Warehouse Insights

Hospital Logistics: Smart Bed Storage & Transport Solutions

kardex

Executive summary

Innovative Bed Storage and Transport Solution for Healthcare

Hospitals face significant logistical challenges in managing the storage and transportation of beds – an essential but space-consuming piece of medical equipment. Traditionally, beds and other mobile equipment are stored in basements or corridors, reducing available space and causing delays.

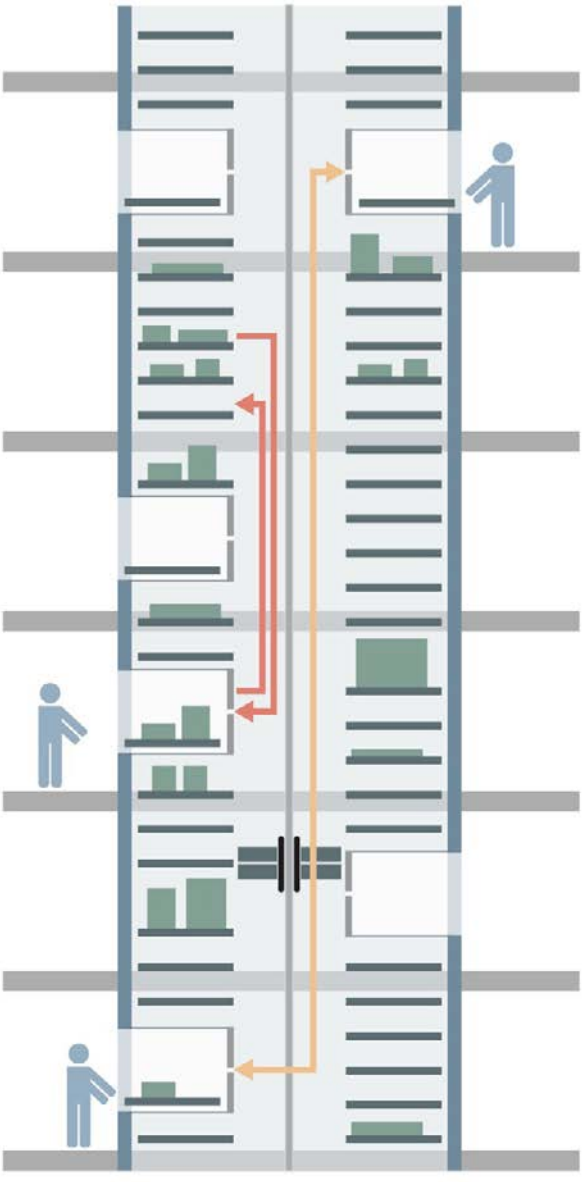
Porters spend valuable time transporting used beds to and from cleaning areas, often using overburdened lifts.

These inefficiencies not only impact hospital operations, but also limit space optimization and staff productivity.

Kardex has developed an innovative intralogistics solution tailored for hospitals using Vertical Lift Modules (VLMs) – a proven technology in warehouse automation (Vertical Lift Modules | Kardex Shuttle 250/500/700/1000) (See graphic below). This advanced solution streamlines both the storage and transport of hospital beds, addressing critical inefficiencies in space utilization. By integrating VLMs into vertical shafts, similar to elevators, Kardex optimizes hospital logistics by automatically storing and retrieving beds on demand. This eliminates the need for porters to manually move beds, significantly reducing labor and delays.

This combined storage and transport solution is unique and forward-thinking, offering a fresh approach to managing hospital logistics. It reduces staff burdens, allows quicker access to clean beds, and frees up valuable space.

Moreover, it eliminates time spent waiting for elevators – a challenge that often takes up to an hour.



Vertical Lift Module with several access openings.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Key benefits

The benefits are substantial. Hospital staff can focus on patient care instead of bed logistics.

Optimized space utilization
Beds are stored compactly, freeing up valuable hospital space for patient care and essential services.

Improved workflow
Automated on-demand delivery ensures quick access to clean beds, reducing wait times and eliminating dependence on overloaded elevators.

Reduced labor costs
Hospital staff can focus on critical tasks instead of moving beds, while Automated Guided Vehicles (AGVs) can further automate movement.

Improved infection control
The system ensures proper cleaning and storage, minimizing the risk of healthcare-associated infections (HAIs) – a major problem that affects approximately 60,000 patients annually in Denmark alone.[1]

Lower maintenance costs
Gentle handling of beds extends their life and reduces wear and tear.

Optimized elevator use
Elevators are freed up for patients, staff and visitors, improving overall hospital efficiency.

By solving long-standing hospital logistics challenges, Kardex's automated bed storage and transport system transforms hospital operations, improving efficiency, space management and patient care while enhancing safety and infection control.

[1] https://www.uk.rigsrevisionen.dk/Media/1/9/5-2017.pdf

Background

It is estimated that approximately 7–10% of hospitalized patients develop health-care-associated infections (HAIs), such as pneumonia, urinary tract infections, or surgical site infections.[2]

There are several reasons why patients may develop infections while in the hospital:

- **Weakened immune system:**
  Many hospitalized patients may have a weakened immune system due to illness or medications (e.g., chemotherapy, corticosteroids).

- **Invasive procedures:**
  Certain procedures such as catheter placement, surgery, or ventilator use increase the risk of infection.

- **Prolonged hospitalization:**
  The longer a patient is hospitalized, the greater the risk of developing an infection.

- **Pathogen transfer:**
  Hospitals can be places with a high concentrations of resistant bacteria, which can lead to infections that are difficult to treat.

- **Hygiene:**
  Poor hygiene conditions or practices can contribute to the spread of infection.

Beds are a critical focus for maintaining hospital hygiene. Research published in the Journal of Hospital Infection shows that cleaning beds and linens is one of the most effective ways to prevent the transmission of infections. Inadequate cleaning can lead to significant patient infections.[3]

As a result, more and more hospitals have implemented centralized, often automated, bed cleaning, to ensure completely clean beds for new patients. This means that after use, a bed must be transported from the department to the bed washing facility, cleaned, stored, and then transported back to the department when a new bed is needed. Currently, this is often done manually by porters using elevators.

[2] Report on preventin of hospital-acquired infections

[3] Journal of Hospital Infection | ScienceDirect.com by Elsevier

Porters spend a lot of time moving beds. This reduces elevator availability, and unclean and clean beds take up valuable space.[4]

Many hospitals face the challenge of waiting for elevators. If these elevators also have to be used to transport beds to and from the central bed cleaning area, this adds to the waiting time.

At Rigshospitalet in Denmark, waiting 20 minutes for an elevator is "normal" for patients and visitors.[5] Therefore, the staff (8,500) is asked to take the stairs up to the 5th floor! In the same hospital, management confirms that a porter spends on average 1 hour per day waiting in front of elevators.[6]

With 420 porters working 200 days/year at this hospital, 8,400 hours used only for waiting. That is 4 full-time employees (FTE) doing nothing but waiting!

Reducing this waiting time by handling empty beds with the Kardex VLM instead of a normal elevator, means more time for the porter to do patient-related work.

[4] Bed washer | Read more about the hospital bed washing machine

[5] Læge om elevator-kaos på Riget: Gak i låget | TV 2 Kosmopol

[6] Lønkroner ædes op af elevatorer – Jyllands-Posten

When renovating a hospital or building a new one, available space is always a key element in the design.

The average price per m² for building a new hospital in Europe can be estimated at around 6,000 EUR. (2020 prices)[7], so it's obvious that optimizations that can ensure a better use of the available space are highly appreciated.

It's not uncommon for a medium-sized hospital to have a buffer of 50 beds, and if each bed using 2 m² of space in the corridors of basements, 100 m² could easily be released.

This means an estimated saving of 600,000 EUR or, even better, additional 100 m² that can be used for patient-related issues.

[7] €6,500 cost per square metre of new hospital '10pc higher than average project' | Irish Independent

The technical solution

The **Kardex Vertical Lift Module (VLM)** is an automated storage and retrieval system designed to maximize storage efficiency and improve productivity in warehouses, distribution centers, and manufacturing environments. As part of the Kardex Remstar product line, it uses the available vertical floor to ceiling height. With this vertical storage it frees up floor space while ensuring fast and easy access to stored items.

Here's a detailed description of the solution:

1. Key features

- **Vertical space utilization:**
  The VLM utilizes the height of the storage area by stacking storage trays vertically, offering storage solutions in spaces where floor space is limited.

- **Goods-to-person technology:**
  Instead of workers moving to retrieve items, the VLM automatically delivers the requested tray containing the required items to an ergonomic access point, reducing labor time and increasing efficiency.

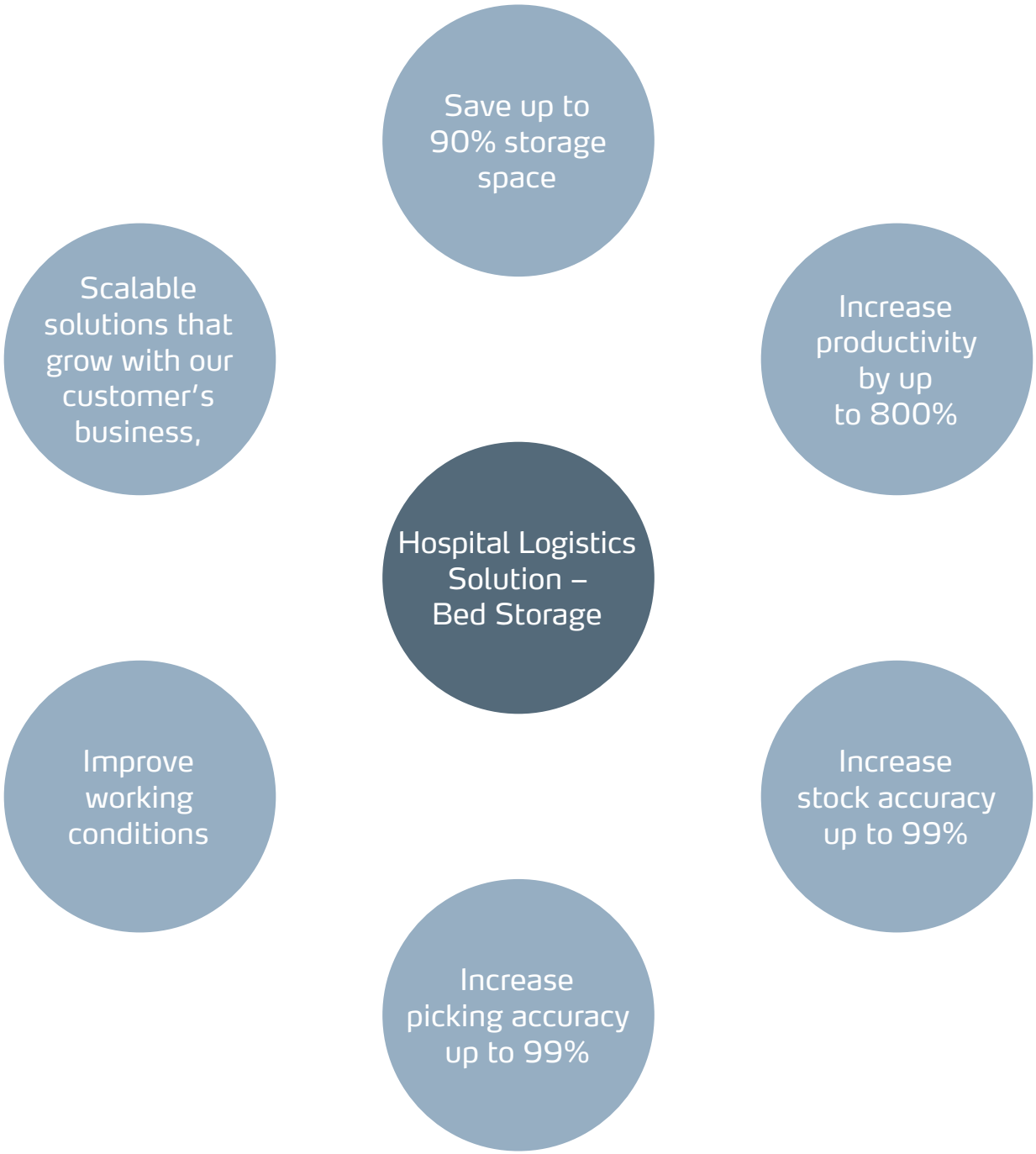
- **Dynamic storage system:**
  The system automatically adjusts storage trays within the unit based on the height of the stored items, optimizing storage density and ensuring no space is wasted.

- **Modular design:**
  The system can be customized and expanded to meet specific business needs, with options for different unit heights, widths, and tray sizes.

- **Integrated software solutions:**
  Kardex VLMs can be integrated with warehouse management software (WMS) for seamless inventory control, real-time stock tracking, and order processing.

- **Ergonomics and safety:**
  The design minimizes the physical strain on operators by delivering trays at an ideal working height. Safety features, such as light curtains and safety doors, protect operators during operation.

- **Energy efficiency:**
  Advanced energy recovery and low power consumption make it a sustainable solution for modern businesses.



The customer value is similar or identical to the E-Commerce business.

2. Hospital specific customization

Based on the standard VLM product, we have spent a lot of time and resources to develop a unique product for hospitals with several specific features for storing hospital beds and medical equipment. The main technical adaptations of the Kardex VLM are:

- **Access opening on floor level** to load and unload beds
- Multiple access openings (up to 12) to **make the beds available on all floors.**
- Modular, specially equipped trays (load handling unit) with adjustable and lockable railings for **safe transport of different types of beds** (children's/ adult bed) **and other equipment such as wheelchairs, infusion stands, etc.**
- Extended unit height from existing 30m to 60 m to **meet the requirements of new hospital buildings**
- **Charging functionality** on trays
- Speed roller door in front of the access opening for the **safe system operation**
- Hospital design of the access opening to integrate the VLM into the building structure with requirements for a **clean atmosphere** and the possibility of better cleaning with fewer edges
- Simplified HMI (Human Machine Interface) for a **better usability by hospital staff**
- Optional: Equipping the VLM for the operation in **clean room or hygienic environment**
  - Perforated machine panels on dedicated positions to connect to a air conditioning system and to realize a homogenous airflow inside the VLM to create a clean room atmosphere.
  - Special oil in the gears of the drive motors
  - Special greasing of the chains
  - Special clean room paint
  - Special cladding in the access opening for better cleaning
- AGV/AMR (Automated Guided Vehicle/Automated Mobile Robot) interface to VLM for **automatic bed transport and automatic loading and unloading of beds** onto the VLM tray.
- **Robotic solution for supply and CSSD** (Central Sterile Services Department) units

Realized Projects

The Children's Hospital in Finland was the first hospital to test the hospital-grade bed storage and transport system.

Since then, other hospitals in the Nordic countries have decided to do the same and it is expected that hospital projects in the DACH region will now also include these systems, followed by the rest of Europe.

The feedback we have already received is very positive and the saving in space and time for porters is significant.

Children's Hospital | Finland
- 2 Shuttles for supplies to different floors
- 2 Shuttles for beds and other large equipment
- Each unit 5–6 access openings
- Unit heights up to 38,5 m
- Power Pick Global Software

Movie from Children´s Hospital

Also, Torshavn Hospital, Faroe Islands, have decided to implement the system:

Torshavn Hospital | Faroe Islands
- Modern Architecture requires modern Logistics Solutions
- 2 bed units + 1 supply unit. 20,5 m

«We have 4 Kardex units, two – we call them the big ones – where we have medical equipment, aid-equipment, and beds. They have a larger access opening to the floor. They go to all floors. We have a total of 9 floors and the height of the automat is 38 meters.

One of the many advantages of this Kardex system is that we wanted to cut down storage space and take all available space to clinical tasks. We also wanted nurses have more time to patient care, so they don't have to go around and look for things and equipment.

It's all stored in the system, and easy to find for the nurses.»

Tiina Sköönilä, Deputy Nurse Manager
New Childrens Hospital, Helsinki

The future

It always hard to predict the future, but we know for sure that the pressure on the Healthcare sector and hospitals will be increasing.

Aging Population
WHO reports that by 2050, the number of people aged 60 years and older will surpass 2 billion, putting significant pressure on healthcare systems.

By 2030, 1 in 6 people in the world will be aged 60 years or over. At this time the share of the population aged 60 years and over will increase from 1 billion in 2020 to 1.4 billion. By 2050, the world's population of people aged 60 years and older will double (2.1 billion). The number of people aged 80 years or older is expected to triple between 2020 and 2050 to reach 426 million.[8]

Healthcare Workforce Shortages
Also by WHO it´s highlighted that the global shortage of healthcare workers is a major concern, with an estimated shortage of 18 million health workers by 2030.[9]

Rise in Chronic Diseases and Non-Communicable Diseases (NCDs)
Chronic conditions are expected to increase worldwide, which will contribute to more hospitalizations. For example, conditions like diabetes, hypertension, and cardiovascular diseases, which require ongoing management and occasional hospital intervention, are on the rise. These diseases often lead to complications that necessitate hospitalization, such as strokes, heart attacks, or diabetic crises.[10]

Rising Healthcare Costs
A report from the NIH details how healthcare costs are expected to continue rising in the coming years due to factors such as an aging population and advances in medical technology.[11]

With this in mind, automated solutions in hospitals are expected to play a critical role in improving efficiency, safety, and overall quality of care in the future. As healthcare systems face increasing pressure due to mentioned rising patient numbers, cost constraints, and workforce shortages, automation offers significant potential to address these challenges.

[8] Ageing and health

[9] Addressing the 18 million health worker shortfall – 35 concrete actions and 6 key messages

[10] Noncommunicable diseases

[11] News and notes – pmc

Conclusion

In summary, the innovative Vertical Lift Module (VLM) from Kardex offers hospitals a highly efficient and practical solution to some of the most pressing challenges in bed storage and transport. The system addresses several key areas that directly impact hospital operations, ultimately improving efficiency, space utilization, and patient care.

1. Porters save time
One of the most significant benefits of the Kardex VLM system is the significant time saveings for hospital porters. Traditionally, porters must manually transport used beds to cleaning areas and then return them to patient rooms, often using elevators that are already crowded with patients, staff, and visitors. This process is time-consuming and disruptive to the overall hospital workflow. By automating bed transport with the VLM, porters no longer waste valuable time waiting for elevators or making multiple trips. Instead, they can focus on more critical patient-related tasks, improving both efficiency and staff satisfaction.

2. Always a bed available when needed
Hospitals often face the challenge of ensuring that clean, available beds are always available for patients. With the VLM system, beds are efficiently stored and automatically delivered to the departments when needed. This eliminates delays in obtaining clean beds and ensures that staff can quickly access the equipment required for patient care. This reliable, on-demand delivery system minimizes downtime, reduces waiting times, and supports better patient flow throughout the hospital.

3. Capacity in elevators
Elevators in hospitals are oftencrowded because they are used to transport both patients and beds. This causes delays, especially in busy hospitals where elevators are used frequently. The Kardex VLM system addresses this problem by handling the transport of empty and clean beds, freeing up elevators for their primary function – transporting patients, staff, and visitors. By reducing the number of beds being manually moved through elevators, the system optimizes elevator capacity, reduces waiting times and improves overall hospital operations.

4. Saving space
Space is a critical issue in hospitals, especially as patient demands increase, and available space becomes more limited. Traditionally, beds are stored in corridors, basements, or other areas that are not optimal for patient care. The Kardex VLM utilizes vertical space, allowing beds to be stored in compact, efficient units that free up valuable floor space. This space optimization can be particularly beneficial when renovating or designing new hospitals, as it allows storage areas to be converted into spaces that can be used for patient care or other essential services. In some cases, as much as 100 m² of space can be freed up, representing a significant cost-saving opportunity in hospital construction or renovation projects.

5. Supporting hygiene issues
Maintaining high standards of hygiene in hospitals is essential to prevent healthcare-associated infections (HAIs), which can have serious consequences for patient health and safety. The Kardex VLM system plays a critical role in supporting infection control by ensuring that beds are properly stored and transported in a clean and organized manner. By automating the process, including centralized bed washing systems, the VLM system reduces the risk of cross-contamination between clean and used beds, helping to maintain a higher level of hygiene. This is especially important in light of research indicating that improper cleaning and handling of hospital beds can contribute to the spread of infection. By improving the hygiene process, the VLM system helps hospitals reduce the incidence of HAIs and improve overall patient outcomes.

In summary, the Kardex VLM system represents a transformative innovative advancement in hospital logistics that combines efficiency, space optimization, and infection control to improve hospital operations. By automating the storage and transport of beds, the system saves valuable staff time, ensures beds are always available when needed, and frees up space for other critical uses. In addition, the VLM system supports hygiene practices, reducing the risk of healthcare-associated infections and contributing to improved patient safety. With these benefits, the Kardex VLM solution will have a significant positive impact on hospital efficiency and patient care, paving the way for smarter, more effective hospital management.