ON MODELING MEDICAL MANPOWER REQUIREMENTS

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DISCLAIMER

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QUESTIONS TO BE ADDRESSED

- Are there reasonable (manpower) standard models, or model structures with broad validation and acceptance by customers (i.e., medical personnel)?
- What level of aggregation is "best" for a model: individual departments, groups of departments, whole organization?
- How does the solution integrate with other corporate programs such as budgeting and planning to ensure that the forecast is consistent with corporate resources and plans?
- What factors did you consider in the selection of the correct technique(s) among the range of forecasting possibilities?
- What was the problem, what method you applied, and how the method matched the problem?

OVERVIEW

- Do Medical Labor Standards Exist?
- Manpower Requirements—At What Level?
- How Does Requirements Determination Fit Into the Budgeting Process?
- By Which Method?
- Case Study
- Summary

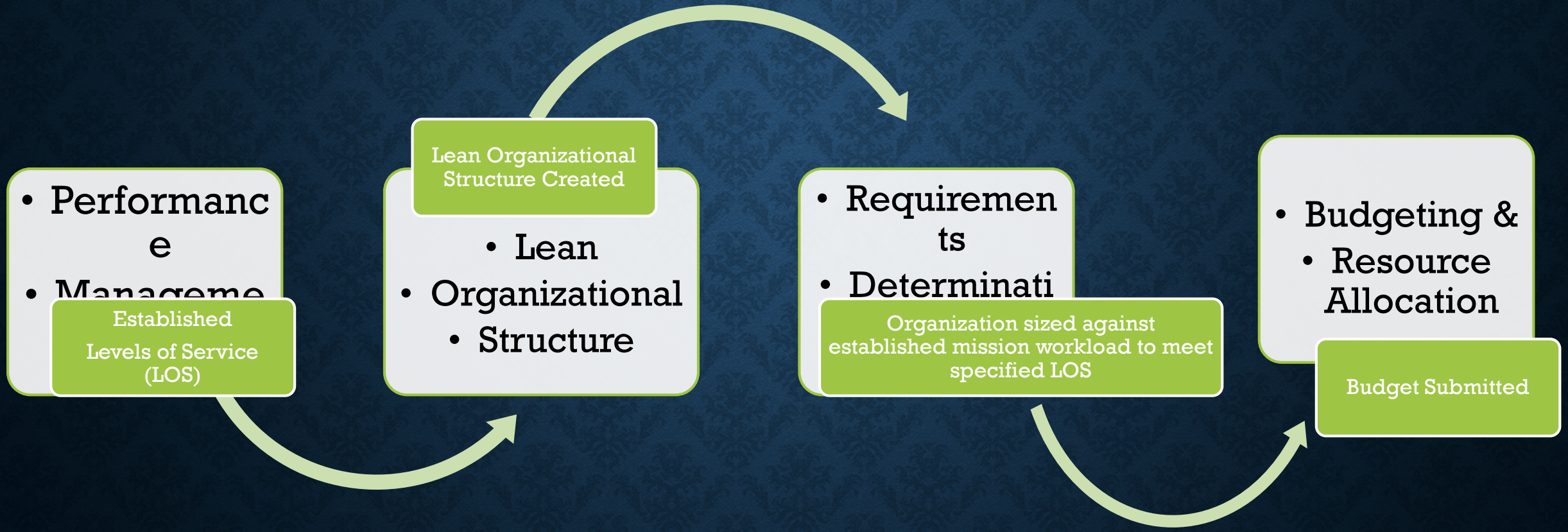
DO MEDICAL LABOR STANDARDS EXIST?

- Short answer: within the US Air Force, via its Management Engineering Program—yes
  - Medical manpower requirements have been modeled since at least the 1980s
  - Contact HQ USAF/A1M for details

MANPOWER REQUIREMENTS AT WHAT LEVEL?

- Generally, an organization should want to initially develops manpower standards by medical function (individual department)
  - Function = a work center with "homogenous tasks"
    - For example, Primary Care Clinic manpower standard would quantify physician, nurse, and medical technician requirements
  - Approach will yield near-term benefits—but watch for system sub-optimization!
- Longer-term: enterprise models (i.e., grouping of related functions up to an including entire hospital) can be developed
  - However, if enterprise models are intended, plan your approach (well) in advance

HOW DOES REQUIREMENTS DETERMINATION FIT INTO THE BUDGETING PROCESS?



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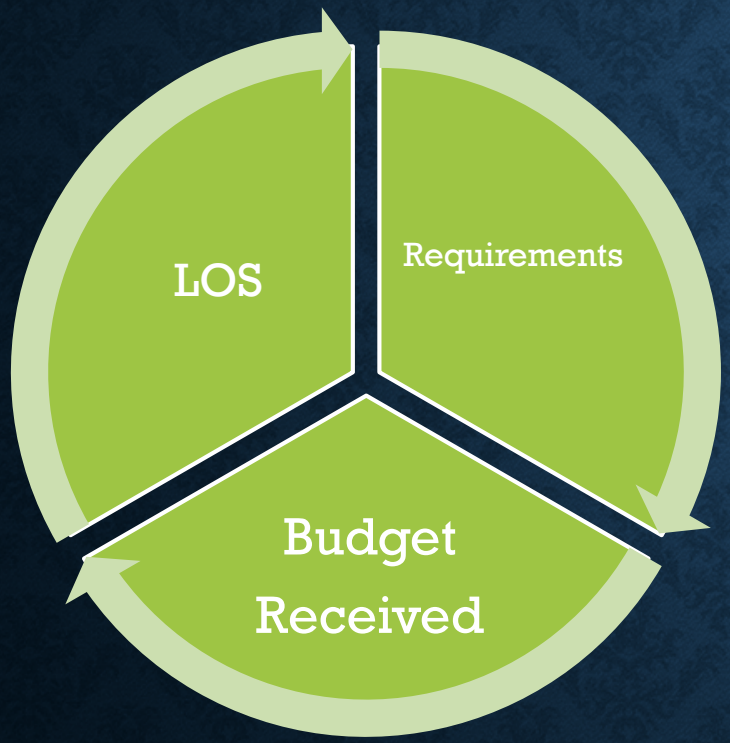

If 100% of requested budget received, allocate according to your requirements . . .

- When budget received < budget requested, budget constraints **never directly** change workload content of a function
- Instead, corporate decisions ***should*** be made to reduce levels of service/types of services received to reduce workload content
- Of course, budget realities can/should spur process improvement initiatives to mitigate/eliminate risk
- Never arbitrarily erase/ignore unfunded requirements
- **Bottom line:** Unfunded requirements are a means to quantify a function's risk

BY WHICH METHOD?

- Manpower requirements forecasting models can be developed via:
  - Discrete event simulation modeling
  - Regression analysis
  - Queueing models
  - Ratio Unit Times equation*
  - Minimum Manpower Models**
  - Staffing Patterns

Notional Example of Medical Clinic of Type X

$Y_c = 241.5 + 4.1X_1 + 1.1X_2 + .055X_3$, where:

Y_c = monthly man-hours predicted
X_1 = patients serviced with the catchment area
X_2 = dependents serviced within catchment area
X_3 = non-traditional patients seen

* USAF term: method relates closely to traditional industrial engineering methods for quantifying cycle time/task.

** USAF term: method used for vigilance functions (e.g., security). Name is something of a misnomer—generally most expensive manpower requirement.

BY WHICH METHOD? (CONT'D)

- Forecasting method(s) selection should be informed by:
  - Nature of the function's work:
    - Patient-centric (e.g., Primary Care, Internal Medicine)
    - Highly transactional? (e.g., Pharmacy, Customer Call Center)
    - Diligence required? (e.g., Emergency department, ambulance crews, security)
    - Management/overhead? (e.g., Department Head, Hospital Administrator)
  - Ease of collecting/forecasting workload factors to apply in model
    - For example: we expect Hospital A to service X number of primary care patience within the catchment area for FY XX
  - Budget/time constraints for building models

BY WHICH METHOD? (CONT'D)

- ***Not so fast***—one more thing—for no forecasting model will ever be more accurate than the data used to build it
- Manpower forecasting models should be built on accurate measurement of workload content, i.e., accurate man-hour measurement ***at the process level***
- Many medical processes cycle times can be determined via traditional work measurement techniques

Methods for Determining Cycle Time:	
"Engineered" Work Measurement Methods	Non-engineered Work Measurement Methods
Time Study	Good Operator Timing*
Pre-determined Time Study Systems (e.g., MOST®)	Historical Record
Work Sampling	Technical (Tech) Estimate (least accurate)**

* USAF term involving a stopwatch to measure cycle time but does not typically pace rate and sample sizes are not driven by statistical requirements. ** USAF term for determining cycle time via interview with subject matter experts.

CASE STUDY

- Background
  - 1998: Air Force Management Engineering Agency (AFMEA, San Antonio, TX) wanted "proof of concept" to use discrete event simulation modeling
  - Wilford Hall Medical Center (WHMC) agreed to partner with AFMEA to conduct a Management Advisory Study to initially model their "new" TRICARE clinic (Primary Care)
    - WHMC Leadership vested to see this new clinic succeed
  - Manpower Study Team consisted of team lead, facilitator, and modeler—expanded with additional personnel (up to 7 additional technicians) during 3-week measurement phase

CASE STUDY (CONT'D)

- Approach
  - Process mapped Primary Care
    - Used IDEF-0 (Integrated Definition for Functional Modeling Language)
      - Identified processes, resources performing specific functions, business rules for medical protocols
    - Warning: process mapping with intent to measure a task's workload content is **not** the same as simple flowcharting!
  - Data collection
    - Time studied high process frequencies; tech estimate for low frequency processes (measurement phase took ~ 3 weeks)
    - Gathered facility layout diagram, patient arrival times (by day of week, hour of day)

CASE STUDY (CONT'D)

- Approach (cont'd)
  - Data Analysis
    - Determined each process mean, data dispersion, and shape of the distribution (latter, critical)
    - Built simulation model (modeled business rules, resource types, production routings, patient arrivals, etc.) performed model validation and verification of model
    - Activity-Based Costing Models (cost per procedure)
  - Final Report (FINREP)
    - Completed FINREP and brief results to functional personnel—pointing out resource usage percentages and facility layout issues
- Time to complete pilot study: ~125 days

CASE STUDY (CONT'D)

- WHMC Primary Care and Hospital Leadership so impressed with tools' potential, asked for additional functions to be studied:

Function	Time To Complete	Notes
Ob-Gyn	~75 days	Study team expanded to 7 during measurement phase; study team taking advantage of learning curve; could have cut time here but couldn't get briefing room!
Internal Medicine	~42 days	Able to use much from Primary Care model; study team expanded to 10 during measurement phase
Pharmacy	UNKNOWN	Study completed but further studies ceased due to new AFMIA/CC focus on AF-wide studies

CASE STUDY (CONT'D

- During study of Internal Medicine, Primary Care personnel approached team lead and asked for their model to be re-accomplished based on process (production routing) and resource changes
- Changes to Primary Care model made over weekend—model's predicted results were uncanny
- Results from Primary Care Study:
  - Saved $100K (FY00 $$) annually (via reduction in LPN staff)
  - Reduced Congressional Inquiries from patient complaints from 1/week to less than 1/quarter
  - Increased patient throughput by 30%

SUMMARY

- It's been done before!
- Performance management informs requirements determination which develops budget submission
- Many methods to forecast manpower requirements—all require accurate workload content adjustment
- Manpower requirements modeling is involved (measurement, analysis, model development, and reporting)—but can reap huge benefits in mission accomplishment for the right cost