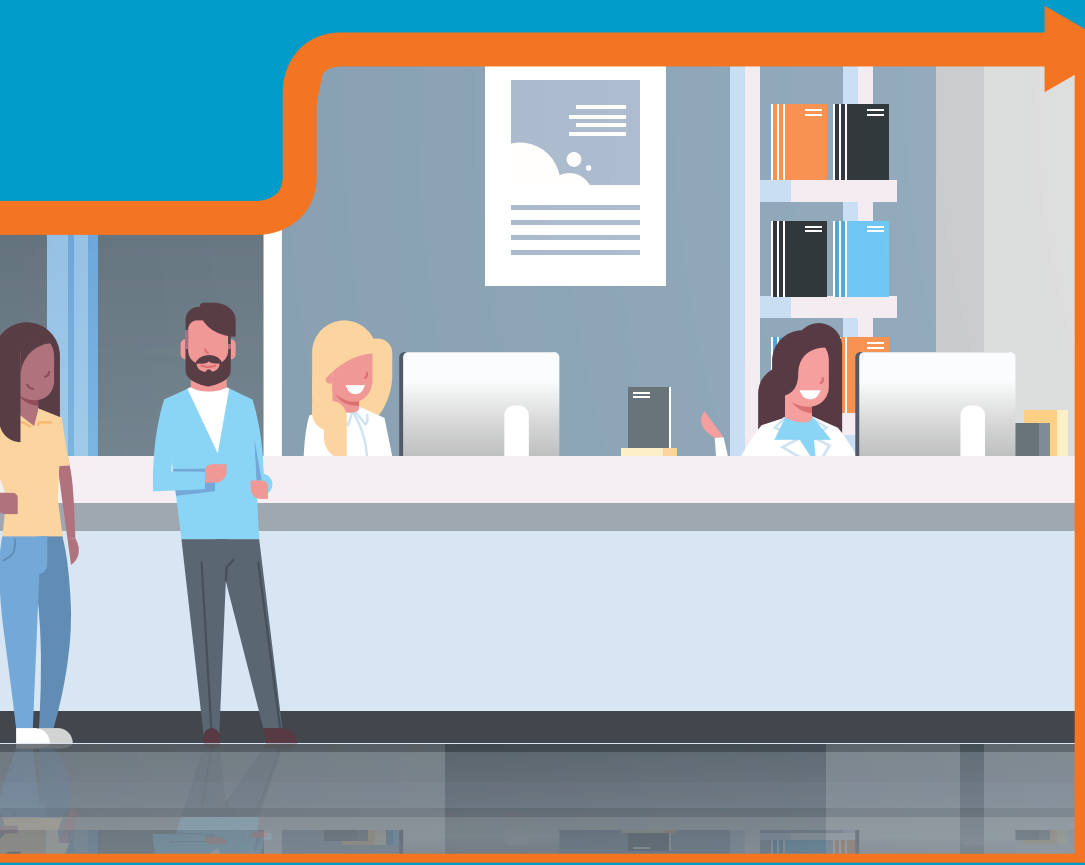
# The Path to Autonomous Floor Cleaning


## How robotic technologies drive cleaning performance in healthcare facilities

# Interactive Table of Contents

This comprehensive guide is designed to provide simple, actionable resources for organizations at any point on their journey toward adopting autonomous floor cleaning. The interactive table of contents below features direct links to each chapter, letting you jump right to the content that is most relevant to you:



# CHAPTER 1:

## Cleaning Robots Arrive in Healthcare

What's driving adoption of robotic floor cleaning?

# Facility Cleaning is More Critical Than Ever for Hospitals and Clinics

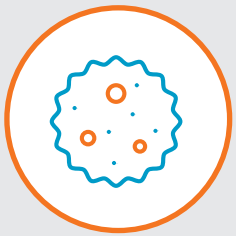
Cleanliness has always been essential in healthcare, but today, the confluence of rising risks, rising expectations and rising standards make the cleanliness of spaces and surfaces more critical than ever for healthcare organizations.

## CLEAN FACILITIES HELP PROTECT PATIENT SAFETY

The emergence of highly resistant "superbugs" makes the fight against healthcare-acquired infections (HAIs) even more challenging. Several studies have demonstrated a strong correlation between consistent facility cleaning measures and reduced infection risk[1], and the CDC has published best practices that illustrate how environmental cleaning can help prevent transmission.[2]

## CLEAN FACILITIES HELP DRIVE PATIENT SATISFACTION & LOYALTY

Patients are more attuned to infection risks within hospitals and clinics, and are seeking out facilities that demonstrate a strong commitment to cleanliness and infection prevention. Research shows a strong connection between patients' perception of overall facility cleanliness and HCAHPS (Hospital Consumer Assessment of Healthcare Providers and Systems), indicators of patient loyalty.[3]



### COVID-19 Crisis Intensifies Importance of Clean Facilities

The recent COVID-19 pandemic punctuates the rising value of facility cleaning in the healthcare world. The pandemic intensifies concerns around facility cleaning and infection control for protecting the health and safety of both patients and staff in hospitals and clinics.

1. https://aricjournal.biomedcentral.com/articles/10.1186/s13756-018-0420-3
2. https://www.cdc.gov/infectioncontrol/guidelines/environmental/background/services.html
3. https://www.pressganey.com/docs/default-source/default-document-library/pg_compass_one_whitepaper_final.pdf?sfvrsn=0

# Achieving Higher Cleaning Standards Presents Operational Challenges

As healthcare organizations recognize and adjust to heightened cleaning demands, they are encountering tough operational challenges:

## HIGHER CLEANING DEMANDS

Successfully mitigating rising infection risks — and meeting rising patient expectations for cleanliness — requires more frequent, more intensive and more complex facility cleaning measures.

## RISING LABOR CHALLENGES

Labor is always a major operational cost. But today, many hospitals and clinics are facing both rising labor costs and a shortage of qualified, experienced and reliable talent to fill out their cleaning teams. Additionally, as cleaning standards increase, more labor may be necessary.

## OVEREXTENDED CLEANING TEAMS

With cleaning demands rising faster than cleaning resources, cleaning teams may find themselves overburdened and forced to make tradeoffs between the quantity and quality of their work.

## ABSENTEEISM & TURNOVER

A common outcome of overextended cleaning teams is falling job satisfaction that can increase rates of absenteeism and turnover — leading to further staff shortages.[4]

4. https://www.psychologicalscience.org/publications/observer/obsonline/a-new-take-on-employee-burnout.html

# Cleaning Robots Arrive as a Promising Solution

By nature, healthcare is an innovative industry, so it's no surprise that forward-thinking healthcare organizations are addressing their facility cleaning challenges with robotic cleaning machines.

Healthcare providers already use robotic technologies to deliver some of the most advanced medical and surgical treatments. But the rapid advance of safe autonomous technology is creating new applications for robotics in healthcare operations. In particular, robotic floor cleaning is emerging as one of the most valuable use cases — helping healthcare organizations unlock consistent cleanliness and operational efficiency.

## What is an Autonomous Mobile Robot (AMR)?

The biggest driver of increasing robotics adoption in facility cleaning is the shift to autonomous mobile robots (AMRs). Compared to previous generation autonomous guided vehicles (AGVs) — widely used in industrial applications such as manufacturing lines — AMRs are not limited by physical tracks or magnetic beacons. This new breed of robots possesses sophisticated on-board artificial intelligence (AI) systems that enable AMRs to not only follow complex processes and make intelligent decisions about how to proceed on a task, but also to safely navigate dynamic indoor spaces, including working around patients and staff in the hallways and common areas of hospitals and clinics. In most cases, robotic floor scrubbers are the same, or very similar, to the core cleaning machines already used by many healthcare organizations — fitted with an array of sensors and the on-board AI "brain" interface. This significantly simplifies adoption, as cleaning teams are typically already very familiar with the cleaning machines themselves.

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# How Robotic Floor Cleaners Deliver Value for Hospitals & Clinics

## ENHANCE PATIENT EXPERIENCE/ HCAHPS SCORES

Patients are more aware and sensitive than ever to the cleanliness, health and safety of a healthcare facility. Robotic floor cleaners allow hospitals and clinics to move floor cleaning from the night shift to the day shift, bringing patients peace of mind by showing them visible proof of continuous cleaning.

## CLEAN MORE FREQUENTLY — AND MORE CONSISTENTLY

Healthcare facilities are bolstering their foundational facility cleaning measures, including more frequent floor cleaning of hallways and common areas. Robotic cleaning machines enable frequent, highly consistent cleaning without increasing labor costs.

## FOCUS STAFF ON HIGH-TOUCH CLEANING

Infection control is already a top priority, but facilities are further increasing surface sanitization and disinfection to protect patients and staff from COVID-19. Robotic floor cleaners allow hospitals and clinics to leave floor scrubbing to the robots — freeing up more time for cleaning teams to focus on high-touch surfaces.

## PROVIDE PROOF OF COVERAGE

Real-time performance data from robotic cleaning machines validate that cleaning has been done, demonstrating that hospitals and clinics are taking additional precautions to mitigate risks to patients and staff, and providing hard proof that they are in compliance with any applicable regulatory orders.

## INCREASE STAFF ENGAGEMENT

By shifting unengaging tasks to robotic floor cleaners, cleaning staff can take on different responsibilities — from expanding their skillset to include robot training and management, to focusing on critical disinfection of high-touch surfaces.

## REDUCE COST TO CLEAN

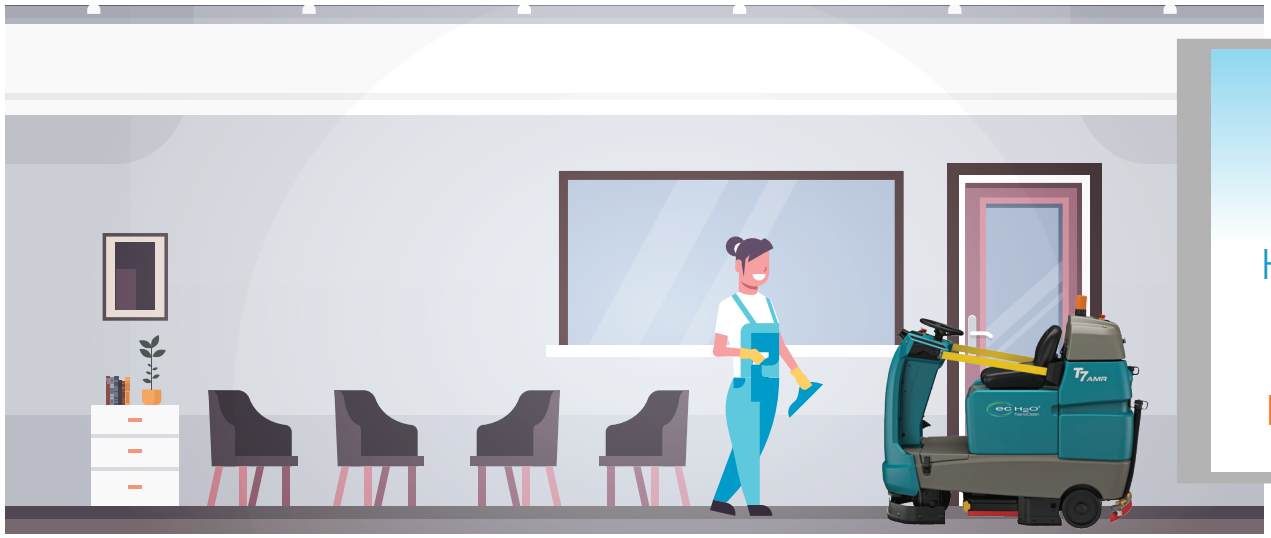
By increasing staff engagement, robotic floor cleaners can help mitigate staff turnover and even potentially reduce the costs of equipment damage from operator error during manual operation.

# "Co-Bots": Robots Supporting — Not Replacing — Existing Staff

Robotic cleaning machines directly address the supply-demand imbalance presented by rising cleaning demands and limited labor resources. But robots aren't replacing cleaning staff. They're working alongside human employees to make cleaning teams more efficient. These "co-bots" are freeing human employees to focus on more complex, strategic cleaning initiatives.

## Supporting Faster Room Turns

One of the major metrics — and pain points — in hospitals and clinics is room "turn time" — how quickly a room can be cleaned, disinfected and made available for the next patient. Recommendations from the Association for the Healthcare Environment Services (AHE) suggest minimum room-turn times of 45 minutes, but rising concerns around infection risks and added cleaning protocols may push that number higher. By deploying robotic floor scrubbing machines to handle routine floor cleaning, healthcare organizations can re-allocate cleaning staff to spend more time on the complex, high-touch requirements of cleaning and disinfecting a patient room in between uses.



DATA DRIVEN
**CLEANING FLEETS**
achieve
HIGHER PRODUCTIVITY
and
HIGHER CUSTOMER/
PATIENT SATISFACTION

## CHAPTER 2:

# Is My Hospital or Clinic Ready for Floor Cleaning Robots?

Key signs that robotic floor cleaning could add value to your organization.

# Is Your Hospital or Clinic Ready for Floor Cleaning Robots?

## Keys to Success — and Limiting Factors

The advancement of robotic technologies for healthcare facility cleaning is allowing more healthcare organizations to realize the real-world promise of robotic floor cleaning, which includes helping to drive more consistent and robust facility cleaning, protecting patient and staff health, enhancing patient experiences, supporting workforces and improving bottom lines. Most promising of all, leading vendors have made the deployment of robotic floor cleaning machines simple. A hospital or clinic can roll out robotic floor cleaning machines quickly because they require no custom infrastructure, no specialized training and provide intuitive user interfaces that are quick and easy for employees to learn. So, how can you tell if your hospital or clinic is ready for floor cleaning robots? In this chapter, we'll explore some of the key pain points that robotic floor cleaning machines can rapidly address, as well as environmental and operational factors that can enhance the success of a robotic floor cleaning program.

# Common Challenges Facing Healthcare Facilities Today

The common pain points below are all issues that can be directly and rapidly addressed through the deployment of robotic floor cleaning machines, helping a healthcare facility realize strategic value from its investment.

### Protecting Health & Safety of Patients, Visitors and Staff

Infection control is a top concern for every healthcare facility today. Facility cleaning, including regular floor scrubbing, plays a key part in providing a foundational clean that helps to protect the health and safety of all those in the facility.

### Enhancing Facility Image

As patients become more sensitive to infection control and other health and safety issues in hospitals and clinics, the aesthetic cleanliness of a facility has become one of the biggest factors in patient satisfaction — with a demonstrated correlation with HCAHPS scores.[5]

### Cleaning High-Traffic Areas

Unlike most other types of facilities, many hospitals and clinics remain open 24/7. This makes regular cleaning of high-traffic areas like entryways and hallways a particular challenge, as it cannot simply be pushed to non-business hours.

### Rising Labor Costs

Labor costs are always an operational concern, but the rising focus on facility cleaning means teams are cleaning more frequently. At the same time, rising average wages and changes to mandated benefits are augmenting labor cost concerns.

### An Over-Extended Cleaning Team

With labor costs and cleaning requirements simultaneously on the rise, many cleaning teams struggle to manage a growing to-do list. Staff may be forced to choose between foundational cleaning tasks like floor scrubbing and more targeted tasks such as disinfection of high-touch surfaces.

### Frequent User Error Issues

Over-extended employees tend to become mistake-prone employees. Increased user error can lead to employee safety incidents and/or costly damage to cleaning equipment.

### Inconsistent Floor Cleaning

Amid rising expectations for facility cleanliness, managers are increasingly dealing with cleaning consistency challenges, from ensuring frequently-missed spaces get cleaned daily, to addressing decreased cleaning performance during overnight hours, and more.

### Limited Visibility/Proof of Coverage

Related to the cleaning consistency challenge, many healthcare facility managers are finding that they do not have the visibility and data necessary to validate consistent and/or compliant facility cleaning, to internal and/or external stakeholders.


5. https://www.pressganey.com/docs/default-source/default-document-library/pg_compass_one_whitepaper_final.pdf?sfvrsn=0

# Key Considerations for Successful Robotic Floor Cleaning

There is no secret formula for success with robotic floor cleaning. There are, however, some key considerations that will help get the maximum value out of your cleaning program.

### Good Cellular Coverage

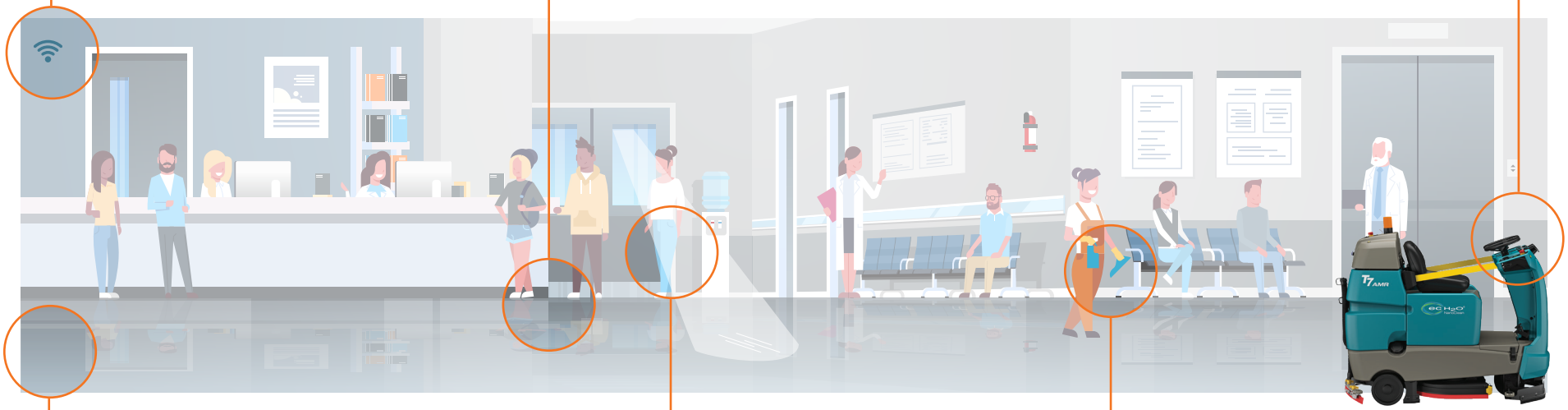
While robotic floor cleaning machines do not require cellular communications to run on their own, certain reporting and technical support functions require an LTE/4G connection to perform routine data uploads when not in use.

### Environmental Traffic Patterns

Robotic floor cleaning machines have artificial intelligence (AI) and sensor technologies that allow them to navigate safely around people and other obstacles. That being said, it's important to think about your facility's heavy traffic flow patterns when deciding on cleaning routes and schedules in order to maximize cleaning efficiency and effectiveness.

### Consistent, Comprehensive Scrubbing Time

Robots are great at consistently cleaning their routes the same way every time. The ROI on robotic floor cleaning grows with use, so robotic cleaning machines are best suited for spaces that are cleaned at least two hours per day, 5 days per week.



### Open Aisle and Runway Spaces

Robotic floor cleaning machines perform best when they have adequate space to maneuver. Some spaces in hospitals and clinics can be challenging — such as patient rooms, where the smaller space is typically filled with sensitive medical technologies and devices.

### Intense Sunlight or Highly Reflective Surfaces

Highly reflective surfaces, such as shiny metal or glass and intense sunlight can affect the machine's sensors and cause navigation confusion. Simple routing considerations and adjustments account for these factors.

### Employee Engagement

Designed with easy-to-understand user interfaces (UI), robotic floor cleaning machines don't require any special technical skills to operate. This makes them particularly beneficial for environments that may experience high operator turnover.

CHAPTER 3:

# How Do Robotic Scrubbers Work?

A quick look at the technical basics of autonomous cleaning robots.

# What is a Robotic Floor Scrubber?

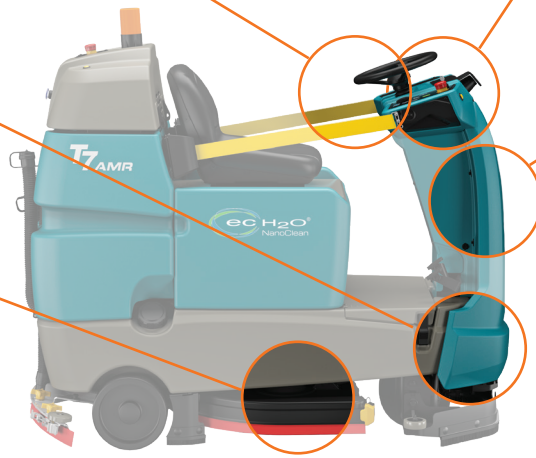
The first thing to know about robotic floor scrubbers is that they are not entirely new machines. They are typically similar to ride-on machines that most cleaning teams in hospitals and clinics are used to — with one major difference: they are fitted with sophisticated, AI-driven technology and sensors to help the machine move and clean autonomously.

This approach offers a key advantage to healthcare organizations, when compared to robotic cleaning machines designed from the ground up: it combines best-in-class cleaning technology with best-in-class AI, ensuring organizations do not have to compromise on cleaning performance or autonomous functionality.

**Control panel**
Much like a tablet or mobile phone, operators access the robotic floor scrubber functions via a touch-sensitive user interface screen. All common functions, such as teaching a route, selecting a route and viewing training videos, are accessed via the user interface screen next to the steering wheel.

**LIDAR sensors**
LIDAR (Light Detection and Ranging) sensors accurately scan the area in front of and to the sides of the machine for a wide range of potential obstacles.

**Proven scrubbing technology/hardware**
Most robotic floor scrubbers use the same proven hardware and technology to execute floor cleaning as that found in manually operated machines. This delivers proven floor cleaning performance.




**AI-driven "brain"**
The AI-driven brain of the robotic floor scrubber pulls together the real-time inputs from all the sensors to guide the machine safely and accurately through a space. This central, cloud-based AI software platform also serves as the interface between the machine and robot trainer/operator.

**2D cameras**
2D cameras, located on the sides of the machine, identify the home markers that the robotic cleaning machine relies on to complete cleaning routes.

**3D cameras**
3D cameras located on the front of the steering column allow the cleaning machine to perceive the environment around it and detect any potential safety hazards.

# Putting it All Together: How Robotic Scrubbers Work

Now that you understand the basic components of a robotic floor scrubber, let's take a look at how an autonomous robot actually learns a cleaning route in a healthcare environment:

1

### TRAINING ROUTE

For most robotic floor scrubbers, training means having an employee first drive the robot through the intended cleaning routes.

2

### COMMITTING A ROUTE TO ROBOTIC MEMORY

While the routes are trained manually, the robotic floor scrubber uses its array of sensors to digitally scan the environment and create a map of the route.

3

### SELECTING A ROUTE

When it's time to clean an area, the machine operator can simply select from multiple saved routes that appear on the robotic floor scrubber's interface.

4

### AUTONOMOUSLY CLEANING A ROUTE

The robotic floor scrubber follows the saved route map. But it is constantly taking in real-time inputs from its array of sensors and using its AI "brain" to safely and efficiently navigate a route.

5

### ADJUSTING IN REAL-TIME TO IMPROVE PERFORMANCE

By pairing the robot with the operator's mobile device, the operator can receive real-time notifications and alerts about the machine's performance. If the robot requires an assist, the operator can quickly step in.

6

### MEASURING PERFORMANCE

The robotic floor scrubber captures performance data and displays heat maps for each cleaning route that is run. This enables operators and managers to see which areas were cleaned and which may need follow-up attention.

## TEACH AND REPEAT

This approach, called "teach and repeat," has quickly become the predominant method of robotic route mapping in public spaces because of its flexibility and ease of use. It makes initial training and deployment of robotic scrubbers fast and easy — and allows your employees to handle route mapping. This teach-and-repeat approach also greatly enhances the flexibility of robotic cleaning routes. Robots can automatically adjust to obstacles in real time — and operators can easily adapt routes to address.

CHAPTER 4:

# Preparing for Success with Robotic Cleaning

Tips for fast deployment & accelerated ROI.

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# Preparing for Success with Robotic Cleaning

## 5 Tips to Streamline Deployment and Accelerate the Path to ROI

Significant advances in robotic technologies mean deploying robotic floor cleaning machines is easier than ever for hospitals and clinics.

But it's important to note that deploying is not merely a one-for-one equipment swap. The true value in robotic cleaning lies in how it allows your organization to change the way you clean — becoming more efficient and more strategic about your cleaning protocols and how you allocate resources. To realize this value, healthcare organizations need to begin considering how they can best adjust their existing cleaning processes and protocols to take advantage of the specific capabilities of robotic floor cleaners.

This chapter will provide five simple tips to help your business prepare for a successful deployment, so you can realize its full value as quickly as possible.

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# 1 Treat Implementation Like a True Change Management Process

Any significant change can be difficult for employees. Robotics, in particular, can raise understandable concerns for some employees who might wonder, “Will a robot take my job?”

Start by building a solid change management plan, following best practices for establishing and managing staff expectations.

## KEY MESSAGES FOR YOUR TEAM

### Co-Bots

Explain the concept of “co-bots” — how floor cleaning robots will work collaboratively alongside employees, allowing them to spend more time on high-touch, high-value tasks that only a human can do.

### Alleviating Burdens

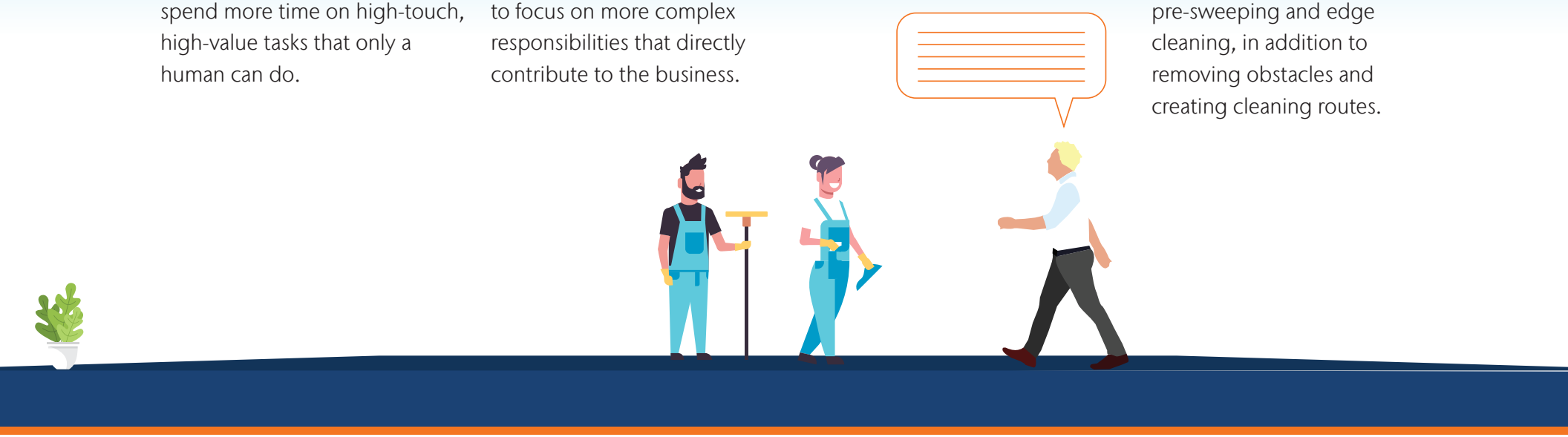
Show employees how robotic floor cleaners will free them from monotonous floor cleaning, allowing them to focus on more complex responsibilities that directly contribute to the business.

### Adding Skills

Explain how employees will be able to add in-demand skillsets around robot training and operation.

### Supporting Tasks

Make sure you mention the cleaning tasks that employees will still have to do in order to support the robots, such as pre-sweeping and edge cleaning, in addition to removing obstacles and creating cleaning routes.



HOME

# 2 Get Buy-in at All Levels

Buy-in from relevant stakeholders is a prerequisite for any business initiative to succeed. In the case of robotic floor cleaning, here's what's most important:

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# 3 Dedicate Time For Proper Route Mapping & Validation

One aspect of deployment that is sometimes overlooked is allocating enough time for thorough route planning. A thoughtful approach to mapping routes will maximize robotic floor cleaning coverage and minimize manual interventions that decrease employee productivity.

## HERE ARE TIPS TO ENSURE SUCCESS

**Be aware of differences between manual and autonomous scrubber operation.** Optimizing a route for autonomous scrubbing is different than cleaning with a manual machine. For example, tight turns and U-turns may impact the performance of the robotic scrubber. Recognizing and correcting for these differences will pay significant dividends in long-term efficiency.

**Validate a route after training.** After an operator has completed training the robot on a cleaning route, validate that route by confirming that the robot can run the full route autonomously, without any required assists. This will minimize operator intervention in the long run.

**Train the operator on pre-sweeping best practices.** As part of the autonomous training process, make sure the operator knows what support steps — such as pre-sweep and/or edge clean — will help ensure the most efficient and effective autonomous cleaning run.

**Plan routes around other operational processes.** As you train the robot, make sure you are considering other aspects of your hospital or clinic operations that may intersect with cleaning. For example, planning cleaning routes around patient room cleaning schedules, or the most high-traffic periods in your hospital or clinic, may be helpful.

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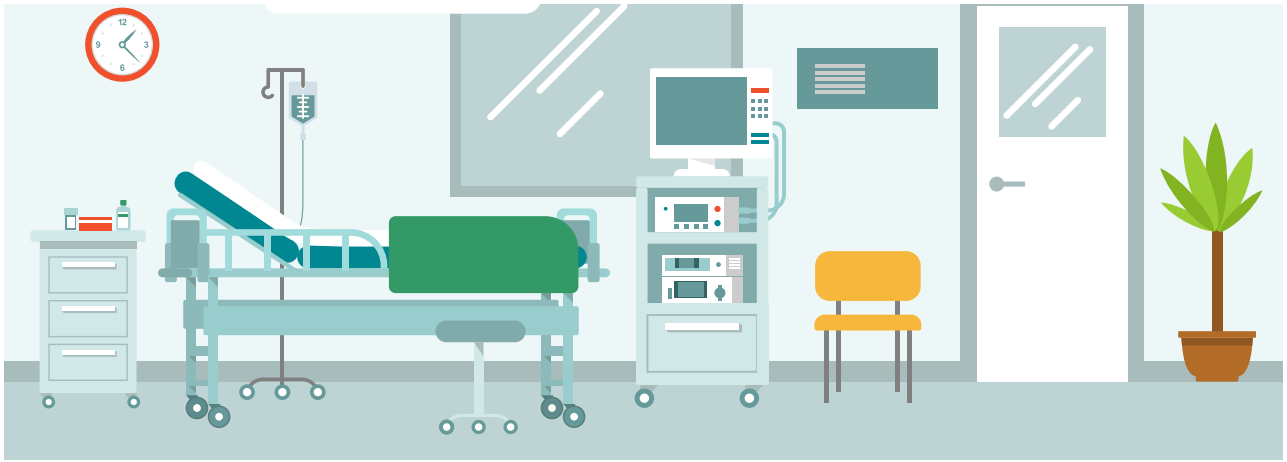
# 4 Plan for How You'll Re-allocate Staff

A key value of robotic cleaning is that it allows hospitals and clinics to re-allocate staff to other responsibilities. But some organizations make the mistake of not having a clear plan for the new responsibilities staff will take on as robotic floor cleaners free up more of their time.



### Be Proactive - Don't take the "wait and see" approach.

While it's true that the initial robot training period will require more time from employees, it's important to begin planning for how you will adjust or reschedule staff before you even begin robot training. Having a plan in place early adds value to your change management efforts, giving employees more tangible ideas of how robots will impact their jobs.

### Ask your employees, "What can you do with extra time?"

This is also an excellent opportunity to engage staff and make them feel like part of the strategic initiative. Ask them what they think they can do with the extra time created through autonomous floor cleaning — not as a challenge for them to prove their worth, but as an opportunity for them to set their own path.

### Align re-allocation plans with key business objectives.

How can you apply newly available labor resources to the top goals of your hospital or clinic? If your organization has targeted infection prevention, for example, employees that previously operated floor cleaning machines can be re-focused to more frequent wipe-down sanitization of high-touch surfaces — as well as validating cleaning consistency.

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# 5 Define Your Goals — and Determine How You'll Measure Success

Another essential goal for any successful initiative: Define what you're trying to achieve — and how you'll gauge your success.

## Connect with business-level objectives

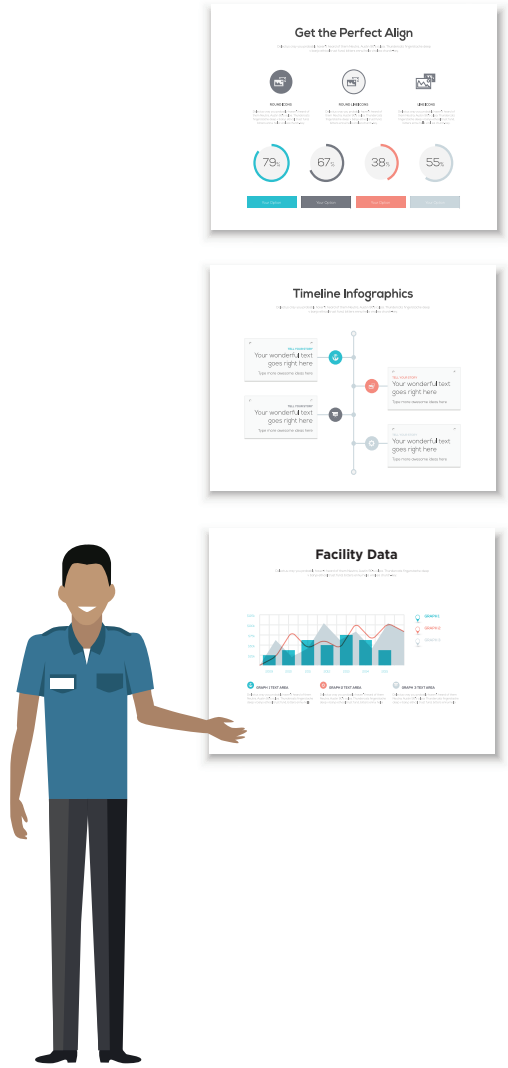
Start by looking at the top-level objectives of your healthcare organization. Your robotic cleaning program should ladder up to one of these business goals, such as reducing infection risk, increasing HCAHPS scores, or optimizing operational costs.

## Define value

Robotic cleaning can increase cleaning efficiency and staff productivity, but these are just two operational ways to define value or ROI. Also consider values such as increased employee satisfaction, reduced turnover or absenteeism, or improved brand image.

## Build ongoing reporting and evaluation into cleaning operations

Make sure you're building regular reporting and evaluation into your standard cleaning operations — so you can readily report up on your success, as well as identify opportunities for improvement in real time.




## Communicate your goals at all levels

Once you've defined your goals and how you'll measure success, share these objectives with employees at all levels. Senior leadership should clearly understand what you're trying to accomplish. Cleaning staff managers should know what they are aiming for. The cleaning team should see how their performance can directly drive value for the business. Even clinical staff should understand how enhanced facility cleaning is helping your hospital or clinic provide better patient care.

## Leverage on-board performance data and reporting to track KPIs

After you've defined what value or ROI looks like for your robotic cleaning program, determine how you can leverage the on-board data-gathering and reporting capabilities of your autonomous cleaning machines to track key performance indicators (KPIs). For example, leverage your robotic scrubber's proof-of-coverage metrics and heat maps of areas cleaned as vital KPIs to monitor the daily success of your robotic cleaning program.

## CHAPTER 5:

# How to Build a Business Case for Robotic Floor Cleaning

Setting goals, measuring success
& capturing the full business value.

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# Calculating the Full Value of Smarter Floor Cleaning

## "Dollar Sense" is No Longer a Simple Equation

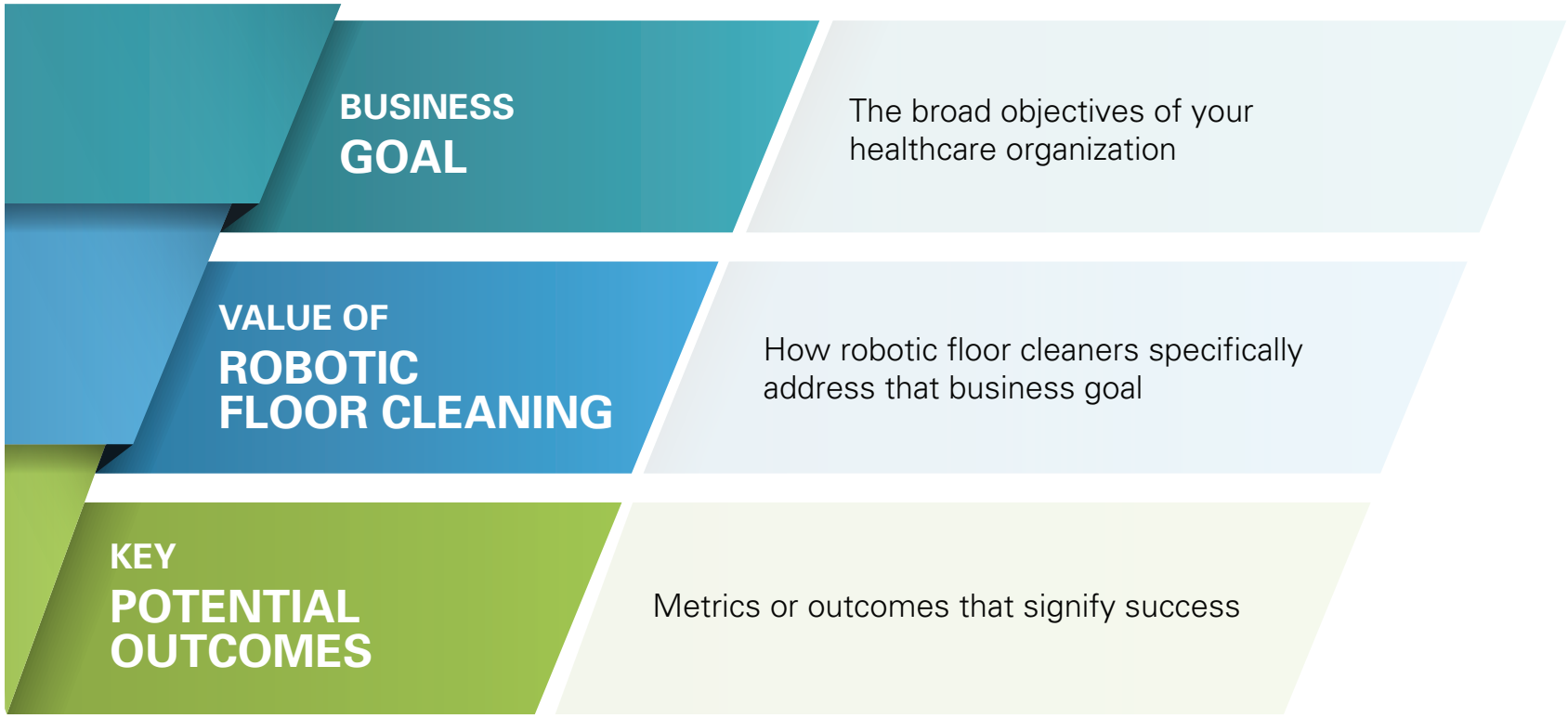
No matter how cool a new technology or how impressive the capabilities, smart hospitals and clinics never make an investment unless it makes "dollar sense." But when it comes to weighing the costs of clean, healthcare organizations are facing a new reality: the value of clean is more complex than ever — and no longer a simple matter of labor productivity. In fact, if you're looking at labor costs as the sole focus of a robotic cleaning program, you're missing significant value.

## Defining the Value of Robotic Cleaning in Your Hospital or Clinic

In this chapter, we'll help you consider exactly what value you should aim to achieve through your robotic floor cleaning program. This includes how to set goals around specific values, how to objectively lay out the potential ROI of robotic floor scrubbers, and how to measure achievement against your defined goals.

## Start With Your Top-Level Business Goals

Not every robotic cleaning program will look the same. The specific goals of your program should align with the unique top-level challenges and goals of your healthcare organization. Working from the top down, you can understand the ROI of robotic floor cleaners by constructing a hierarchy:




On the following pages, we will outline several common business goals, illustrate the relevant values from implementing robotic floor cleaning machines, and define how success might be measured.

# Connecting Goals with Robotic Cleaning Outcomes

## BUSINESS GOAL

### Enhancing Patient Experience/Improving HCAHPS Scores

Much like other consumer segments, healthcare organizations are competing to attract and retain patients based on experience. Compounding this focus on experience, HCAHPS (Hospital Consumer Assessment of Healthcare Providers and Systems) scores are now directly tied to reimbursement rates and economic outcomes for hospitals and clinics.

## VALUE OF ROBOTIC FLOOR CLEANING

**Clean You Can See**. Not just enhancing aesthetic clean, but moving floor scrubbing from the night shift to the day shift to give patients visible validation of cleaning.

**Proof of Coverage**. Giving healthcare organizations hard data to prove — to patients, management, regulators, etc. — consistent facility cleaning.

**Sustainable Innovation**. A highly visible sign of a healthcare organization's commitment to investing in sustainable innovations.

## POSSIBLE OUTCOMES

**Improve Patient Satisfaction Scores**. Patients more pleased with their experiences.

**Improved HCAHPS Scores**. Research shows a strong connection between patients' perception of overall facility cleanliness and HCAHPS indicators of patient loyalty[6].

**Improved Patient Retention/Decreased Volume Leakage.** Satisfied patients are more likely to return for future care.

6. https://www.pressganey.com/docs/default-source/default-document-library/pg_compass_one_whitepaper_final.pdf?sfvrsn=0

# Connecting Goals with Robotic Cleaning Outcomes

| BUSINESS GOAL | Ensuring Compliance/Mitigating Infection Risk | Optimizing Operational Efficiency |
|---|---|---|
| | In light of growing public sensitivity about facility cleaning protocols due to the pandemic, healthcare organizations are doubling down on regulatory compliance, and other risk mitigation strategies to protect patients, staff and the business. | Increasing competition and shifting reimbursement models make budget concerns top-of-mind for every healthcare organization. But the challenges growing out of the COVID crisis make bottom-line pressures more acute than ever for hospitals and clinics, leading them to look for creative ways to improve operational efficiency and get more from their budgets. |
| **VALUE OF ROBOTIC FLOOR CLEANING** | Cleaning Consistency<br>Proof of Coverage<br>Re-Allocating Labor | Low Labor Cost<br>Giving Employees More Time<br>Less Misuse/Abuse |
| **KEY POTENTIAL OUTCOMES** | Audit-Readiness<br>Reduced Infection Risks<br>Reduction in Safety Incidents<br>Reduction in Litigation Costs | Cleaning More — Without Costing More<br>Higher Cleaning Productivity<br>Reducing Maintenance Costs |

# Connecting Goals with Robotic Cleaning Outcomes

| | | |
|---|---|---|
| **BUSINESS GOAL** | **Healthcare Employee Satisfaction**<br>Healthcare organizations increasingly recognize that their people have the potential to be one of their greatest differentiators. More are focusing on improving employee satisfaction, enhancing engagement and increasing retention. | **Investing in Sustainability/Innovation**<br>Healthcare is a technology-driven industry. From treatment capabilities and risk mitigation to brand reputation, hospitals and clinics are constantly looking to invest in new technologies that deliver forward-thinking, future-ready capabilities. |
| **VALUE OF ROBOTIC FLOOR CLEANING** | **Offloading Repetitive Tasks**<br>**Assigning Higher-Value Responsibilities**<br>**Adding In-Demand Skillset** | **Efficient Floor Cleaning**<br>**Visible Innovation** |
| **KEY POTENTIAL OUTCOMES** | **Increased Employee Satisfaction & Engagement**<br>**Reduced Employee Turnover**<br>**Lower Absenteeism** | **Improved Sustainability Metrics**<br>**Enhanced Brand Image** |

HOME

# Think About TCO (Total Cost of Ownership)

Another way to think about the ROI of robotic floor scrubbers is to consider total cost of ownership, or TCO. Here are the core elements of TCO to consider:


### Initial Cost

This is the actual purchase price of the equipment, including the scrubber machines and additional software costs associated with the AI technology. The "sticker price" of different vendors' robotic scrubbers varies, but will almost certainly be higher than a manually operated machine. However, the initial cost is often one of the smallest components of TCO.

### Operational Cost

This is the cost of actually using the floor scrubber — including the costs associated with deployment. The operational costs of robotic floor scrubbers tend to be much lower than manual floor scrubbers, largely because there is almost zero incremental labor cost to operating a robotic floor scrubber. But deployment and training costs can vary widely between robotic cleaning machine vendors.

### Downtime Cost

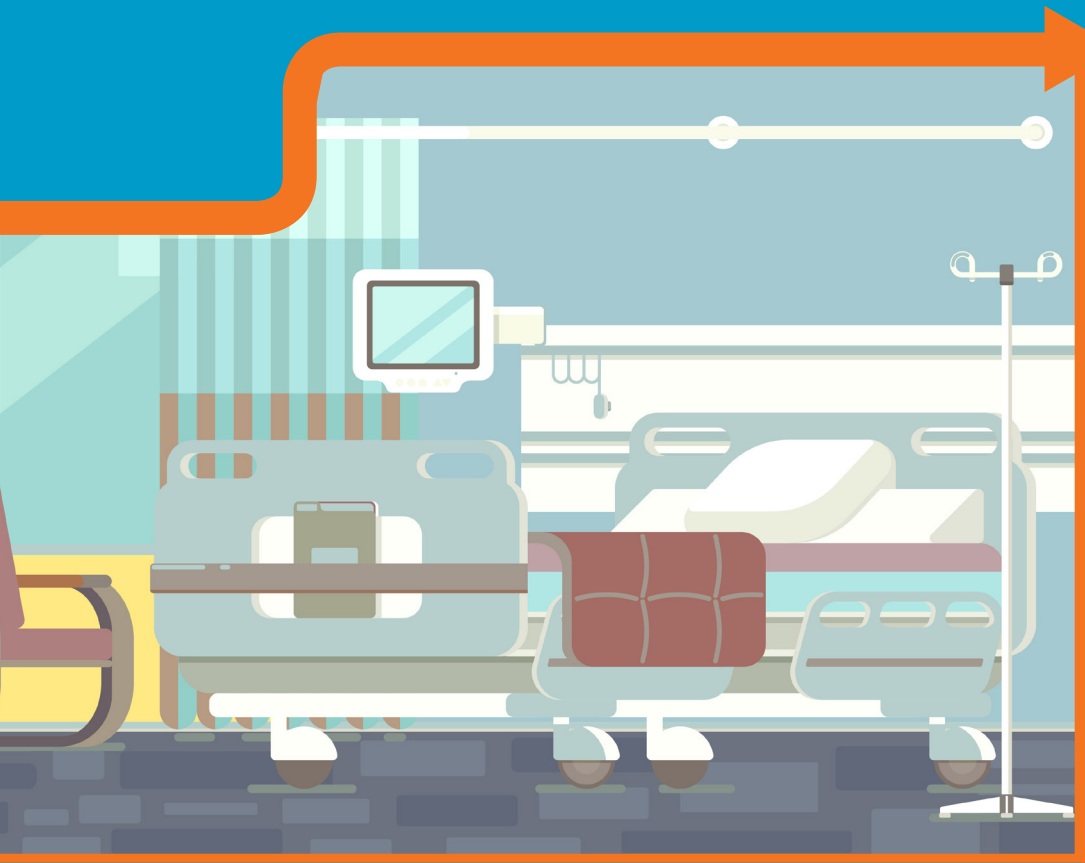
This is the cost of cleaning productivity that is lost when the machine is unavailable for any reason. Robotic machines have an advantage on downtime cost because they work side-by-side with employees, allowing higher utilization rates. The downtime costs of a robotic cleaning machine depend on qualities like battery life, as well as the overall reliability of the cleaning hardware.

### Maintenance Cost

This includes labor and parts costs for all preventative maintenance and emergency repairs. Leading robotic cleaning machine vendors leverage proven hardware and in-house maintenance support that tends to reduce overall maintenance costs further. Don't forget to consider software maintenance/upgrade costs. Best-in-class vendors enable seamless, cloud-driven software updates as part of the subscription.

### Remaining Value

Since most healthcare organizations investing in a floor cleaning machine will seek to fully depreciate the value of the equipment, this is mostly a question of longevity and durability: How long can you expect the machine to last? Once again, proven hardware is one of the best predictors of equipment durability and longevity.



## CHAPTER 6:

# What to Expect from Your Cleaning Robotics Manufacturer

Careful considerations for choosing the right partner.

# Building a Requirements List

## All Robots Are NOT Created Equally

As we've covered in previous chapters, the potential value of robotic floor cleaning is broad and significant. These technologies continue to improve, becoming more practical, more cost-effective and easier to implement for hospitals and clinics of all sizes. But not all robots are created equally. There are now many robotics manufacturers in the floor cleaning market, and different manufacturers have taken different approaches to building, deploying and supporting their autonomous cleaning machines. This chapter will help you build a requirements list for manufacturer evaluation that focuses on the four most important aspects:

THE MACHINE

THE SOFTWARE

THE PEOPLE

THE PROCESS

# The Machine

We'll start with the robotic cleaning machine itself. Robotic offerings from different manufacturers vary widely in their appearance, and more importantly, what's inside. Here's what to look for:


## Proven AMR Experience at Scale

The first and biggest requirement should be demonstrated experience in building and deploying robotic floor scrubbers in real-world environments. With many start-up manufacturers entering the market, proven experience at scale is critical. It's easy to build a few machines, but it is much harder to make and deploy hundreds of AMR units for a large healthcare organization.

## Proven Floor Cleaning Hardware

Some manufacturers have attempted to build a robotic cleaning machine from the ground up, focusing on the exciting part: the AI-driven autonomous navigation software. But commercial floor cleaning is no lightweight business. These machines need to consistently clean in unpredictable conditions, and stand up to daily, rigorous use. Look for floor cleaning hardware from a trusted manufacturer that offers proven usability, performance, reliability and durability.

## Familiar Machines

Many manufacturers have created robotic cleaning machines that cannot be operated manually. Manual operation is essential to move the autonomous scrubber into position and enable highly efficient teach-and-repeat route mapping.

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# The Software

The equipment does the actual cleaning, but it's the AI-driven software that enables the machine to clean autonomously.


Here's what to look for:

### Safety Through Experience

Autonomously navigating around a dynamic, high-traffic hospital or clinic environment is one of the most exciting capabilities of robotic floor cleaners. But can you really trust the robot to safely navigate around patients and staff? Ultimately, the proof is in experience. AI and machine learning technologies continually grow smarter with time and experience, so you want an AMR software platform with millions of hours and thousands of robots[7]. This is the only way to know that a robot is capable of operating safely in your healthcare facility.

### Integrated Approach

You need a manufacturer with the right mix of sophisticated software and years of proven experience delivering reliable floor cleaning hardware. Look for a best-of-breed approach that combines an established equipment manufacturer with a proven AMR software platform.

7: Brain Corp. network data, 2020

# The Software

## Intuitive UI/UX

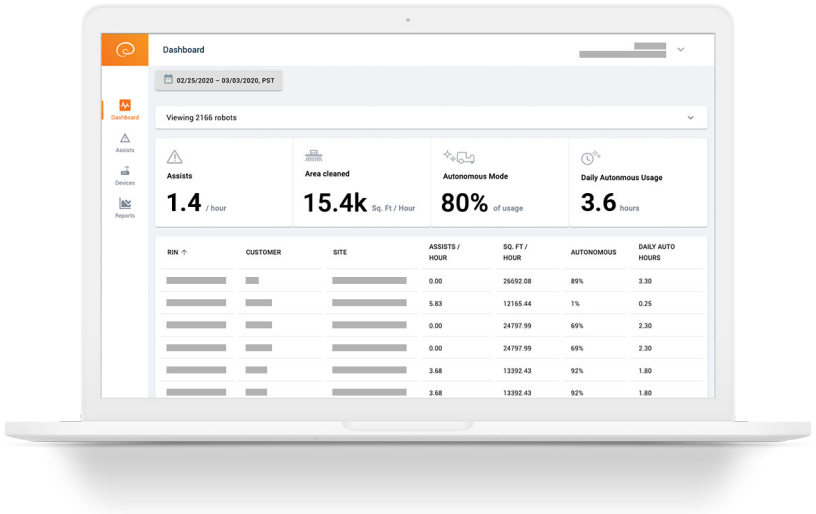
While your operators will be spending less time with a robotic floor scrubber than they do with manually operated machines, they are still the operators of the robotic machines — teaching routes, selecting routes, assisting when necessary. A simple user interface (UI) and intuitive user experience (UX) will significantly streamline training and reduce associated program costs.

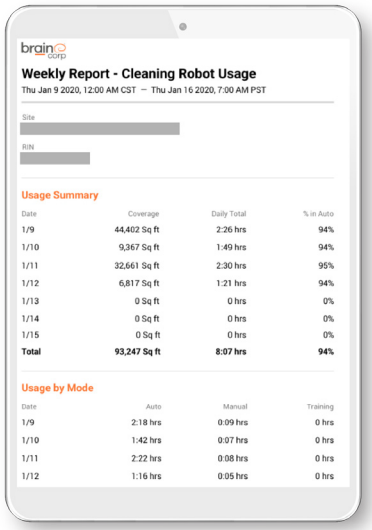
## Teach & Repeat Methodology

The simplicity of the teach-and-repeat approach has made it the predominant method for dynamic public spaces such as those in hospital and clinic environments. Teach-and-repeat allows your employees to handle initial route mapping and make ongoing adjustments and changes to autonomous cleaning routes.

## Proof of Coverage/Operational Metrics

Any established AMR software platform should be able to deliver robust performance data and real-time reporting capabilities. This should include data on machine utilization, cleaning performance and efficiency metrics. Leading software platforms even give your facility heat maps that show exactly where cleaning has and hasn't been done. Reporting should easily scale up by facility, region, state, etc., to give larger healthcare organizations comprehensive visability.



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# The People

Even the best robotic cleaning machines still require people to map routes, train operators and troubleshoot route issues, not to mention strategically re-allocate newly available labor resources. But you shouldn't have to do it alone. Here's what to look for in a partner:

### Dedicated Customer Success Team

Supporting large healthcare deployment at scale requires significant support resources. Best-in-class vendor partners have the breadth of support to provide you with a dedicated customer success team. This dedicated team can focus on the unique goals and challenges of your deployment. Critically, look for a support approach that continues well beyond deployment, helping you continually optimize your robotic cleaning program.

### Consultative Approach

Excellent service is not reactive — it's proactive and predictive, driven by experience and expertise. Look for a vendor partner that aims to anticipate your needs and help you customize your deployment to align with your unique operational conditions and specific organizational goals.

### Proven Process

Leading vendor partners have developed efficient and effective processes around deployment and program optimization. This includes tips and best practices to help set your program up for success and more rapidly realize value and ROI. A vendor should also have clear processes around ongoing optimization, to help you extract more value from your robotic cleaning program.

### Proven Reputation for Service

Above all, don't trust promises — look for proof. Seek out a vendor partner that has built its reputation and customer relationships on service. Some of the most trusted vendors strive to maintain in-house control of nearly all elements of service to ensure the highest level of quality.

# Vendor Evaluation Checklist

Here's a simple checklist that distills many of the points we covered on the previous pages:

## THE MACHINE

- ☐ Manufacturer with experience at scale
- ☐ Proven commercial floor cleaning hardware
- ☐ Machine can be operated manually when necessary
- ☐ Automated machine diagnostics

## THE SOFTWARE

- ☐ Integrated AMR software platform
- ☐ Proven real-world safety
- ☐ Intuitive UI/UX
- ☐ Teach-and-repeat route mapping
- ☐ Robust performance data and reporting
- ☐ Seamless software updates

## THE PEOPLE

- ☐ A dedicated customer success team
- ☐ Ongoing optimization support
- ☐ Proven service reputation

## THE PROCESS

- ☐ Change management guidance
- ☐ Best practices for strategic staff re-deployment
- ☐ Ongoing program optimization

# Own, Lease or Rent: What option is right for me?

Yet another consideration when building a robotic floor cleaning program is whether you will purchase, rent or lease the machines. There is no right answer, as the best option depends on the specifics of your program. Here's a quick look at the benefits of each path:

## BENEFITS OF OWNERSHIP

If you plan to use a machine at or near its full capacity — even when your workload fluctuates — then buying will generally be the best option.

- **Amortization:** You own the asset in the end and can amortize over years.
- **Predictable cost:** You know upfront the fixed price of the equipment and you won't pay additional financing or rental fees.
- **Flexibility and convenience**: You can use the equipment when and how it works best for your facility.

## BENEFITS OF LEASING

With leased assets, you can avoid making large down payments and conserve capital.

- **Lower upfront costs:** Makes it possible to avoid a large down payment or having to purchase equipment outright.
- **Lower, fixed payments:** Payments are generally lower, fixed and amortized.
- **Option to buy:** Leases typically offer the opportunity to purchase at end of lease term.

## BENEFITS OF RENTING

Renting offers the most flexibility, allowing you to pay for the equipment you need for a limited period. This option benefits those that don't have the resources to maintain equipment.

- **Lowest upfront costs:** Maximizes liquidity and allows you to use operating funds.
- **Faster deployment:** Accelerate speed to market with immediate access to equipment.
- **Flexibility without risk:** Scale equipment need to the labor pool, ensuring maximum productivity.

# Keeping Pace with Innovation: A Must in Healthcare

New technologies are introduced every year that completely redefine the standard of care, including robotic treatment technologies that have transformed many common clinical procedures.

But as healthcare organizations feel added pressure from every angle — evolving reimbursement policy, heightened demands of patients-as-consumers, increasing market competition, and now the complex impacts of a global pandemic — savvy organizations are now looking to leverage robotics to drive value in non-clinical applications. Robotic floor cleaning is emerging as a promising non-clinical application, directly addressing the growing importance of facility cleaning in healthcare with a simple use case and clear path to ROI.

Forward-thinking hospitals and clinics need to stay ahead of the technology curve to maintain their competitive advantage. More and more are beginning to identify opportunities where robotic floor scrubbers could address their organizational goals, and are starting the process of evaluating robotic cleaning manufacturers. Even if a full-scale robotic cleaning program is not yet right for your hospital or clinic, launching a small pilot program can put your organization in a better position to easily and rapidly scale up and expand in the future.


**The bottom line is that robotics will change healthcare facility cleaning for good.**

**Will you be ready?**

**> TAKE THE ROBOTICS SELF-ASSESSMENT TODAY**

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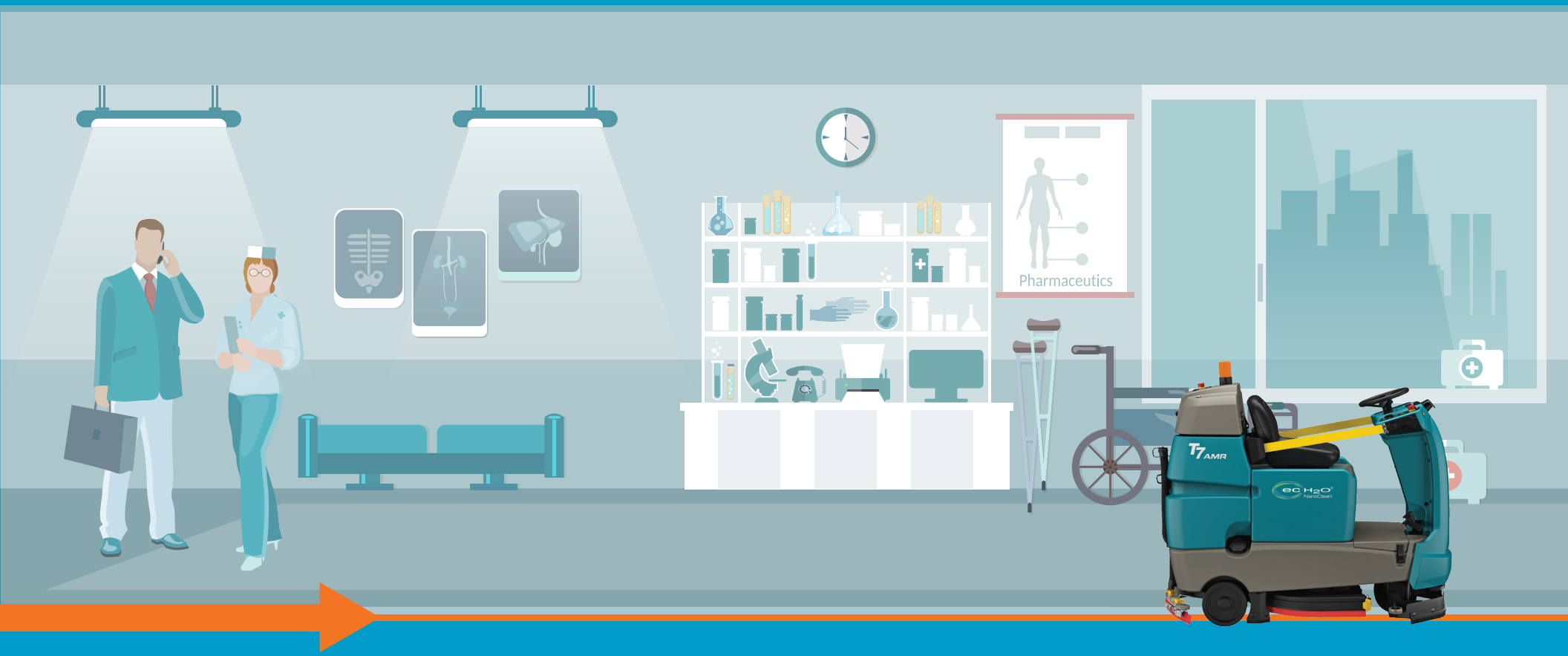
## About Tennant Company

Tennant Company  is a world leader in designing, manufacturing and marketing solutions that empower customers to achieve quality cleaning performance, reduce their environmental impact and help create a cleaner, safer, healthier world. Our products, including industry-leading robotic floor scrubbers, help our customers clean more spaces more effectively, addressing indoor and outdoor cleaning challenges. Tennant's manufacturing operations throughout the world and sells products directly in 15 countries and through distributors in more than 100 countries, backed by the industry's most extensive global field service network. For more information, visit www.tennantco.com and www.ipcworldwide.com.

## About Brain Corp

Brain Corp is a San Diego-based AI company creating transformative core technology for the robotics industry, including BrainOS, a cloud-connected operating system for commercial autonomous robots. Robots powered by BrainOS navigate autonomously, avoid obstacles, adapt to dynamic and complex environments, manage data, generate reports, and seamlessly interact with human users. Working with its manufacturing partners, Brain Corp has deployed or enabled 10,000 robots worldwide, accounting for a total of more than 1.5 million autonomous hours. Named the world's top autonomy solution provider by ABI Research, Brain Corp is funded by the SoftBank Vision Fund and Qualcomm Ventures. For more information, please visit www.braincorp.com.

# Interested in learning more about the path to autonomous floor cleaning?




Learn more about how Tennant autonomous cleaning technology is already transforming healthcare facility cleaning.
tennantco.com/robotics • braincorp.com/robotic-floor-care