly shaped or
  - Dose uniformity and CI is a concern (e.g., dmax <110%).
  - Try VMAT/RapidArc first for faster delivery
  - Use STSH or SLWD for potentially better OAR sparing
- 3D
  - If the target is regularly shaped (e.g., spherical) and
  - Higher dmax allowed.
  - Use static beams if PTV is close to OARs
  - Otherwise, use arc beams

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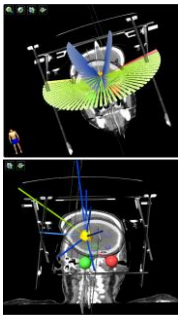
Reports recommend 5 arcs or 15 static beams for brain SRS/SBRT, but

- For brain SRS, it might be sufficient using
  - 3 couch angles with
  - 3 dynamic/conformal arcs or
  - 10 static/IMRT beams.
- For brain SBRT,
  - 2 (e.g., 0 and 90) couch angles with
  - 2 VMAT/RapdiArc beams or
  - 7-8 IMRT beams.



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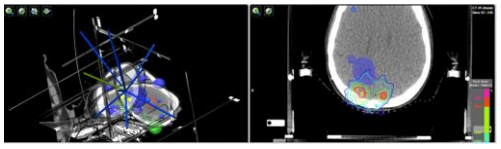
Single isocenter for multiple targets saves planning and delivery time

- Not limited to VMAT/RapidArc
- Can also be used for STSH, SLWD, DARC…
- Potential additional setup error due to rotation
- Use slightly larger PTV margin if necessary



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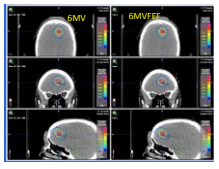
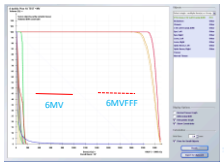
FFF beams will speed up the delivery for SRS/SBRT

- The target is generally small: you can get a good plan with either FFF or traditional beams
- The delivery is faster for a SRS/SBRT plan using FFF beams.
- FFF is great for SRS that requires non-uniform dose distribution within PTV





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Yes, we all joke about P&P but the reality is that… we need them particularly for time constrained cases

- Run the TP operation fairly, effectively and efficiently
- Deal with many users, each with different personality and individual need.
- Be prepared when there is an emergency.
- Say NO to people with unreasonable requests.

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Conclusions

- Time-constraint cases are manageable.
- Implement a lean process:
  - Avoid convoluted process
  - Level the production by training the planners with the right mentality and mix of skills
  - Reduced planning scope
- Have a written P&P
  - Algorithm for choosing planning approach
  - Clear acceptance and rejection criteria