GE Clinical Command Centers Help Caregivers Fight and Win the Daily Patient Care Battle

"The Command Center helps us fight and win the daily patient care battle."

– Assistant Chief Nursing Officer of a 6-hospital, 900-bed community health system.

Contents

Introduction

What is GE's Clinical Command Center?

"Clinical Command Centers" or "Command Center" is a business unit of GE Healthcare that helps caregivers and health systems routinely deliver high-quality efficient patient care. It does so by helping organizations to design clinically efficient health systems; and to achieve next level daily patient care operations powered by real time[1] information.

This work is critically important because patient care never stops, is incredibly complex, lives are at stake, and constant information sharing is required to bring mission critical capabilities to bear. In this environment, a few things are essential for success:

- **Real time and complete information**
- **Connected sub-teams**
- **Decision rights**

The idea of "Command Center" is to sustainably clear the "fog of war", connect teams, align resources, and manage both the future and the unexpected. Importantly, "Command Center" ideas are not limited to a physical location or large video screens; instead the "Command Center" toolkit connects caregivers from bedside to functions, departments to clinics, mobile to tablets, PC to mobile workstations, video wall to 55" touch screen; with ongoing innovation steadily extending the scope of work across the continuum including home care.

Command Center client engagements include process change and technology to deliver sustained outcomes.

- **Process work can include "access" processes like clinical review, patient placement and block schedule management, "throughput" processes like multi-disciplinary rounds and discharge huddles, and "quality" processes like protocol compliance.**
- **Technology includes the Command Center Software Platform (CCSP) which puts actionable information at caregiver fingertips through apps called "Tiles"[2]; and Hospital of the Future Analytics Suite (HoF) which allows leaders to test strategic alternatives in a simulation model of patient flow.**

What "solutions" does GE's Command Center offer?

GE's Clinical Command Center capabilities are used in many ways. The most common are the three solutions below; which are often delivered together over 18 – 36 months, and also often implemented as a single solution over 3 – 12 months. In any case, clients continue using the software on an ongoing basis.

Central Command Center

Connected Operating System
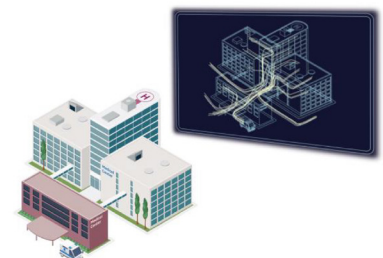
Capacity Strategy

Enabled by Command Center Software Platform

Create and operationalize a **new "Command Center" department** for access and throughout functions. New processes, org. structures, real time information, and a purpose-built space bring next-level accountability, culture and performance. GE has created such Command Center departments for ~20 health systems orchestrating care at ~375 hospitals in thee US, Canada, Netherlands and UK. Enabled by **Expediter, Prioritizer & Planning Tiles**.

Refine and reinvigorate the **daily operating system** that connects nursing units, ICUs, surgery, procedures, ED, imaging, laboratory, pharmacy, therapies, dialysis, bed management, transfer center, staffing and all the reset in the daily patient care ballet; emphasis on multi-disciplinary rounds, huddles, proactive expediting practices and shift hand off driven by connected and smart real time information. Enabled by **Patient Manager** and its Modules.

Develop and align leaders to a **data-based clinical capacity plan for the next 3 - 10 years** using a simulation model to test system performance in various scenarios... Which services at which hospitals? On which units? How many beds by level of care? ED bays? PACU? How much average ED and PACU boarding? How much capacity for each clinical service? When and which cohorts to decant? Enabled by **HoF simulation models**, aka Digital Twins.

Why do caregivers like GE's Command Center solutions?

1. **Save Time.** Less searching for information, fewer paper notes, fewer mouse clicks, less rework and less stress because the information was out of date or incomplete.
2. **Better Flow & Quality.** Patients get care sooner, with less waiting between steps, and with higher clinical protocol compliance.
3. **Unify Cross-Functional Teams.** Nursing, physicians, case managers, therapists, techs, labs... work together more easily with less confusion and wasted effort.

Why do healthcare organizations like GE's Command Center solutions?

1. **Save Money.** Saving caregivers' time at scale, reducing length-of-stay and filling "whitespace" generates huge cost savings.
2. **Better Throughput & Outcomes.** Better unit-level performance leads directly to better throughput and clinical performance.
3. **Grow.** Eliminating bottlenecks, creating capacity, streamlining schedules and simplifying access attracts physicians and patients needing patient care.

What benefits have been documented?

Organizations have publicly announced a range of outcomes including those below which are consolidated from Johns Hopkins Hospital, Humber River Hospital, OHSU Health, Tampa General Hospital, Virginia Mason Franciscan Health, and AdventHealth. Please keep in mind that different health systems use slightly differently language, thus these are grouped by common theme:

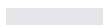| Metrics	Impact
Fewer EMR mouse clicks per user by day	300 - >4,000
Increase ADD/EDD compliance	20% - >80%
Increased patient or admission volume	1% - 7%
Increased transfer acceptance or reduced declines	30% - 60%
Balanced utilization between sites	12% - 20%
Increased surgical utilization or prime utilization	5 - 15 pts
Reduced excess days, acute conservable days or length-of-stay ratio	10% - 47%
Created virtual beds	3% - 6%
Reduced length of stay (for adults)	1/2 to 1 day
Earlier median DC time of day, or earlier median patient exit	40 - 60 min.
Reduced turn-around-time for image, lab, pharmacy, EVS...	11% - 25%
Reduced NICU admits, restraint use, code blues, ED LWOBS	40% - 70%
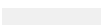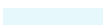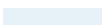
Save Time   Access   Throughput   Quality

What is Command Center Software Platform?

GE's Command Center Software Platform (CCSP) is used to streamline minute-to-minute patient care operations. It underpins the next-level performance achieved with Command Center solutions. It was built with caregivers to put truly actionable information at their fingertips. CCSP creates value by transforming heterogeneous streaming data into a normalized data model, applying algorithms to that data, and presenting users with apps through which they can maintain situational awareness, collaborate, prioritize, problem solve, understand what is expected, and communicate with both the next shift and other disciplines in real time; with all relevant information presented in context to support those activities.

CCSP is experienced by users as web-apps called "Tiles", each of which is accessed from "Tile viewer." Tiles contain all sorts of real time information and update automatically every 30 seconds. Tiles draw information from a real time data model inside CCSP which is constantly being updated by applying logic and algorithms to real time streaming data being ingested from heterogeneous source systems like orders, lab, ADT, pharmacy, ORIS, RIS, bed management, nurse staffing, cardiology, and so forth. Information in the data model is created by connected the dots in real time, and in many cases by using artificial intelligence like machine learning and natural language processing to further enrich the data.

Information in each Tile changes ~2,800 times per day. Each prior value is also stored in "Tile History", a data repository used to 1) study the past to help determine the next improvement initiative, and 2) inform dashboards reviewed in governance forums.

Information in Tiles can also be "pushed" to nudge caregivers through new unified communications systems, or legacy pagers, email and cell phones.

The magic of CCSP is the speed, smarts and usability of Tiles.

Command Center Tiles are:

- **Easy & Fast to learn and use.** Tiles are modern intuitive web-apps that caregivers learn in minutes. Vital complex information is accessed in seconds with 1 or 2 mouse clicks. While impressive, the technical sophistication is kept "under the hood" from users.

- **Automated in real time.** "Under the hood" CCSP is processing hundreds of messages from workflow systems every minute, connecting dots and applying algorithms. A typical deployment has >200 automated key real time indicators for each patient, such as what is the current disposition, most recent vital or working diagnosis right now.

- **Flexible.** Tiles serve the nuanced needs of each individual care team member. For example, just the right information for a multidisciplinary round; just the right information for the dialysis coordinator to prioritize first chair; or just escalated patients from this morning's line huddle; and hundreds more.

- **Smart.** Much of the information in Tiles does not exist directly in the EMR or other source system but is instead derived by connecting the dots in real-time (aka KRTIs, key real time indicators). Other information is derived using artificial intelligence, like predicted length-of-stay or ICU downgrade/transfer readiness.

- **Scalable.** Tiles can be expanded modularly. Most organizations start with Patient Manager for care progression and discharge planning. Then add Patient Manager "modules" like ICU Downgrades, Perinatal, Observation Management, and Lines & Drains before adding additional "Tiles" like Capacity Expediter and Surgical Growth.

What "Tiles" are in the Tile catalog?

The list below includes most of the current Tiles. Treatment Team Workload Tile is the next Tile to be released as of the writing of this document.

Central Command	Departments
Capacity Expediter	Surgical Growth
Placement Prioritizer	Procedural Growth
Ancillary Prioritizer	Imaging Growth
Boarders Expediter	Census & Staffing Forecast
Transfers Expediter	ED Expediter
Infectious Disease	PACU Expediter

| Connected Daily Operating System |
|---|
| **Patient Manager**   *Start: Care Progression & DC Planning* |
| Priority Discharge |
| Avoidable Days |
| Lines, Drains & Ports |
| Risk of Harm |
| Deterioration |
| Downgrades |
| Observation |
| Perinatal |
| Sepsis |
| Advanced Illness |
| Hospital at Home |
| Cancer Pathway |

Modules add new smarts, automation and widgets to Patient Manager

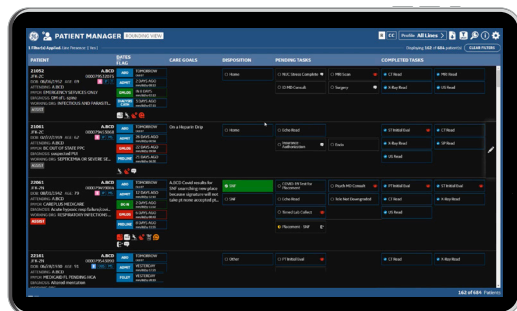|	
	Expediter Tiles
	Predictive Planning Tiles
	Patient Manager Tile
	Patient Manager Modules

GE can provide live demonstrations or pre-recorded 1-minute demos when convenient.

Here are a few 1 minute demo videos:
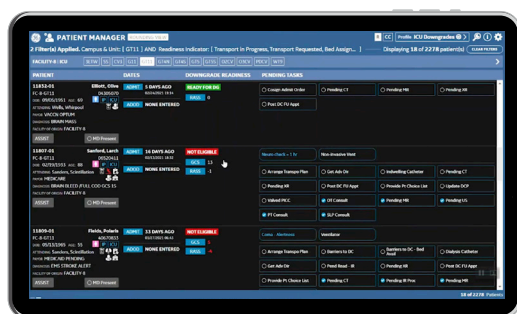*(Click on Tile to view demo)*

Patient Manager in MDRs
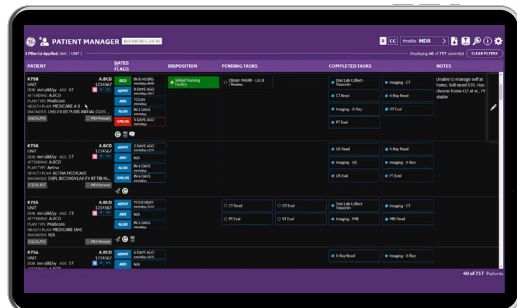
Patient Manager with Lines Module

Patient Manager with ICU Downgrades Module

Capacity Expediter Tile with Pressure Indicator Module

What is AI predicting in real time in Tiles?

Tiles provide information in-context for specific use-cases. This is different than tools which just provide forecasts, for example. Tiles instead provide current information and transparent suggestions in concert with relevant forecasts on a single screen to give the target user all needed information to support a decision or discussion.

Within Tiles there are many forecasts, including:

- **Downgrade readiness.** Identifying patients who are ready or nearly ready to step down from ICU based on hospital protocols. Updates every 30 seconds.

- **Day of discharge forecast.** Using Machine Learning to predict a patient's discharge date. Updates every 6 hours.

- **Discharge lounge candidate.** Flagging patients ready to be discharged to a discharge lounge based on 5 – 15 clinical factors. Update every 30 seconds.

- **Discharge disposition forecast.** Predicting the most likely post-acute destination for patients nearing their discharge date. Updates hourly.

- **Transfer reroute.** Identifying alternate locations that can meet the care needs of an inbound patient. Updates every 30 seconds.

- **Contraindicated lab.** Flagging treatments or procedures that should proceed with caution based on lab results. Updates every 30 seconds.

- **Bed matching algorithm.** Identifying and recommending the best available bed for a patient with an open bed request. Updates every 30 seconds.

- **OR downstream bed availability.** Forecasting the availability of inpatient beds for post surgical patients to inform schedule adjustments. Updates every 30 seconds.

- **Occupancy*.** Projected bed occupancy later today, factoring in expected arrivals and departures. Updates every 30 seconds.

- **Predicted census (48 hr, 14 days).** Hourly census (or bed availability) for each of the next 48 hours at one critical hour for the next 3 – 14 days. Updates hourly.

- **Predicted nurse call offs.** Updates hourly.

- **Predicted surgical add-ons.** Updates ever 30 seconds.

- **Risks of harm (labs, lines).** Flagging clinical tasks that are overdue or that otherwise require attention. Updates every 30 seconds.

- **Level of care reclassification.** Spotting patients whose level of care may not be appropriately classified. Updates every 30 seconds.

With more being developed now.

The following sections expand on the three major Command Center solutions.

1. Central Command Center. With Expediter & Planning Tiles.

2. Connected Daily Operating System. With Patient Manager.

3. Capacity Strategy. With HoF Digital Twin.

Solution Deep Dive

1. How does "Central Command Center" work?

A Central Command Center for a hospital, hospital network or health system usually consolidates access functions into a single "team of teams" with well-organized processes and information tools for consistently excellent performance. An increasing portion of these Command Centers also support next-level throughput and quality for both total patient flow and for targeted patient cohorts like seniors, mothers in labor and deterioration patients.

Common teams in such centers include patient placement, transfer center, ambulance and flight dispatch, clinical review, critical care transport, evs and internal transport dispatch; and sometimes surgical schedule and partner organization resource management teams.

Command Centers in GE's Ecosystem also feature "Clinical Expediters", experienced nurses who use Tiles to proactively barrier bust and resolve front-line escalations. Some centers also include "imaging expediters", "post-acute expediters" to focus in those high value areas.

Central Command Centers can be virtual. In large institutions and health systems a physical Command Center can also be valuable by providing a cultural center of gravity for throughput and quality. GE has helped ~14 organizations to design, build and operationalize purpose-built physical spaces with an environment tailored to Command Center activity... the bullpen, commander's office, overlook conference room, break areas, pod structure and so forth. Some GE client Command Centers are onsite at hospitals. Others are offsite. Each decision is made through a careful planning process with key leaders and broad stakeholders involved.

Common process work aligned to Central Command Centers includes:

- Integrating siloed bed management teams into a single hospital or enterprise-wide patient placement function; that preserves the immense specialized value of many of the units.
- Implementing a nursing-led transfer center
- Improving transfer-inquiry-to-patient-in-bed processes
- Implementing a clinical review process
- Routinizing lateral transfers from ED to the best site of care
- Routing ambulances to system-wide best site of care
- Reinventing the surgical and/or procedural block schedule and governance processes
- Implementing daily hospital throughput and safety huddles

Common Tiles used in central Command Centers include:

- **Capacity Expediter.** Used by patient placement, transfer center and many others to understand current and near-term bed status from enterprise to unit; assigned to pending discharge; staffed and blocked.

- **Patient Placement Prioritizer.** Uses Machine Learning to prioritize all patients in the queue for beds; learns behaviors of placement team and constantly adapts.

- **Census Forecast with Staffing Module.** Forecasts hourly census/capacity for each of the next 48 hours and daily for the next two weeks; overlays staffing plan to identify potential shortages; predicts call-outs.

- **Ancillary Service Prioritizer.** Smart prioritization of ancillary queues such as imaging, physiotherapy, EVS and transport.

- **ED Expediter.** Optimizes flow through ED by identifying care progression delays and expediting patients who are ready to leave the department; zone-level pressure score; status of outstanding orders for imaging, lab, consults; critical departmental stats such as census, arrival rates and volumes, patients waiting.

- **PACU Expediter.** Predicts PACU census and staffing shortages for next 24 hours; Real time status of active cases in OR to improve preparedness; optimizes flow out of PACU by identifying patients ready to depart and identifying delays.

- **Boarders Expediter.** Near view of patients waiting for the next bed; recommends available candidate beds for unassigned patients; monitors status of assigned beds and ensures patients are moved swiftly into those beds.

2. How does "Connected Operating System" work?

GE helps to clearly define and implement a new daily operating system anchored by well structured rounds, huddles and handoffs; and informed by Patient Manager Tile with various modules based on organizational structure, focus and maturity.

A Connected Operating System or Daily Operating System (DOS) is the cascade of processes routinely conducted by nurses, case managers, hospital-based physicians, supporting departments, and central functions to orchestrate daily patient progression. The DOS can be characterized as a set of interconnecting handoffs, rounds, huddles and prioritization practices which collectively disseminate information, connect functional and unit-based caregivers, and ensure accountability, efficiency and risk management.

Virtually every modern hospital has at least a partially defined daily operating system. And virtually every hospital is working to make a portion of it better. Major challenges usually include inconsistency, unclear expectations, lack of information and/or poor teamwork.

- In our experience, the median OECD hospital has a well-organized daily huddle at the hospital-level, several effective huddles on topics like today's discharges, and a mixed bag of practices at the unit level.

The daily operating system is vital for organizational success because it's the primary mechanism used to synchronize the disciplines of acute care in the flow of daily patient care.

How does Patient Manager enable next level Daily Patient Care Operations?

Patient Manager (PM) underpins, informs, facilitates and routinizes the Daily Operating System that connects daily patient care operations. PM provides a real time "sheet of music" so caregivers can work together seamlessly. It integrates complex fragmented information for fast easy awareness and review of critical information. It provides the scaffolding for consistent practices, and creates continuity between shifts. And it gives a pathway for issue escalation and resolution.

Patient Manager underpins new Daily Operating System

Proactive, connected, reinforcing real time, easy & smart.

MDRs

- 45 seconds per patient
- EDD, Barriers, Care Goals
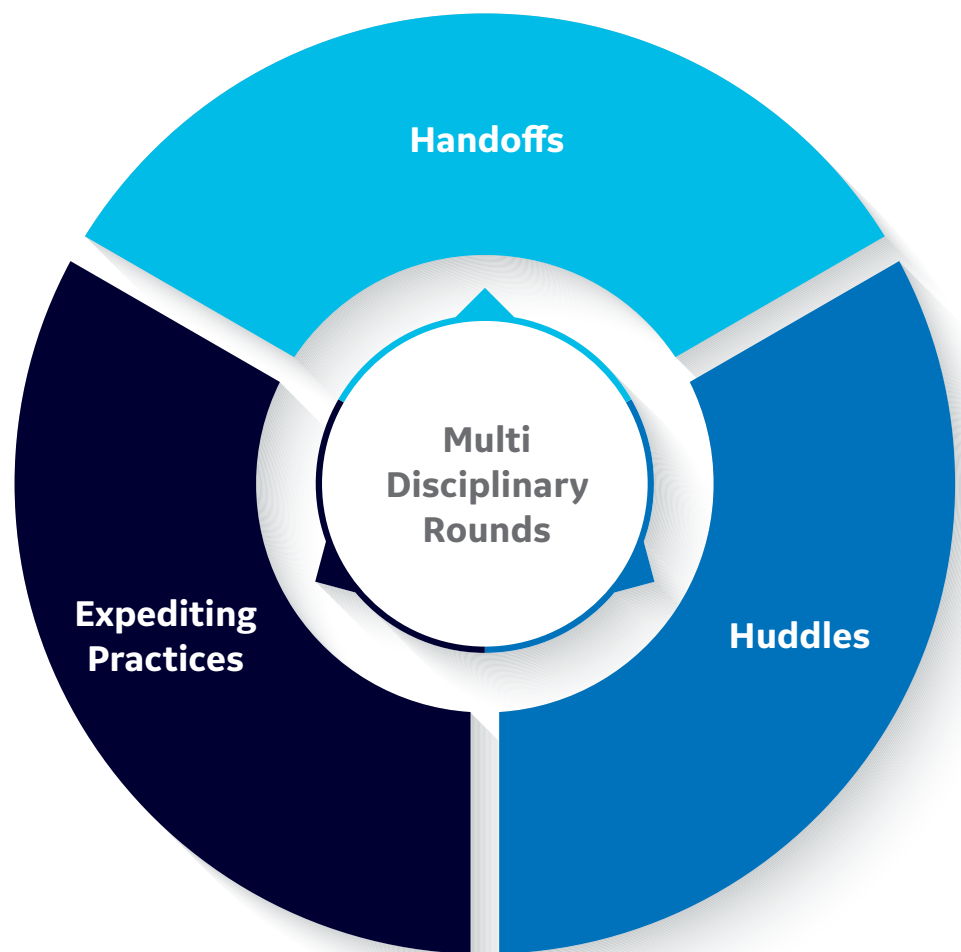
Handoffs

- AM shift handoff
- PM shift handoff

Huddles

- Discharge huddles
- Quality huddles
- Line huddle

Expediting Practices

- Pull pts to DC lounge
- Prioritize early DCs
- Escalate for help

Handoffs

Multi Disciplinary Rounds

**Huddles**

Expediting Practices

How and who uses Patient Manager?

Patient Manager (PM) connects the front lines, adjacent departments and critical hospital functions through common information, customized for each user for speed and convenience.

- **Ad Hoc.** Caregivers of many types (nurses, physicians, case managers, department leaders, imaging techs, service leaders...) use PM to quickly identify and orchestrate care for nuanced patient cohorts in real time. E.g., COVID+ patients on vent discharging to SNF in next 3 days.

- **Multi-Disciplinary Rounds.** PM drives the conversation in daily MDRs. Each patient's multi-disciplinary care team uses Patient Manager to stay in sync on daily care goals, discharge plans, risks and outstanding tasks. The speed and ease-of-use of PM enable MDRs to be completed in a fraction of the time it took before PM was implemented.

- **Huddles.** Dozens of huddles throughout the day use PM to inform plans. E.g. Long LOS huddles use PM to quickly visualize a list of long-stay patients and the barriers keeping them in the hospital.

- **Shift Change Handoff.** PM enables fast, rich handover conversations focused on the most critical tasks and risks.

- **Service and Departments Prioritization.** PM's enterprise-wide view allows services and departments to effectively prioritize their work. Imaging departments use PM to prioritize inpatient scans. Critical Care Response Teams use PM to prioritize visits to high-risk patients. Clinicians use PM to prioritize requested consults. And many more examples.

- **Proactive Expediting.** Caregivers across the hospital use PM to spot risks and other problems in advance, then address them before they reach critical levels.

- **Escalations.** PM makes it possible to escalate tasks and alerts with a single click, directing it to the attention of a service or department who can support. Escalation profiles are created to allow those services or departments to view a continuously updated list of items that need their attention.
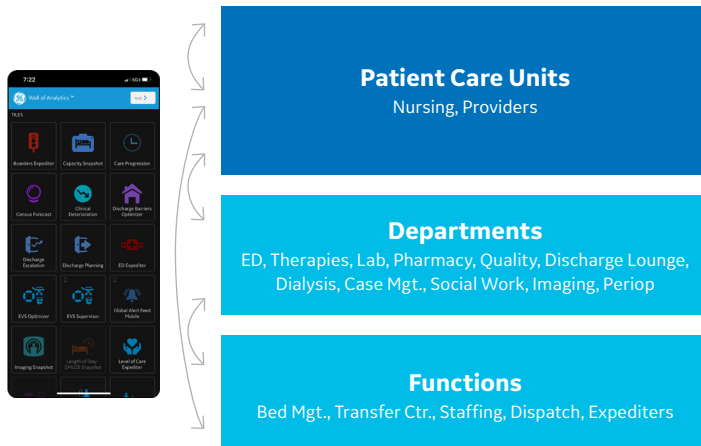
How can Patient Manager be configured?

Patient Manager starts with discharge planning and care progression. Initial set up includes basic patient information, disposition trajectory, pending tasks, completed tasks and the ability to add notes about a patient's tasks, trajectory and anticipated discharge date. (As well has unlimited sorts, filters, profiles, views and so forth).

Organizations can add additional modules, each of which adds new automation, tasks, risks, algorithms and so forth.

Major modules include:

- **ICU Downgrades.** Constantly monitors patients' readiness for downgrade based on hospital criteria; identifies criteria preventing readiness.

- **Discharge Prioritizer.** Prioritizes discharges based on forecasted unit occupancy; tracks tasks preventing discharge.

- **Risk of Harm.** Automates near information about risks like CLABSI, CAUTI and/or medication combinations.

- **Sepsis.** Monitors patients on the Sepsis pathway to ensure compliance; spots and reduces delays in screening, diagnosis and treatment.

- **Lines, Ports and Drains.** Identifies patients with lines and date it was inserted; key information about the line such as line type, location, date of last change.

- **Patient Deterioration.** Flags patients at risk of deterioration based on early warning scores and vital sign recordings; identifies overdue and incomplete assessments.

- **Observation Management.** Ensures efficient progression of OBS patients; flags status mismatch between provider and case management system; # midnights.

- **Advanced Illness and Risk of Dying.** Helps manage patients who are rapidly deteriorating or who have multiple chronic end-stage conditions; status of palliative care and hospice consults; critical clinical flags.

- **Perinatal.** Keeps track of expectant mothers and babies, providing critical situational awareness and clinical risk alerts.

Patient Care Units
Nursing, Providers

Departments
ED, Therapies, Lab, Pharmacy, Quality, Discharge Lounge, Dialysis, Case Mgt., Social Work, Imaging, Periop

Functions
Bed Mgt., Transfer Ctr., Staffing, Dispatch, Expediters

What are the features and functions of Patient Manager?

- **Views.**
  - **Rounding View.** Detailed view of all key patient care information relevant to the discussions happening in rounds.
  - **Expediter View.** Consolidated view of information relevant just to a specific user group (e.g. an Imaging Expediter might show just the overdue imaging tasks).
  - **Patient View.**
  - **View Editor.** Users can build their own unique Profile and user interfaces using an intuitive editor tool.
- **Algorithms.** Algorithms use predictions, decision trees, complex rule sets and other smarts to create new information. Examples include readiness to downgrade from ICU, readiness to move to discharge lounge, predicted discharge date, predicted discharge disposition, priority discharge unit, and contraindicated lab.
- **Filters & Sorts.** Users can create their own custom lists and views using multi-factor filtering and sorting. Filtering allows users to quickly narrow Patient Manager down to a specific unit, clinician, service, clinical cohort, or other. Sorting allows users to view lists in their preferred order, often used to prioritize.
- **Notes.** Patient Manager supports continuity of throughput and discharge planning by allowing users to capture notes about today's goals of care, orders not yet entered, and so forth. These notes are not double documentation, nor are they documentation at all; instead they replace ubiquitous paper notes (which are inherently aged and lost between shifts) with a connected information thread. Some clients call the free text notes, "Today's Action Items."
- **Escalations.** Tasks and Alerts can be automatically escalated based on time or combination criteria to a warning (yellow) or critical (red) level. Or, users can manually escalate something and route it for attention to either an owning Department or an Expediter.
- **Profiles.** Profiles enable users to find carefully curated lists of patients of interest with a single click. Each user has their own Profiles. Many users will have a few standard profiles from the Profile Library, as well as ad hoc saved profiles they create over time based on various dynamic lists they like to check throughout the day.
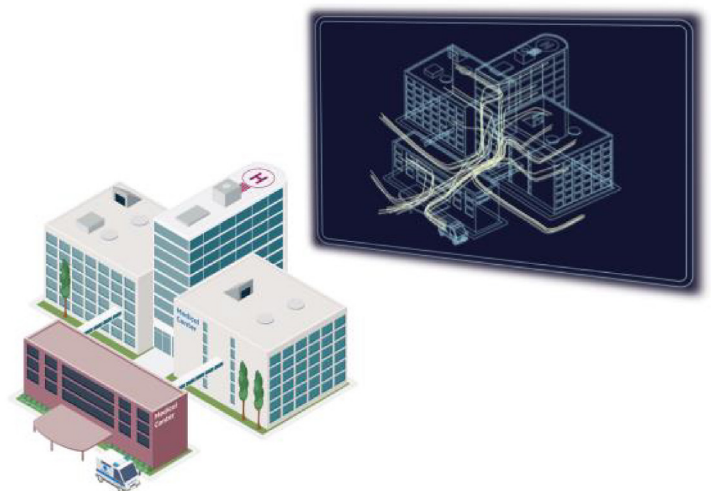- **Profile Library.** A standard list of Profiles accessible to all users with a single click.

3. How does Capacity Strategy work?

Capacity Strategy complements the near optimization in the central Command Center and connected daily operations by working to design the system to best meet the needs of patients. To ensure that as much as possible resource allocations are designed to meet patient need with balanced utilization levels across the enterprise.
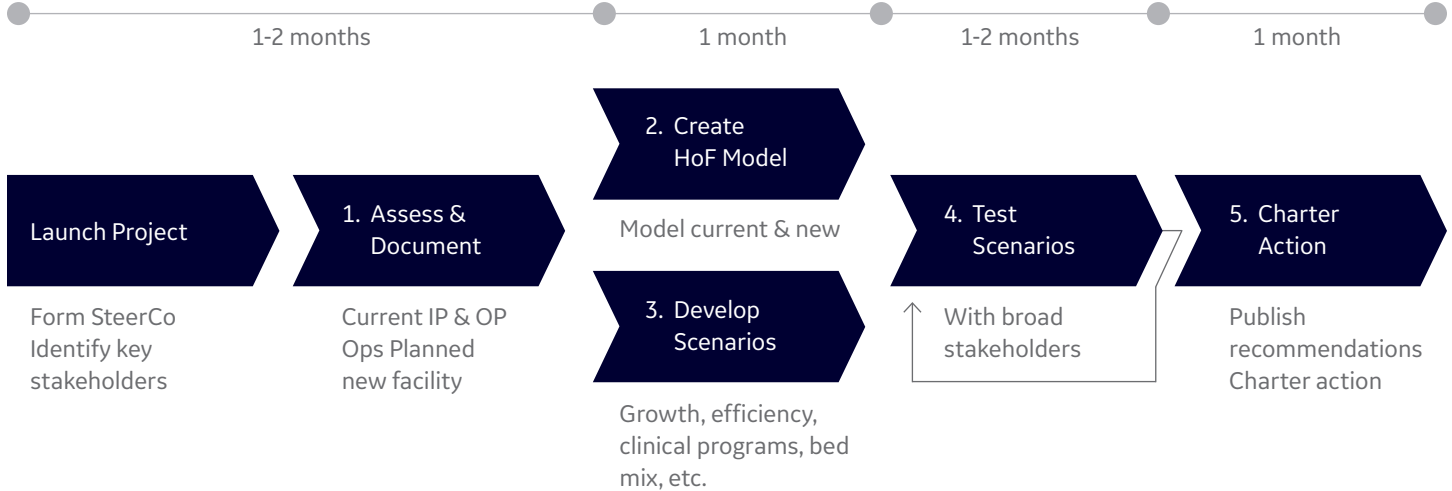
Capacity Strategy is a structured process to create a 3-10 year capacity plan; meaning a plan for the allocation of beds, bays, ORs, and scanners by level of care, service line, facility and so forth over time. This work complements and informs master planning and new facility design processes. GE works with clinical leaders and other planners to help make relevant decisions. For example, what is the optimal "bed base" and "bed algorithm" design for the current, interim and final stages of new tower construction? How does that change based on different strategies to decant patient cohorts from main campus to partner facilities?

GE helps in three ways:

1. Lead the process to baseline data, develop a scenario framework with broad stakeholder input, test alternatives and iteratively refine scenarios, facilitate a consensus, publish recommendations and leave an effective decision making team in place.

2. Building a discrete-event-simulation-model in GE's Hospital of the Future Analytics Suite ("HoF") to test scenarios and quantify expected performance in terms of census patterns, utilization, patient waiting in ED and PACU, staff utilization and so forth.

3. Maintain the HoF simulation model on an ongoing basis to test future scenarios as the situation changes. This usually continues to years and includes updating the data in the model from time to time.

Total Project: ~5 months

1-2 months   1 month   1-2 months   1 month

Launch Project

Form SteerCo
Identify key
stakeholders

1. Assess & Document

Current IP & OP
Ops Planned
new facility

2. Create HoF Model

Model current & new

3. Develop Scenarios

Growth, efficiency,
clinical programs, bed
mix, etc.

4. Test Scenarios

With broad
stakeholders

5. Charter Action

Publish
recommendations
Charter action

Other questions might include:

- How to optimize current operations to enable maximum patient volume, with maximum home-unit assignments, and minimum patient waiting, boarding and holds?
- Which improvement projects will have the highest impact on current operations? Which projects should be abandoned?
- How should the resulting set of improvement projects be integrated to collectively achieve the best result?
- What is the optimal bed mix, bed algorithm and service mix in the new facility?
- Quantify bed needs based on growth assumptions (customer provided)?
- How to optimize the phasing of existing capacity improvements, new ambulatory construction, and new hospital construction to maximize capacity while minimizing net spend?

References
1 *Command Center data constantly ingests streaming data, and updates information visible to users every 30 seconds.*
2 *Tiles present and aggregate information gathered from other hospital systems to improve visibility and workflow efficiency, based on hospital defined standards. Tiles do not make clinical determinations and are not intended for patient monitoring.*

Imagination at work