

Enhancing PPE Preparedness for Healthcare Facilities

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Disclosure

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Agenda

- Motivation
- Framing the problem
- Anticipating and influencing demand
- Understanding your internal supply capacity
- Deciding your risk tolerance for emergency stockpiling



Learning objectives

- Anticipating and influencing PPE demand during COVID-19 type pandemics
- Understanding your internal PPE supply capacity and residual demand
- Deciding your risk tolerance for emergency PPE stockpiling



Motivation



- From July 2020 – July 2021 our team conducted research funded by the Assistant Secretary for Preparedness & Response (ASPR) determining the appropriate PPE stockpile for a state level public health agency.
- Over the course of this research, we conducted:
 - 30 subject matter expert interviews
 - Released a survey with 332 responses
 - 14 meetings with MDPH representatives

Scope

- Acute care hospitals
- Outpatient services
- Emergency medical services (EMS)
- Skilled nursing facilities
- Assisted living facilities
- Inpatient behavioral health
- Dental



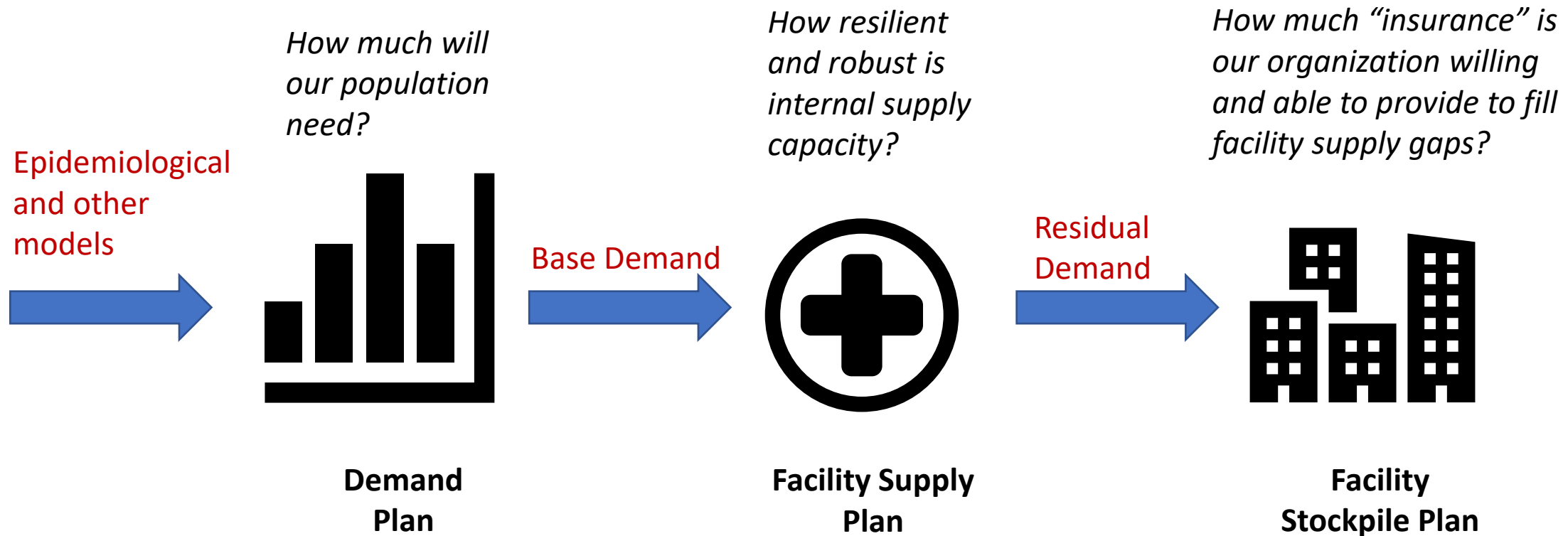
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Preparedness plan framework



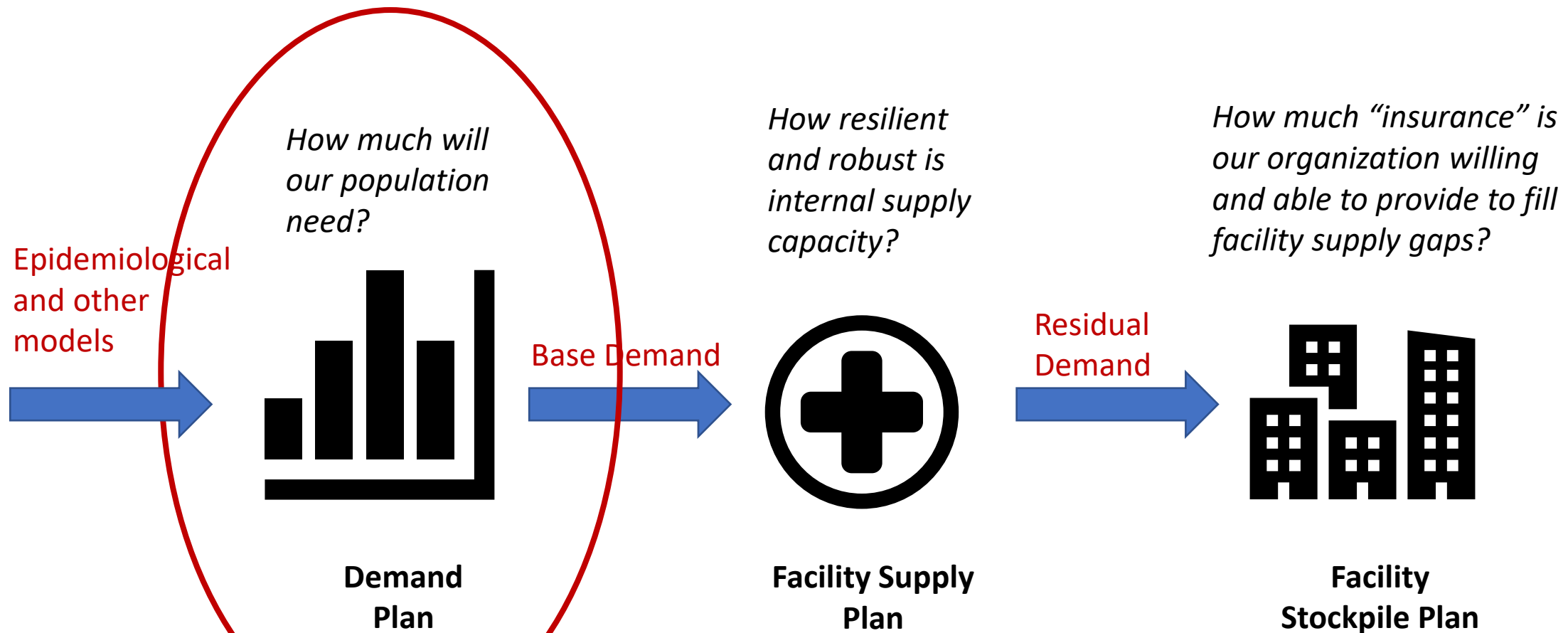
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Understanding facility demand – bottom line

1. To prepare for the next pandemic facilities must have an accurate understanding of PPE use in relation to case loads.
2. Facilities should invest in policy levers that can be pulled early in demand surges to decrease demand before supplies run out.

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Determining demand through simulation

Patient population

Staffing policies

Infection control policies

Patient transfer policies

Standards of care



PPE use



Created by SteveMark
from Noun Project

Created by NounProject
from Noun Project

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Determining demand through simulation

<https://github.com/MIT-HSCL/PPE-Use-Models>



MIT-HSCL / PPE-Use-Models Private

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molymcguigan Add files via upload e7a54ef on Sep 30, 2021 40 commits

Acute_Care_Hospital_Model	Add files via upload	4 months ago
Other_Facility_Models	Add files via upload	4 months ago
README.md	Update README.md	5 months ago

README.md

PPE-Use-Models

These models calculate daily PPE use for the designated healthcare facility given three types of inputs (described below). All excel files are example inputs with data from Massachusetts gathered during and after COVID-19.

Inputs:

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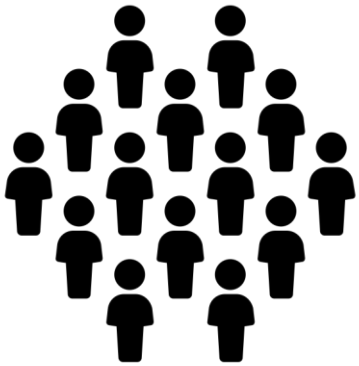
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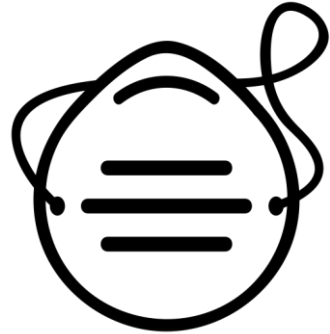
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Key take-aways – Facility demand levers

Cohorting



PPE reuse



Patient visits



Diagnostic test turnaround time



All PPE



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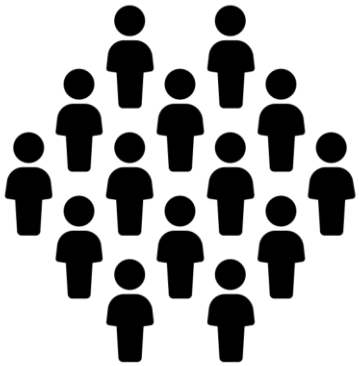
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Key take-aways – Facility demand levers

Cohorting



Cohorting can decrease N95 use:

- 47% in acute care hospitals
- 92% in assisted living
- 95% in skilled nursing

PPE reuse



Increasing N95 and eye protection reuse policies from 1 use to 5 uses can decrease N95 use by 80% in all facilities

Patient visits



Decreasing patient visits by 50% decreases gown and glove use by 50%

Diagnostic test turnaround time



Decreasing COVID test turnaround time from 2 day to 1 day decreases N95 use in skilled nursing by 22%



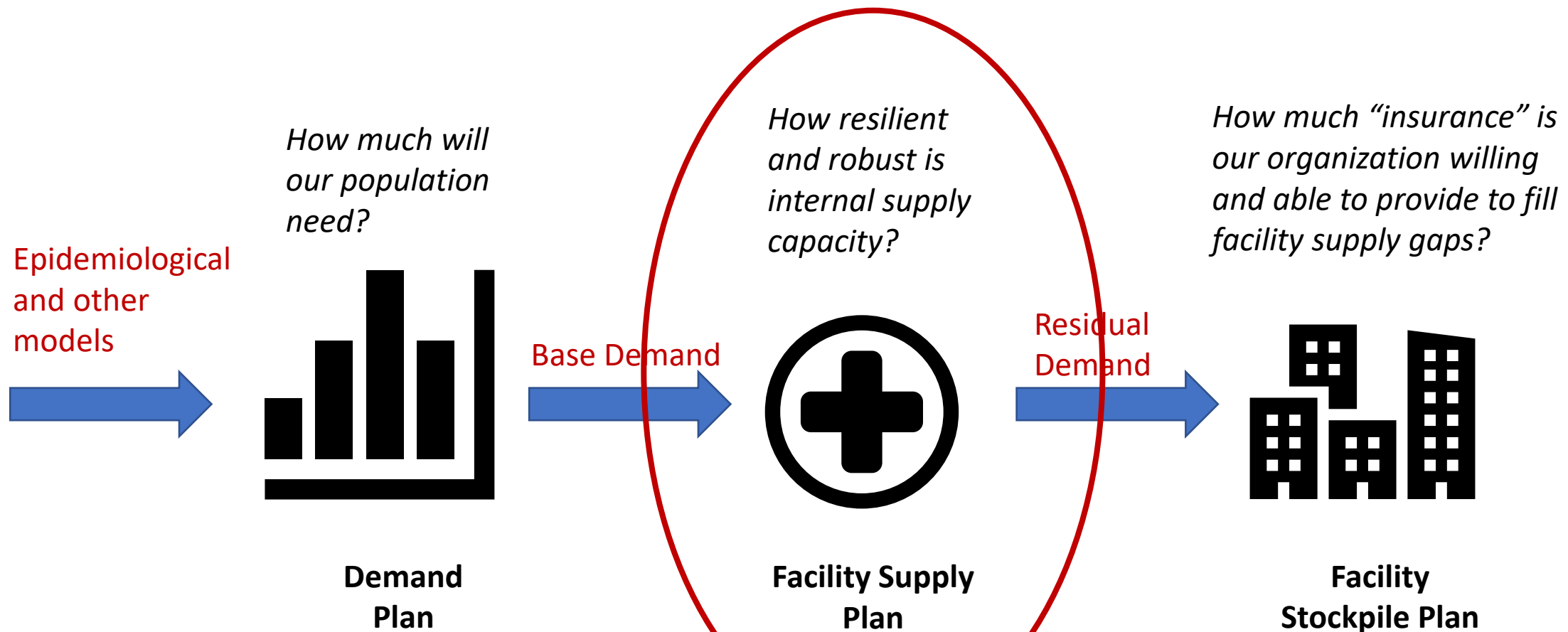
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Understanding facility supply – bottom line

1. Facilities must understand their own capacity to meet PPE demand surges, including their buffer stock, internal stockpiles, and supplier allocations.
2. Facilities can improve their internal capability to meet demand through investing in emergency stockpiles and building relationships with PPE suppliers.



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Text **GSHCC102** to **22333** once to join



What is your current days of supply on hand for PPE?

0 - 30

31-60

61-90

over 90

I do not know but I think my facility has a PPE stockpile

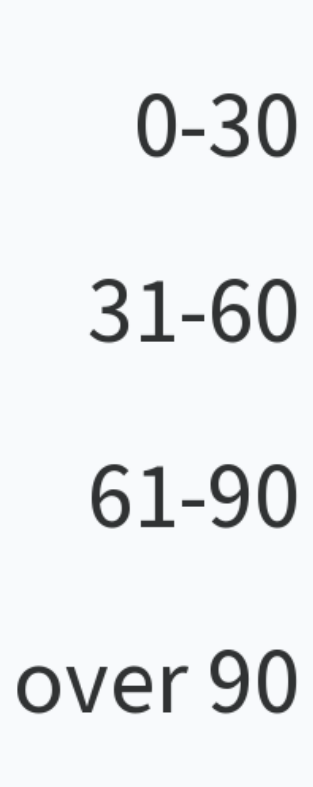
I do not know and don't think my facility has a PPE stockpile

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How many days of supply of PPE would you like to have on hand if resources allowed it?



Massachusetts facility supply plans – April 2021

Facility type	Days of supply on hand in Apr 2021	Days of supply on hand prior to COVID-19	Days of supply definition
Acute care hospital	90	14	Average daily use during COVID-19
Outpatient	90	14	
Skilled nursing	60	4	
Assisted living	60	4	
EMS	90	30	
Dental	90	7	
Behavioral health	90	7	



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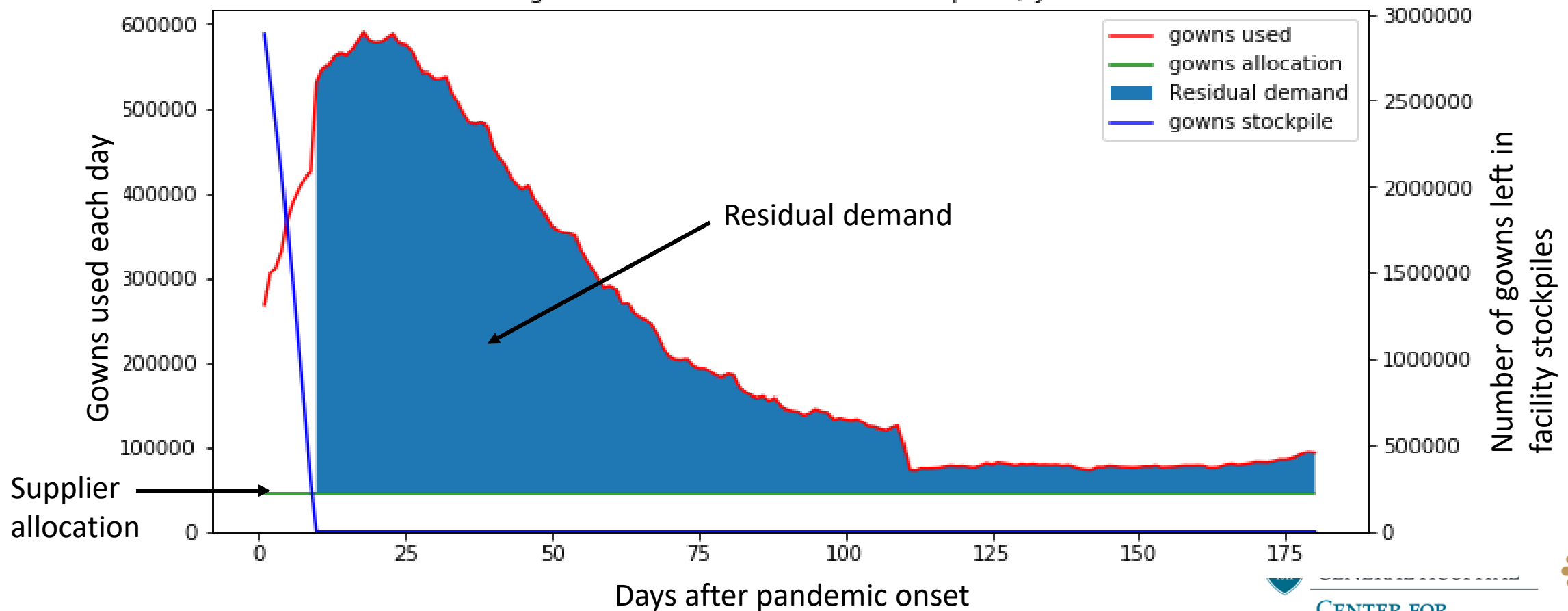


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Impact of internal facility stockpiles

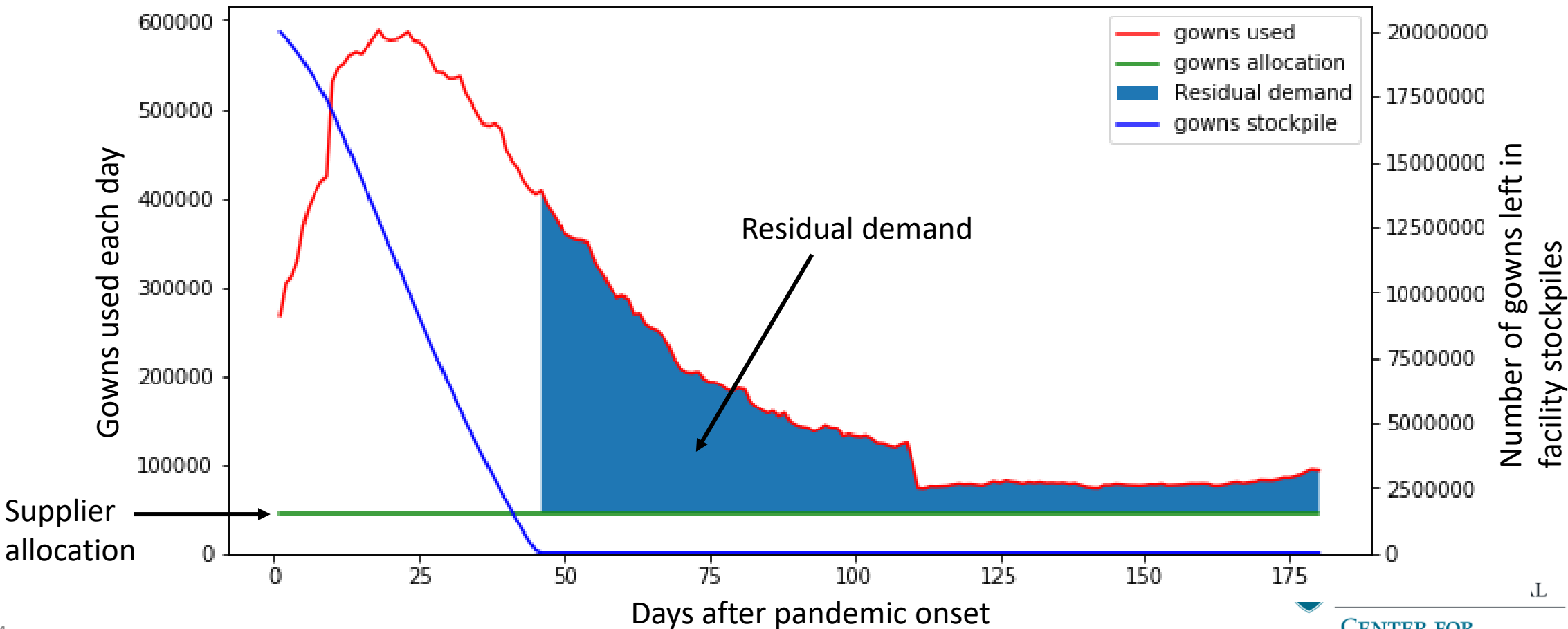
1X COVID with pre-COVID stockpiles

gowns Use and its Effect on Stockpile Qty



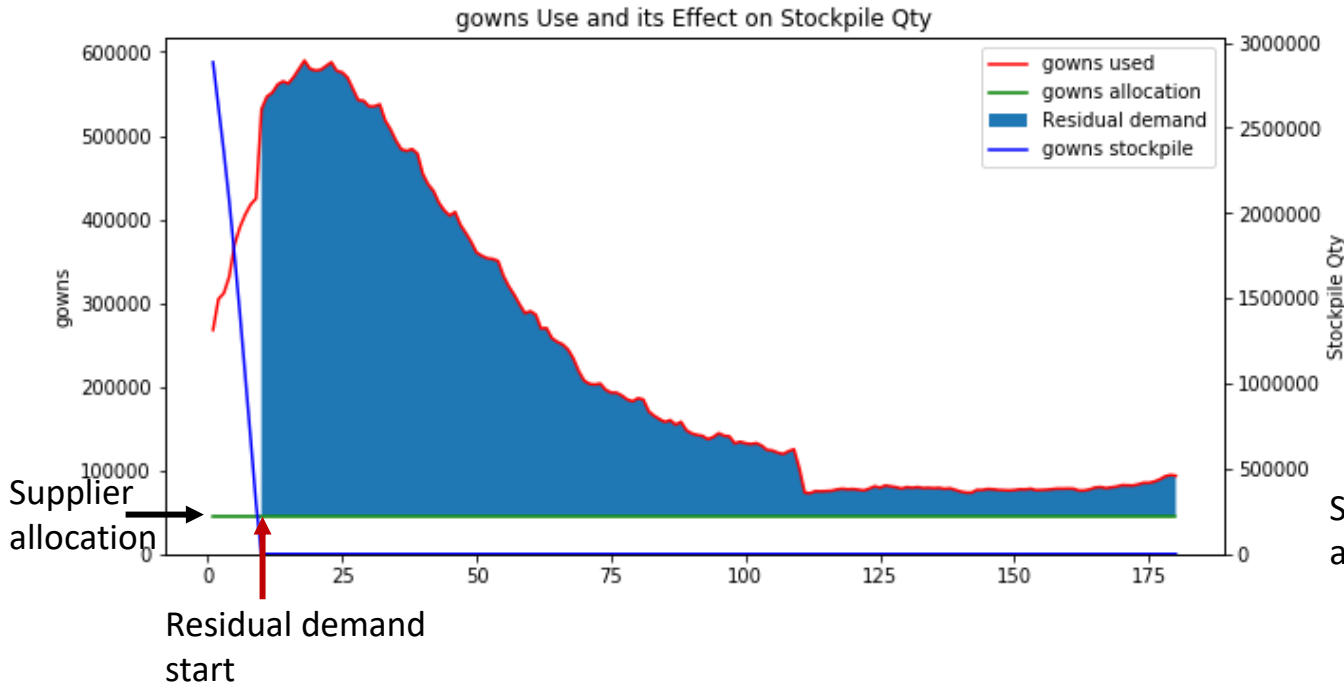
Impact of internal facility stockpiles

1X COVID with post-COVID stockpiles
gowns Use and its Effect on Stockpile Qty

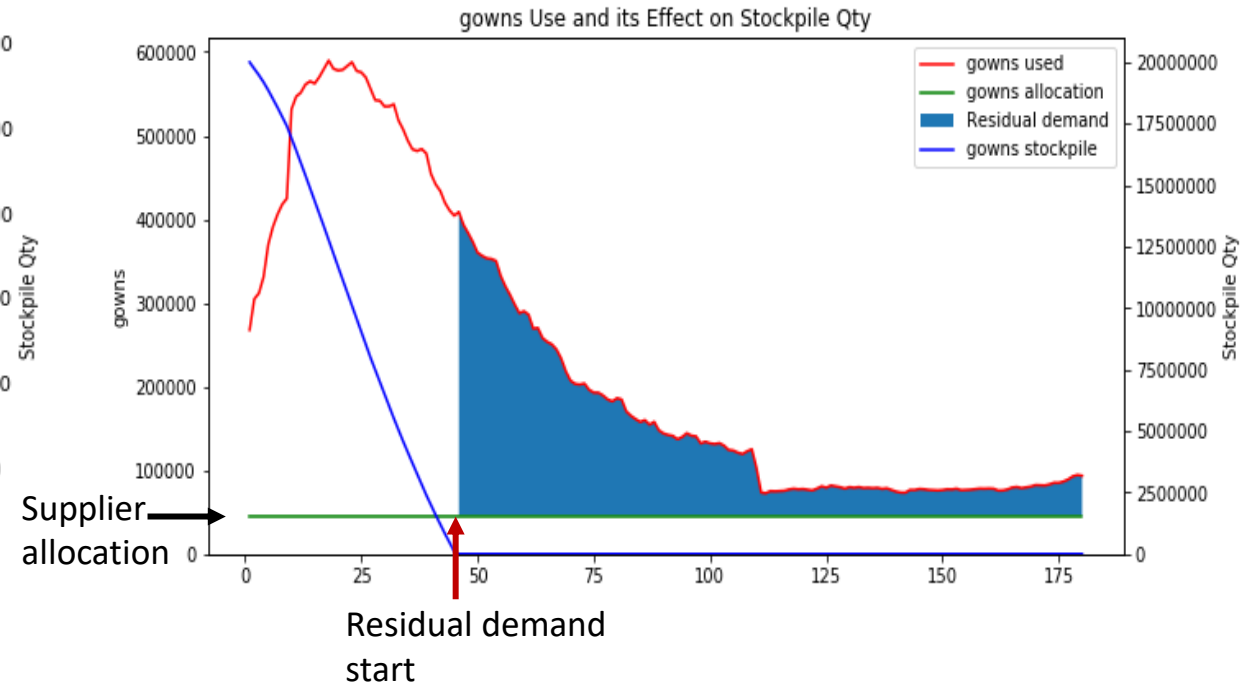


Impact of internal facility stockpiles

1X COVID with pre-COVID stockpiles



1X COVID with post-COVID stockpiles



- Maintaining a PPE stockpile equivalent to post-COVID levels as opposed to pre-COVID levels results in fewer stockouts, decreasing reliance on external assistance.
- The larger the on-hand PPE stockpile, the later stockouts begin, allowing time to place replenishment orders.



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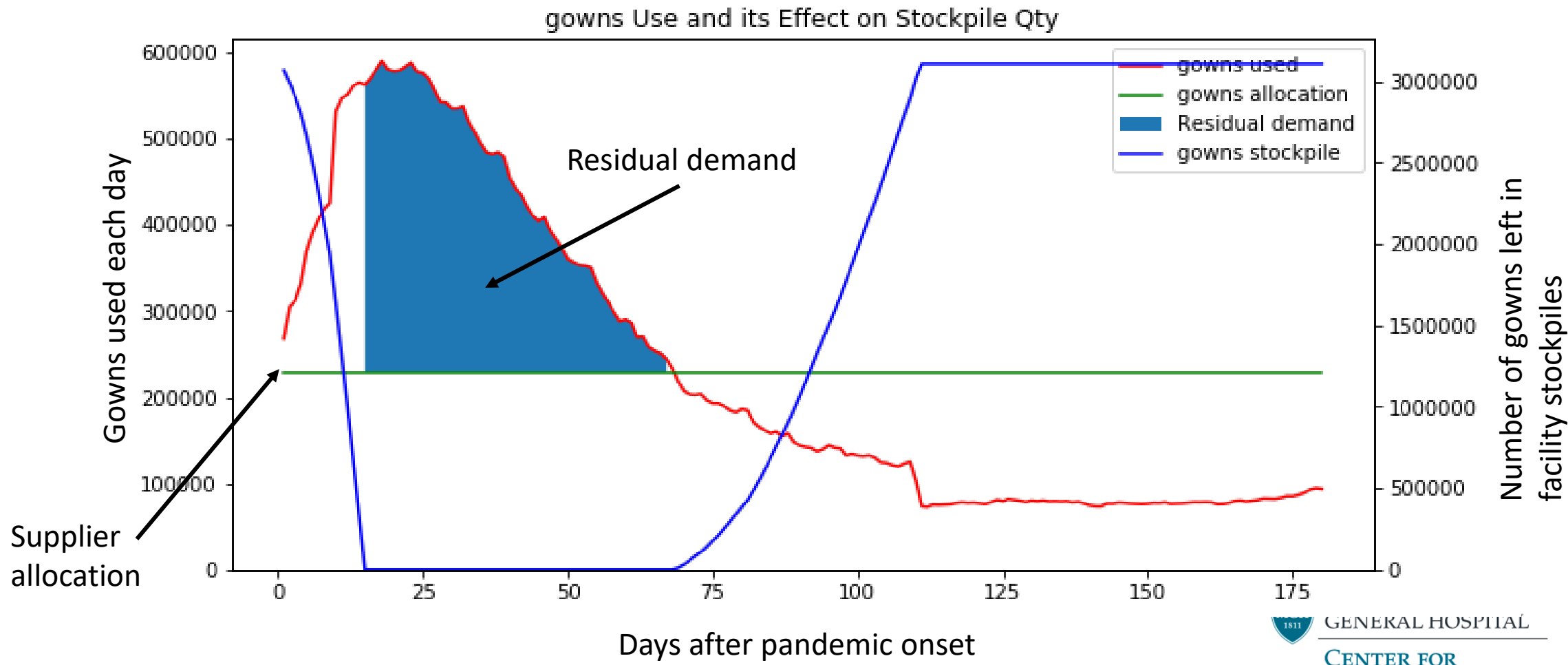
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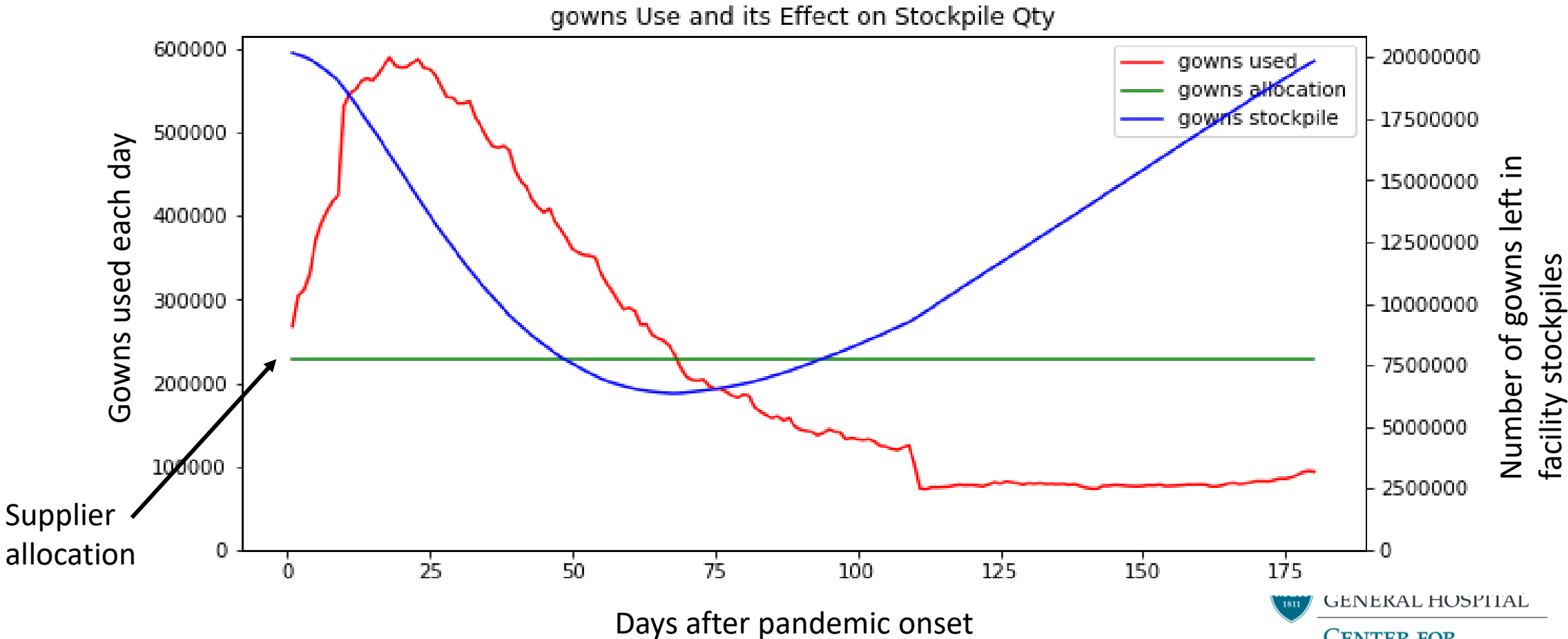
Impact of strong supplier relationships

1X COVID, pre-COVID stockpiles, supplier daily shipment = average daily PPE use



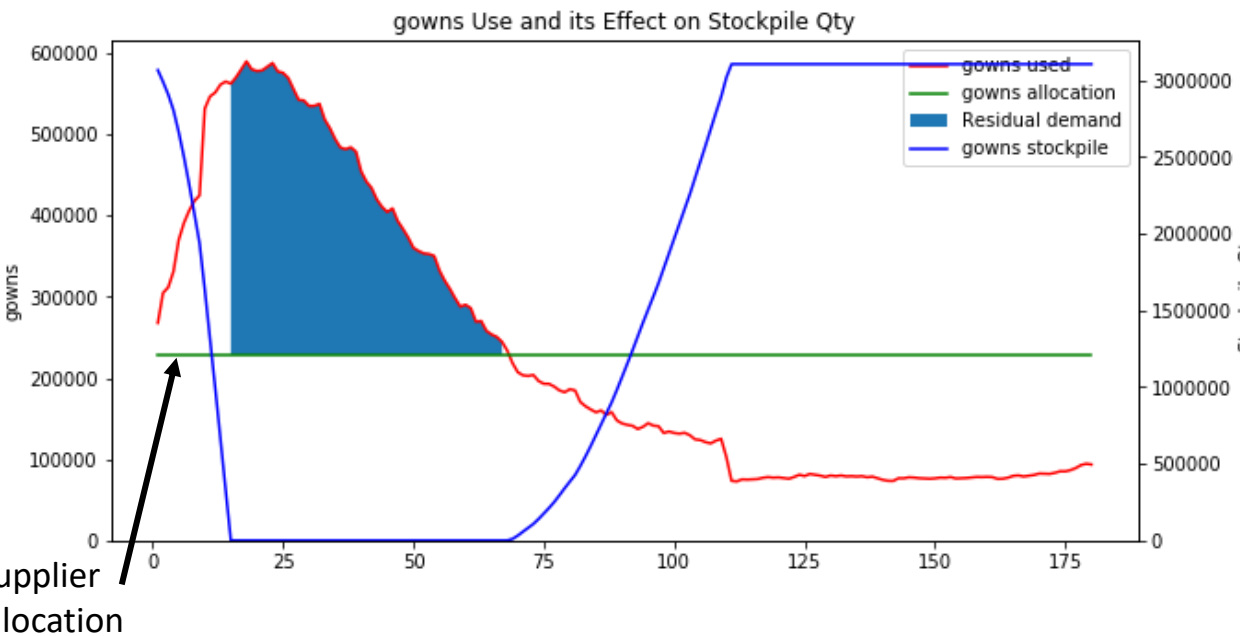
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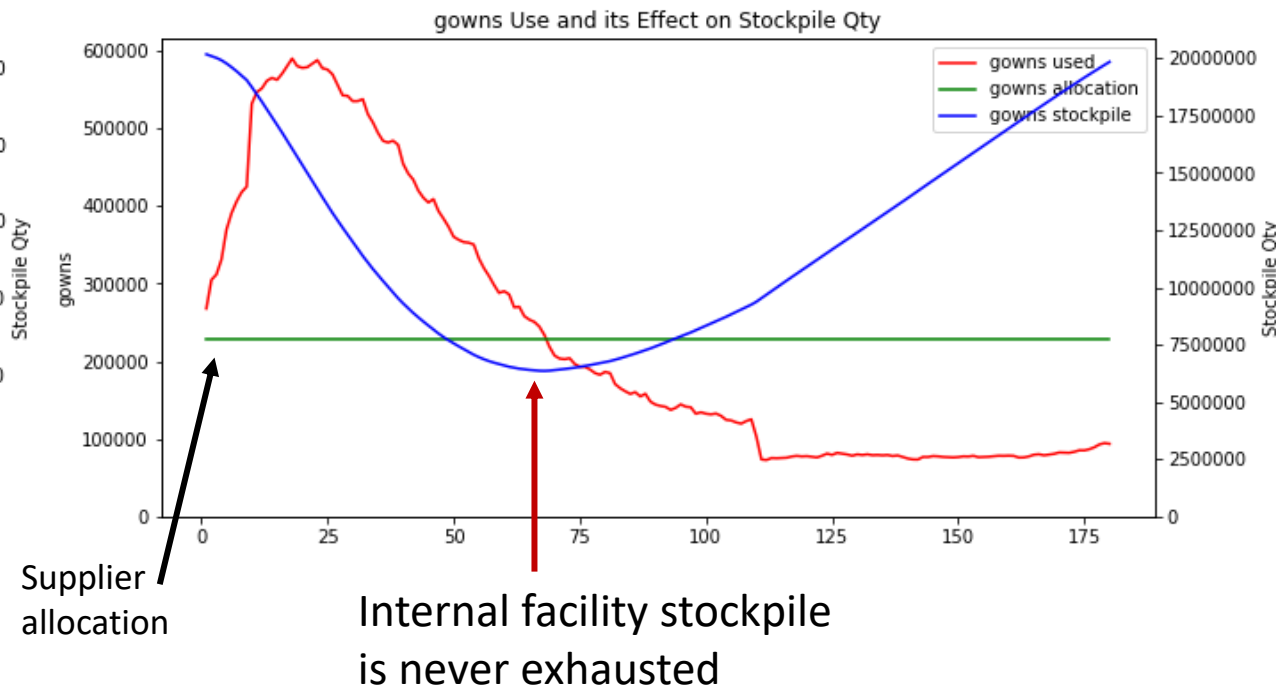


Impact of strong supplier relationships

1X COVID, pre-COVID stockpiles, supplier daily shipment = average daily PPE use



1X COVID, post-COVID stockpiles, supplier daily shipment = average daily PPE use



- Combining a robust PPE stockpile with healthy supplier relationships has the potential to prevent PPE stockouts in a pandemic similar to COVID-19.



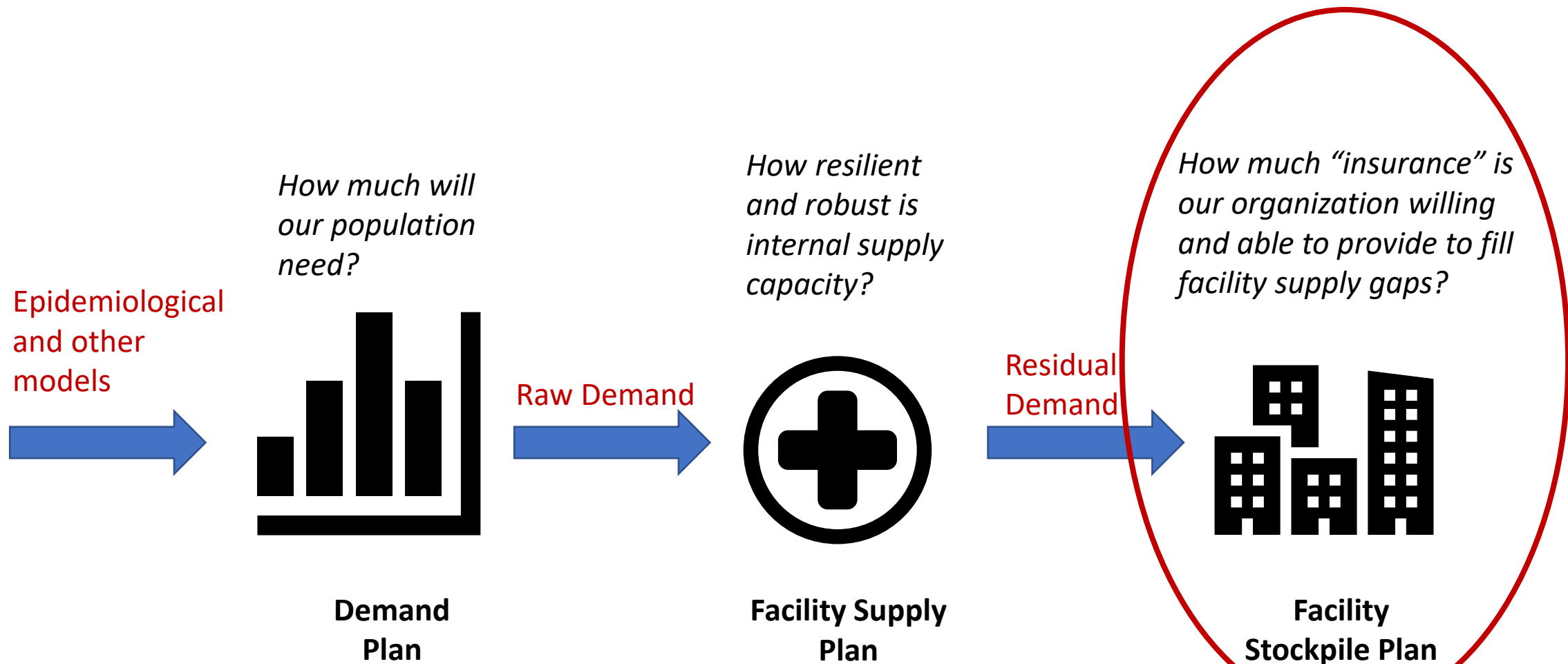
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Would you be willing to participate in a planning group with facilities like yours to form cooperative PPE purchasing and stockpile plans?

Yes - My facility already collaborates with peer facilities/systems

Yes - My facility doesn't collaborate with peer facility/systems right now but I want to in the future

No - My facility is likely uninterested in collaborating with peer facilities/systems

Investment Trade Off Analysis

Cost of not having what you need when you need it

Cost of having more than you need



Weighing your costs

- Determining the cost of having too little:
 - When you didn't have enough PPE to meet the need in early 2020, how much were you willing to pay to buy what you could?
- Determining the cost of having too much:
 - How much loss through expiration would feel unacceptable to you?
 - What other investments would you be curtailing because the money went to the stockpile in a constrained budget environment?
 - Are there competing programs you would invest in if you didn't invest in the stockpile?



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PPE Stockpile Ownership Options

Ownership Option	When to use / Benefits	When not to use / Downside
Vendor Managed Inventory	<ul style="list-style-type: none"> Better for smaller organizations that don't have enough inventory to fill a warehouse Procuring additional infrastructure is not an option. (Requires no additional infrastructure from the organization.) Requires less staff to manage, execute, and deliver orders 	<ul style="list-style-type: none"> Profit has reached a threshold that is > 8% distribution fee Supplier pays to Vendor/ Distributor Contractually may require a longer-term commitment with Vendor
In-house Stockpile Management	<ul style="list-style-type: none"> Organization has more control over its stockpile (i.e. stock rotation, allocation quantities and inventory pipeline) Operations are at a large enough scale that costs are less / do not exceed product markup (3-4%) Direct relationship with suppliers opens the door to suppliers holding additional buffer stock at their warehouse upstream 	<ul style="list-style-type: none"> Requires higher upfront capital investment Demand / consumption does not warrant large enough volumes to overcome high working capital hurdles
User Managed Inventory	<ul style="list-style-type: none"> Requires less warehousing space for the central, controlling organization Cuts down on lead-time to customer facility since product is already pre-positioned Useful method for refreshing stockpile and preventing expiring stock 	<ul style="list-style-type: none"> Cumbersome process if items required for pandemic change as certain brands may not be acceptable at downstream facilities



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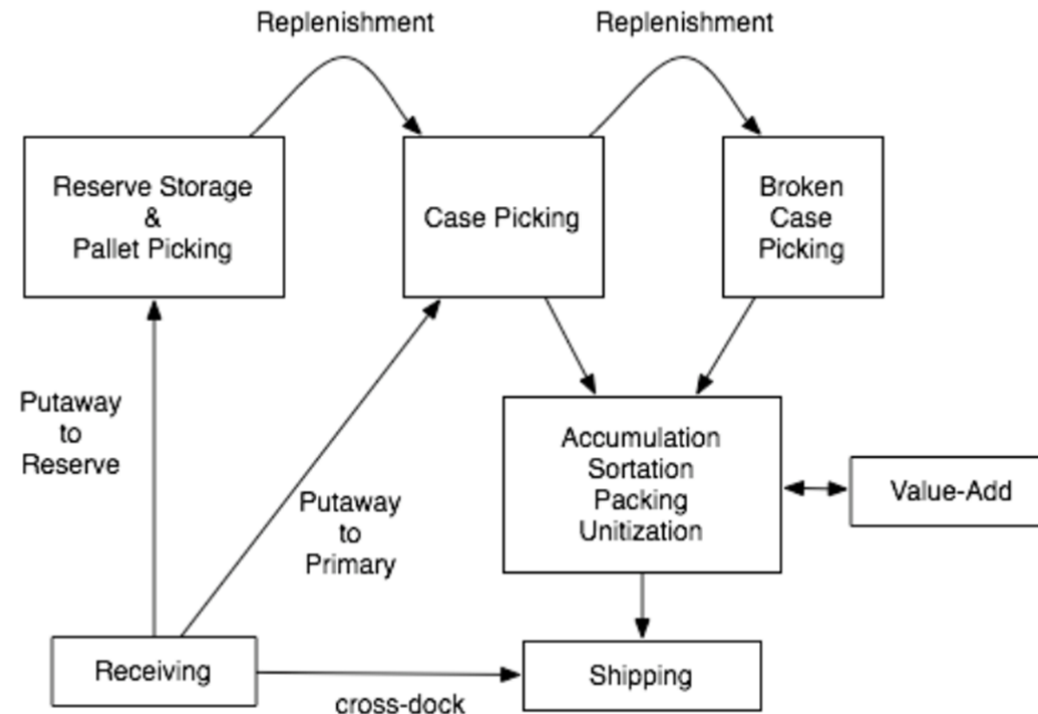


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Warehousing Procedures Overview

- Mostly generalized for application in any industry, with a few PPE/health-specific sections

(adapted from Fig. 9.2, Tompkins *et al*)



Five core warehousing processes: Receiving, Put-away, Picking, Packing, and Replenishment

Receiving and Put-away

Definition: Receiving is the process that accounts for incoming product into the warehouse and adds this product to inventory once it is counted and verified against supplier paperwork.

- ❑ Ensure that Receiving is an appropriate mix of manual and automated processes.
- ❑ Scan incoming product UPCs (or add a barcode to tie product information to it)
- ❑ Check all physical quantities with quantities stated on the supplier invoice and/or packing slip.
- ❑ Verify that expiration dates and Lot numbers are captured and/or match what is in the system. Discrepancies should be set aside and closed out at the end of the receiving process.
- ❑ Separate and stage product stored in bulk from product that will be “broken down” and stored in a primary picking location.



Definition: Put-away is the process that entails moving product from the Receiving staging area to its primary or reserve location.

- ❑ After the Receiving process has been completed, demarcate product (pallets) by bulk put-away and split case put-away.
- ❑ Ensure proper staff with special equipment licenses, such as forklifts and reach trucks, are scheduled for bulk put-away.
- ❑ For split case put-away, move pallets (can be done using a pallet jack) from the Receiving staging area to primary storage locations.
- ❑ Check that all items are scanned and stored into their locations



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Picking, Packing, & Replenishment

Definition: The Picking process is triggered by customer orders and is the first step in order fulfillment within the warehouse.

Cost review guidelines:

- Schedule Picking operations by starting with the customer and working backwards.
Picking operations start time = (promised delivery time to the customer) – (order processing time (pick time + pack time + delivery time + small buffer to allow for operational uncertainty))
- The number of Picking operators required = (average # of orders per day) * (average # of items per order) / (average throughput per Picking operator)
- Picking throughput can be maximized by increasing the average number of items that a Picking operator is able to pick per shift.

Definition: Packing operations happen once Picking operations are completed and are required to protect the finished order from being damaged during loading and transportation.

- In some operations, an “order merge” or “accumulation and sortation” station is required prior to Packing. A WMS system is required to manage a process such as this one.

Throughput Review:

- Calculate the number of Packing stations required to match Picking throughput.
- This calculation can be modeled by the following formula:
(average # of orders processed per hour) / (average # of orders packed per hour (per operator))

Definition: Replenishment is the process responsible for ensuring that all primary storage locations remain full prior and throughout Picking operations.

- Start Replenishment once Picking operations has begun to limit Picking downtime and prevent bottlenecks or missed delivery windows.
- Continues Replenishment once Picking operations have been completed, prior to the start of Put-away.
- Schedule operators with special equipment licenses in order to move product from reserve to primary locations. Additional operators will be required to move product from staged pallets to its primary location.



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Warehousing Procedures – Quality Assurance

Definition: Product quality assurance starts with maintaining proper warehousing standards, such as storage, temperature control, cleanliness, and security.

- Proper storage procedures: product should be stored off of floor, 6” from walls, out of direct sunlight, etc.
- Temperature and humidity checks (manual or automated alerts)
- Perform warehouse conditions and cleanliness inspections regularly
- Set a schedule for required equipment inspections
- Setup security systems for high-value items
- Identify hazardous chemicals that may require fire vaults or cabinets and check for product Material Safety Data Sheets (MSDS)

Warehousing Procedures – Inventory Management

- Stock Rotation (FIFO, FEFO, LIFO, NIFO)
- Physical Inventory Inspections (Annual)
- Cycle Counts (High frequency)
- Recalls and Shelf-Life Extensions (SLEP)

Physical Inventory Process Checklist (paper-based)

- Freeze stock and operations
- Distribute printouts and equipment to staff
- Count assigned inventory and fill out spreadsheets / printouts (staff)
- Enters count data into Inventory Management System, part of WMS (Stockpile Manager and assigned staff)
- Count data is analyzed (Stockpile Manager)
- Investigate discrepancies (staff)
- Resubmit count data to Stockpile Manager
- Data sent to accounting (or posted automatically in WMS)
- Accounting audits and approves the data
- Unfreeze stock and resume operations

Stockpile Management – Human Resources

- **Organizational Roles**
 - **Operations Manager**
 - Day-to-day operations (administrative)
 - Customer Service Issues
 - Key: 3PL Management (audits for operational readiness)
 - **Stockpile Manager**
 - Responsible for PPE inventory pipeline (stockpile ordering and replenishment)
 - Analytics related to physical inventory inspections and inventory policies
 - Key: Manages relationships downstream facilities / customers to monitor facility supply
 - Engage with various 3PL supply chain roles listed below
- **General Supply Chain Roles**
 - Roles divided into the following seven categories: Purchasing, Warehousing, Inventory Management, Material Handling, Order Processing, Transportation and Customer Service
 - Analytical (i.e. supply chain planner, purchaser, inventory manager)
 - Operational (i.e. warehouse operator, transporter)



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Steps towards a robust PPE preparedness plan

- Create emergency preparedness plans that allow you to quickly pull policy levers that adjust PPE demand
 - Run models or use prior use history to determine expected PPE use in future pandemics
 - Evaluate current guidance for cohorting patients in your healthcare facility
 - Evaluate current emergency PPE reuse guidance
 - Create alternate care pathways to decrease in-person patient visits where appropriate
- Invest in facilitating and understanding facility supply plans
 - Create avenues to share PPE information with other facilities
 - Encourage or mandate minimum facility PPE stockpiles
 - Create contingency supplier contracts when possible
 - Work with suppliers to establish a consistent ordering pattern that will guarantee your facility a supply allocation
- Invest in a dynamic stockpile plan
 - Invest in human capital to monitor facility stockpile, place orders with suppliers, and reassess stockpile levels
- Maintain and improve situational awareness
 - Utilize the demand model for different pandemic scenarios
 - Plan for regular readiness reviews



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Future pandemics ≠ COVID-19



Is a new bird flu the next pandemic?

BY MARC SIEGEL, OPINION CONTRIBUTOR — 06/08/21 08:00 AM EDT
THE VIEWS EXPRESSED BY CONTRIBUTORS ARE THEIR OWN AND NOT THE VIEW OF THE HILL

121 COMMENTS

February 25, 2021 03:34 PM

Re-thinking healthcare supply chain in a post-pandemic world

Michael DeLuca

Executive Order on a Sustainable Public Health Supply Chain

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What COVID-19 Exposed In Long-Term Care

[Karen Wolk Feinstein](#)

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Strategic National Stockpile is ready to meet federal response to COVID-19, officials say

Officials on Thursday took issue with reports of shortages and a lack of a centralized database.

Research article | [Open Access](#) | [Published: 16 October 2020](#)

Adapting hospital capacity to meet changing demands during the COVID-19 pandemic



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