

# Medical Device Marking with RFID & Barcode

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# IOM Report in 1999

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## To Err is Human: Building A Safer Health System

- ✓ One million patients in hospitals daily
  - ❖ 770,000 injuries caused by medication errors per year
    - 39% physician ordering
    - 38% drug administration
    - 11% drug dispensing
  - ❖ 44,000 – 98,000 preventable deaths per year
  - ❖ 5% of patients acquire an infection from a hospital

**Barcoding “is an effective remedy” for medication errors, “a simple way to ensure that ... all of the steps in the dispensing and administration processes are checked for timeliness and accuracy.”**

# Barcode For Healthcare

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- ❖ 1983 – The Health Industry Business Communication Council (HIBCC)
- ❖ 1985 – First published account of medication bar-coding
- ❖ 1985 – Medication dispensing
  - ✓ 1985 – Hokanson JA, et al, Am J Hosp Pharm
  - ✓ 1985 – Nold EG & Williams TC, Am J Hosp Pharm
  - ✓ 1987 – Smith JE & Meyer GE, Am J Health Syst Pharm.
- ❖ 1989 – Medication administration
  - ✓ 1989 – Barry GA et al, Am J Hosp Pharm
  - ✓ 1991 – Lefkowitz S et al, Hosp Pharm
  - ✓ 1992 – Abdoo YM, Comput Nurs
- ❖ 1999 – IOM report: discussed barcode to improve patient safety
- ❖ 1999 – 1.1% of hospitals (60) using barcode
- ❖ 2001 – FDA announces intent to propose a bar code rule
- ❖ 2002 – 1.5% of hospitals (90) using barcode
- ❖ 2004 – JCAHO make a proposal and drops mandate
- ❖ 2005 – 9.4% of hospitals (560) using barcode

# Identification Technology

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## ❖ Linear Barcode

- ✓ Well known technology
- ✓ Lower cost, easy to copy / print
- ✓ Manual process
- ✓ Local data poor / remote data rich



## ❖ RFID

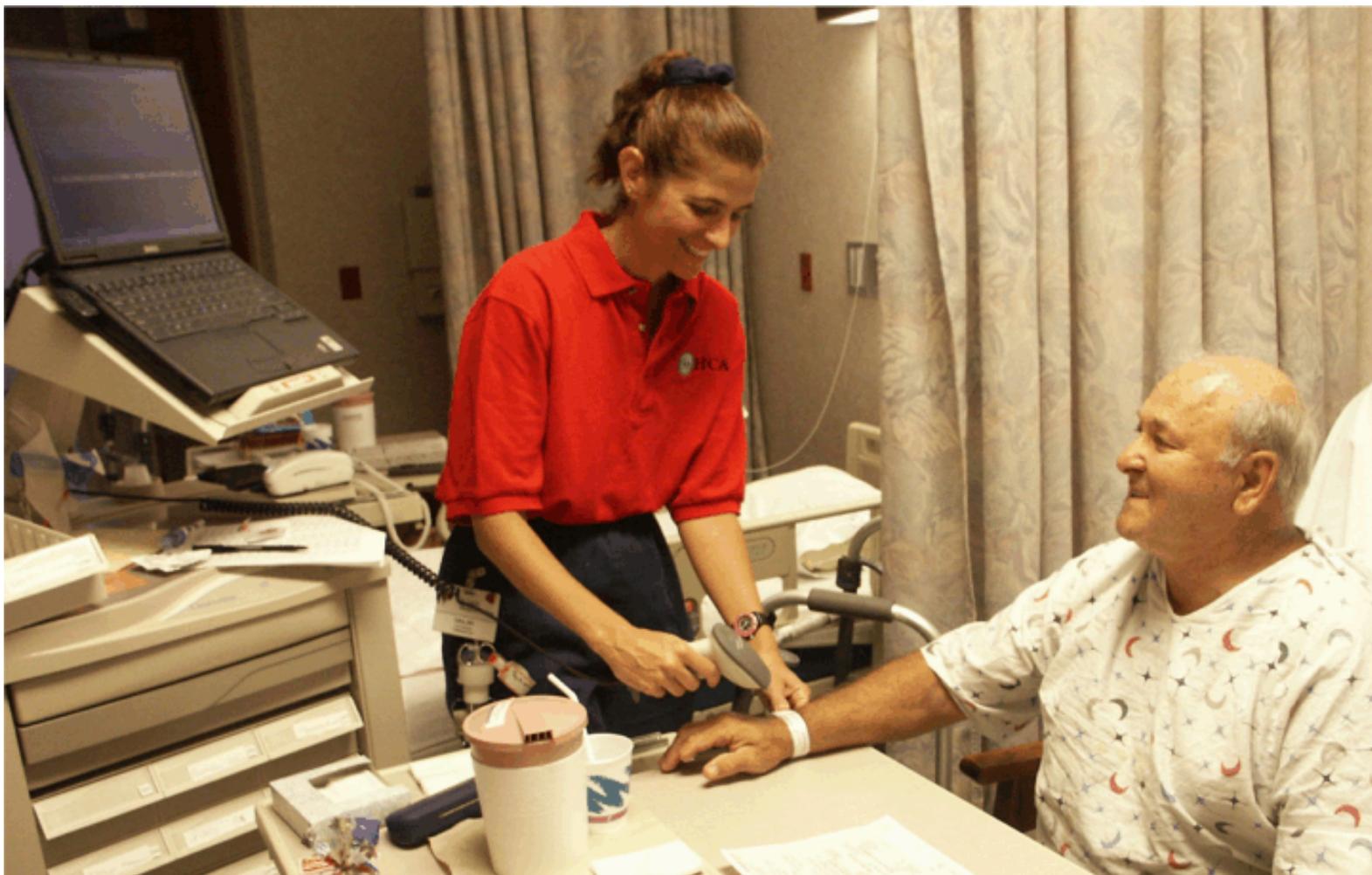
- ✓ Promising new technology
- ✓ High cost, difficult to copy
- ✓ Automation possible
- ✓ Local data poor / remote data rich

## ❖ 2D Barcode

- ✓ Reasonably known technology
- ✓ Low cost, easy to copy / print
- ✓ Item level management
- ✓ Local data rich / remote data rich

# HCA Barcode Point Of Care

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Oct 25, 2006

FDA Meeting on UDI at Gaithersburg

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# Steps Taken For BPOC

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- ❖ Patient safety initiative to reduce medication error  
“Improving Medication Practices” started in Feb 2000.
- ❖ Expect for facilities to implement from 2001 to 2010.
  - ✓ Non-HCA facility cost: \$400K to \$1M per facility
- ❖ Implementation was accelerated
  - ✓ By end of 2005, all 171 facilities implemented BPOC.

# BPOC Experience

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	<i># sites</i>	<i># doses</i>	<i># users</i>
HCA	171	115,933,163	65,000
Mercy	010	7,359,897	10,698
UPMC	002	2,103,789	01,800
BSA	001	1,692,561	00,757

# Lessons From BPOC

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- Fewer medication administration errors
- More complete documentation
- Patient & staff perception of improved safety

⇒ Linear barcode does reduce errors, but

- ✓ Everybody must be engaged
- ✓ Work around is possible

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# Asset Management

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## ✓ Managing infants

## ✓ Managing medical device, consumables

- Theft prevention, location, storage, readiness
- Bio-Medical service, repair, PM
- Rental equipment management

## ✓ Managing Patients

## ✓ Managing nurses, technologists and physicians



# Why Device Management?

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- ❖ National average utilization of mobile equipment is 45% - *Universal Hospital Services*
- ❖ Hospitals can lose nearly \$1 million a year in medical equipment thefts alone - *HCPPro Healthcare Marketplace*
- ❖ Five to fifteen percent of hospital inventory is written off each year since it can no longer be located or more importantly serviced - *Frost & Sullivan*
- ❖ “Equipment moving from patient to patient without going through decontamination in between has become a significant issue to JCAHO in regard to infection control in hospitals” - *JCAHO Sentinel Alert*
- ❖ To build an infrastructure for future patient safety improvements

# Steps Taken

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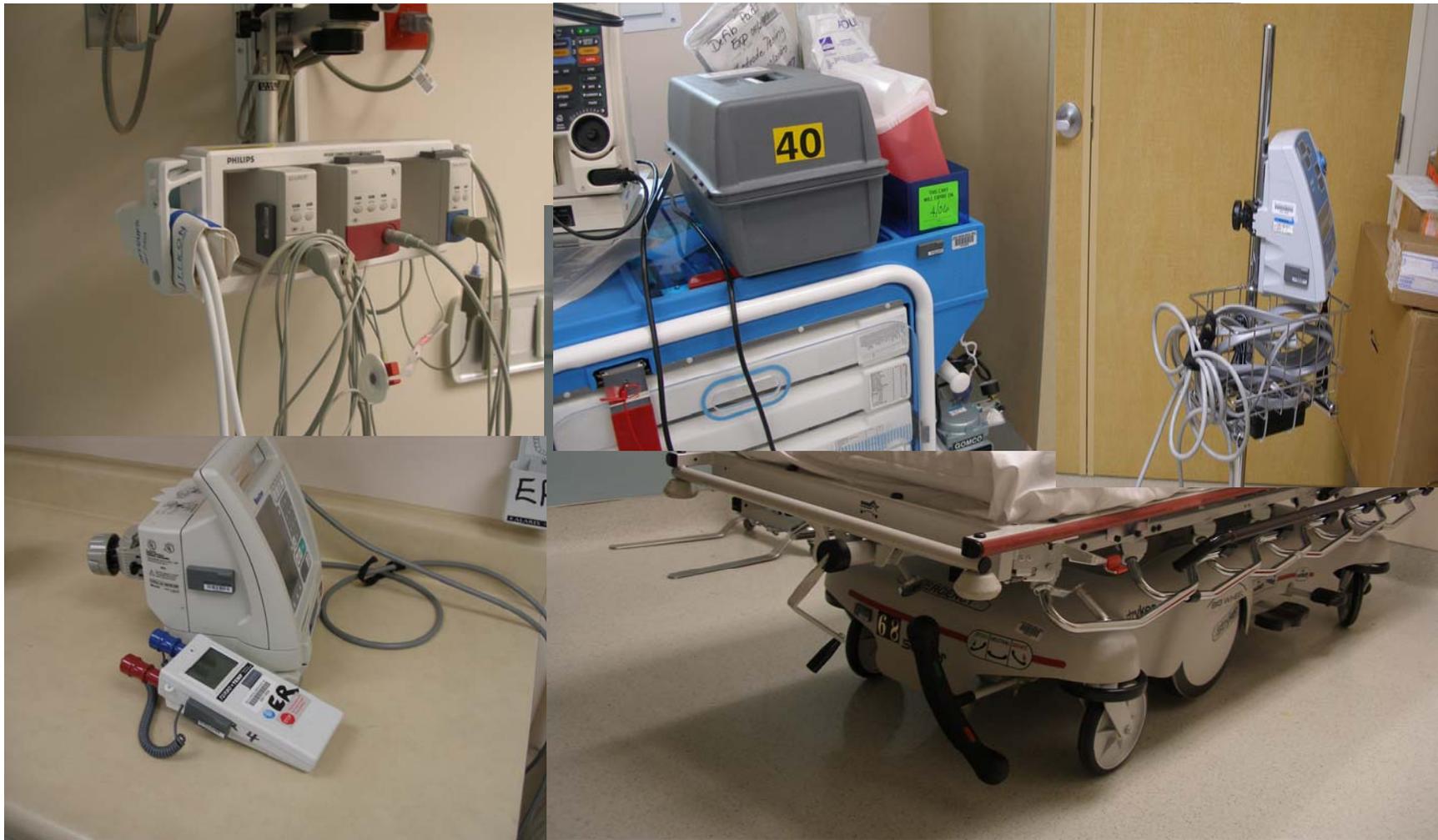
- ❖ Reviewing available technologies starting 2000
  - ✓ Linear Barcode
  - ✓ Passive RFID
  - ✓ Active RFID
  
- ❖ Selected active RFID technology in 2003
  - ✓ Reliability
  - ✓ Automation
  
- ❖ Selected a vendor out of nine vendors in 2004
  - ✓ Battery life
  - ✓ Size of tag
  - ✓ Resolution
  - ✓ Experience
  
- ❖ Implemented a pilot system in 2005
  - ✓ A 120 bed hospital
  - ✓ Hospital-wide implementation

# Pilot Configuration

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- ✓ Device tracking, PM, rental management
- ✓ 433 Mhz active tag
- ✓ Small tags to maximize number of items to track
- ✓ Real-time tracking (broadcast few times per minute)
- ✓ Variable resolution: bed, room, department,...
- ✓ Manage high density of tags in a room
- ✓ Minimum additional network traffic
- ✓ Clean installation: invisible readers
- ✓ Web applications: support PDA, laptop, ...
- ✓ Experience with several large hospital installations
- ✓ Less than three years for ROI
- ✓ To develop additional applications

# Tagged Items



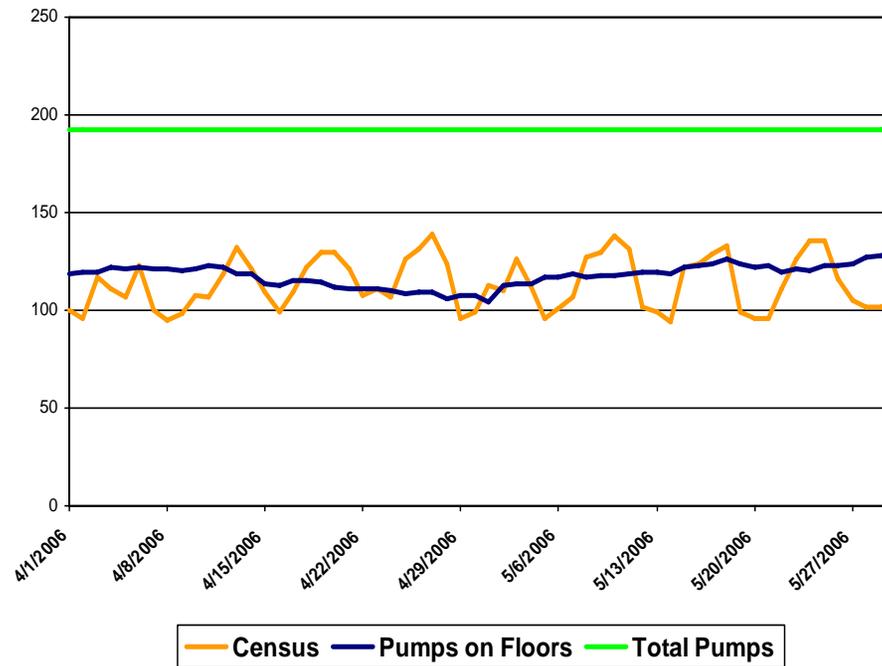
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# Infusion Pump Utilization

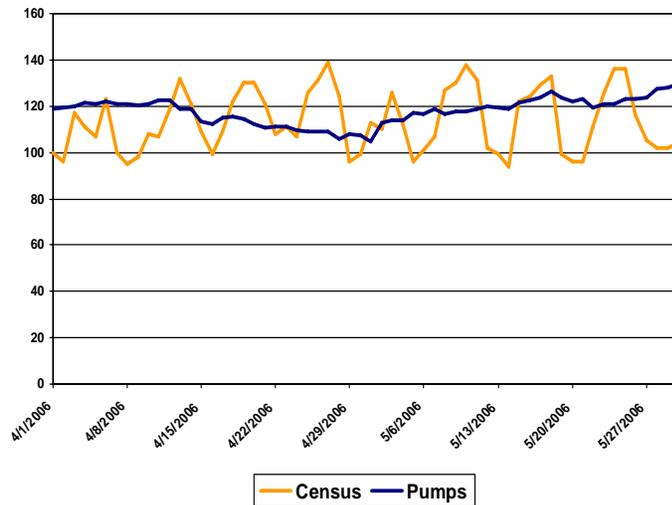
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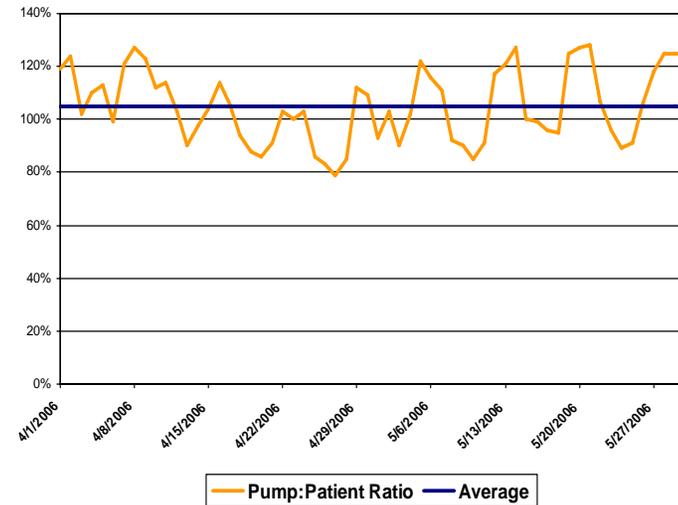
- April 1 through May 30, 2006
- Single and Multi-Channel Infusion Pumps
- Excludes rentals

# All Patient Floors

## Total Pumps vs Daily Census

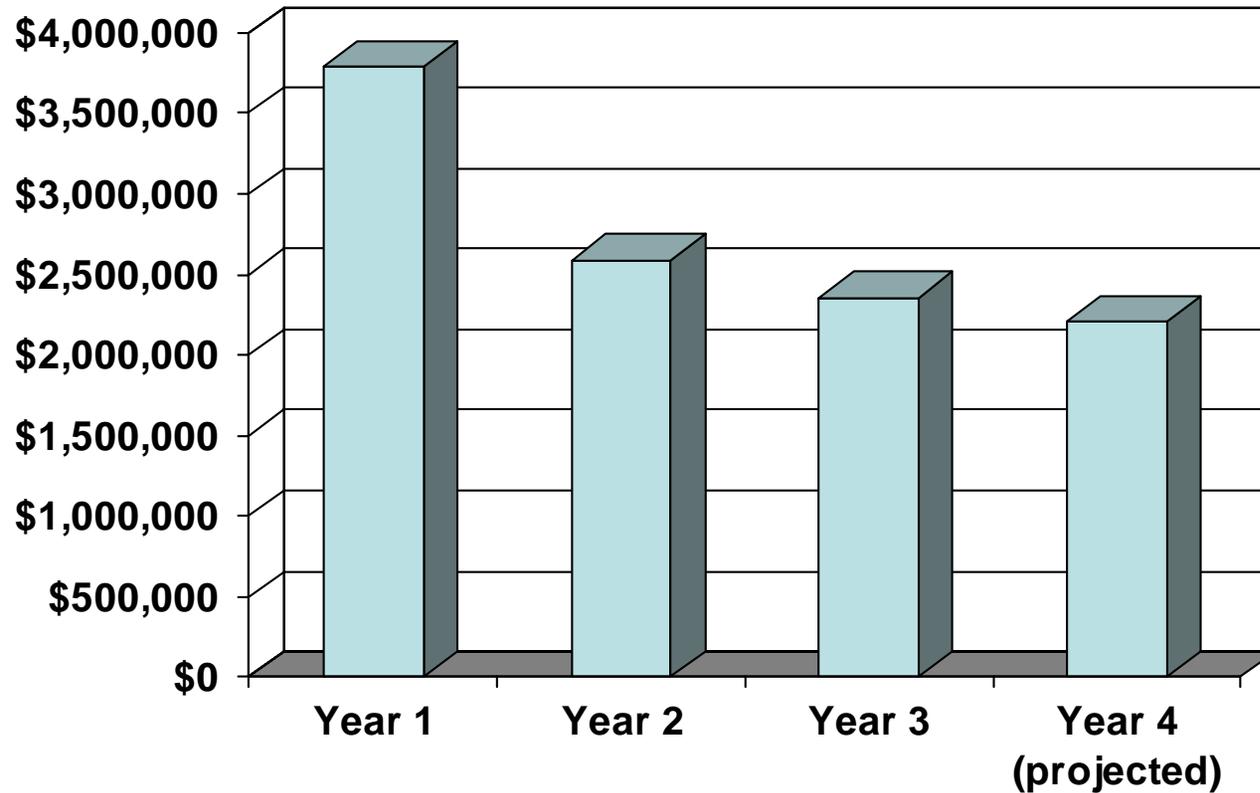


## Daily Pump to Patient Ratio



# Savings By An Early Adopter

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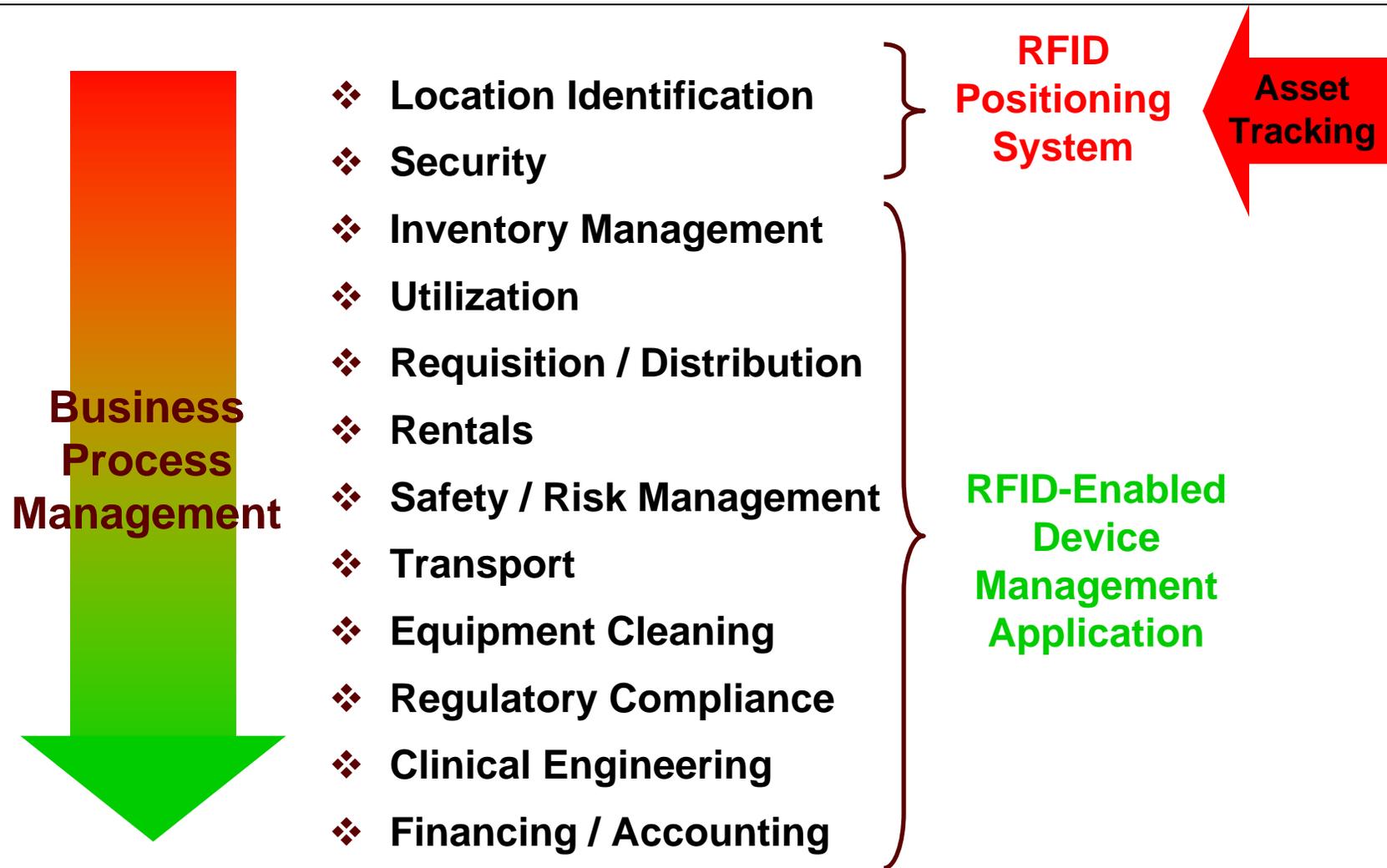
- ❖ **Realized Net Savings to Date: Over \$1.5 Million**
- ❖ **Excludes “cost avoidance” and “soft” savings**

# Current Status

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- ❖ Installation & staff training done
- ❖ Few hiccups & push backs
- ❖ Interfaced to bio-medical service database
- ❖ Interesting information
  - ✓ Some items not moving
  - ✓ Relationship among unexpected items (rental / discharge)
- ❖ Designing new workflows to improve operations
  - ✓ To increase ER throughput
  - ✓ Surgical tool tracking in OR
  - ✓ To improve workflow in ICU
  - ✓ New interface to physician PDA
- ❖ Less than three years for ROI based on hard benefits

# Business Processes



# Lessons

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- ❖ Medical Device / Asset Management using active RFID can be cost effective.
- ❖ Additional developments are needed:
  - ✓ What happens when I lose an active RFID tag?
  - ✓ How do I manage database?
  - ✓ What do I do with surgical tools?
  - ✓ How can I keep the cost down?
  - ✓ Backup information?
  - ✓ Do we have physics problem?
  - ✓ What happens when I lose connectivity?
  - ✓ How can I have information-rich local environment?
    - Reduce errors further
    - Katrina factor

# Database Entries

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<b>Manufacture</b>	<b>Model #</b>	<b>Description</b>
Arjo Hospital equipment Inc.	KGA0200	Lift
Arjo Hospital equipment Inc.	KPA0310	Lift/Patient
Arjo Hospital equipment Inc.	KKA5020	Arjo Lift
Arjo Hospital equipment Inc.	KGA5020	Lift/Patient
Arjo Hospital equipment Inc.	KPA0310	Lift/Patient
Arjo Hospital equipment Inc.	KPA0310	Patient Lift
Arjo Hospital equipment Inc.	KPA0310	Patient Lift
Arjo Hospital equipment Inc.	KKA5020	Lift/Patient
Arjo Hospital equipment Inc.	KPA0310	Lift/Patient
Arjo Hospital equipment Inc.	KGA0310	Arjo Lift

Common name used by nurses:

Arjo Lift

Common name used by industry:

Lift/Patient

The device name:

Patient Lift

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# 2D Barcode?

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- ❖ Minimum change in workflow
- ❖ Reasonable cost for infrastructure
- ❖ Less physics issues
- ❖ Solution for item level issues
- ❖ Data rich local environment
  - ✓ More info available to reduce additional errors
  - ✓ Katrina factor

# RFID & 2D Barcode

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# Information Content

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## ❖ Cost effective unifying standard

- Staff badges
- Patient wristband / patient identification
- Non-IV medication
- IV-medication / smart infusion pumps
- Medical device identification
- Blood products

## ❖ Documents of interests

- Positive identification for patient medication safety from Partners Healthcare Systems
- Working documents from ISBT-RFID Task Force.
- Documents for HIBCC standards

# Comments

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- ❖ Medical device marking for active RFID asset management system appears to work better when supplemented with a locally data rich 2D barcode.
- ❖ Medical device marking with limited information (pointer or unique number) using RFID tag or barcode may not be able to address certain clinical problems effectively.
- ❖ Many clinically critical problems may be best solved when the local environment is data rich.

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# Thank You!