Seeking Perfection in Healthcare: Applying the Toyota Production System to Medicine

"Leading the Revolution"

Association for Manufacturing Excellence

J. Michael Rona

Christina Saint Martin

Virginia Mason Medical Center

“If you are dreaming about it… you can do it.”

Chihiro Nakao, Chairman and CEO
Shingijutsu International

November 4, 2003

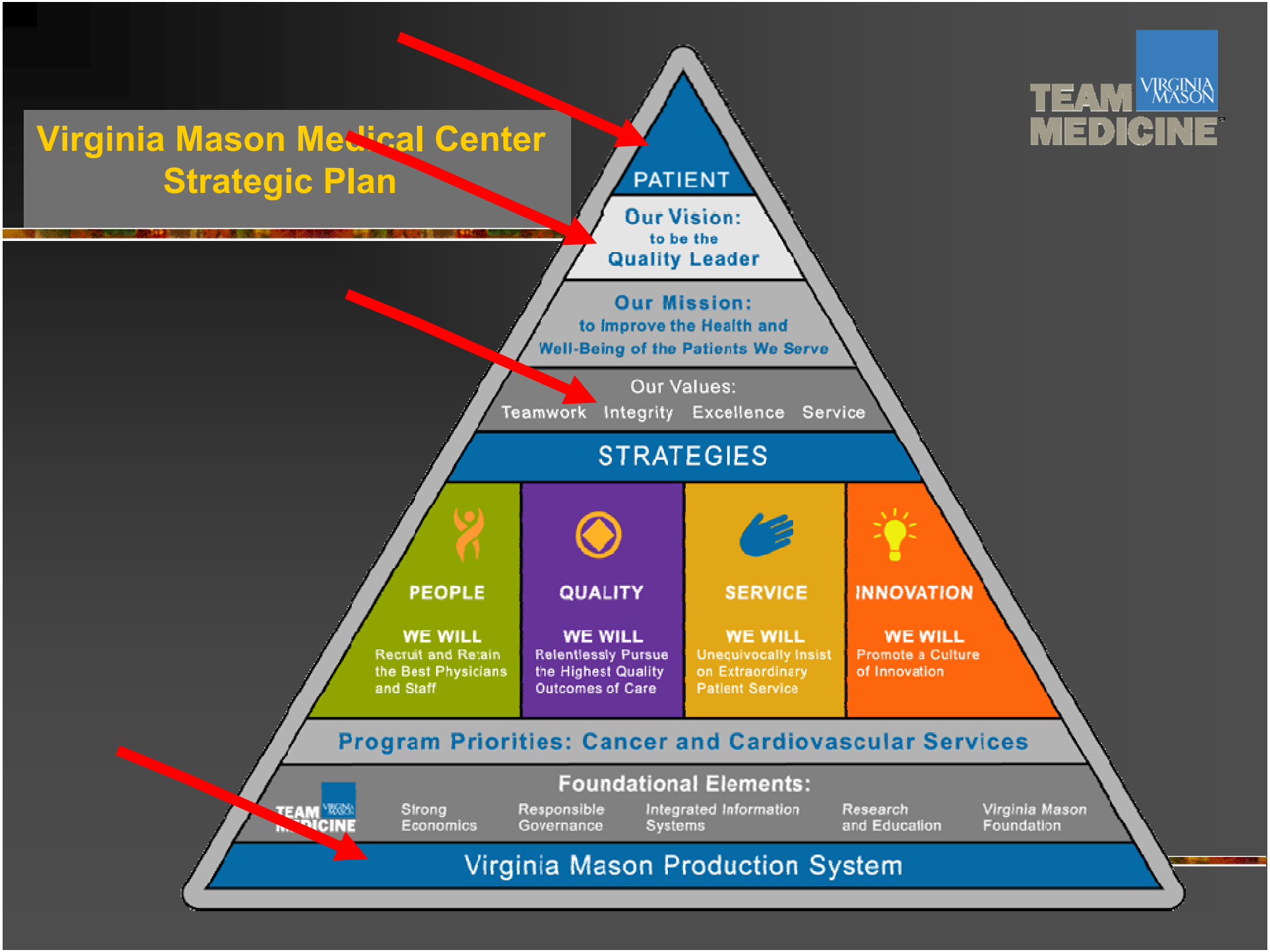
Leading the Revolution

Virginia Mason Medical Center is trying to create a better product. Perhaps when the industry looks back, we will be looked upon as one system that helped "Lead the Revolution"

"Leading the Revolution"

- Customer First
- Zero Defects
- A New Management Paradigm

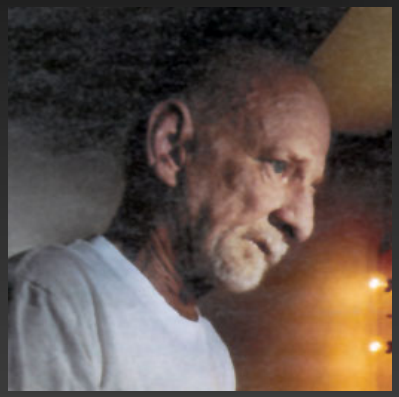
Virginia Mason Medical Center Strategic Plan



An Embarrassingly Poor Product

- The March 16, 2003 edition of The New York Times Magazine front cover reads, “Half of what doctors know is wrong.”
- The lead story is titled “The Biggest Mistake of Their Lives” and chronicles four survivors of medical errors.
- The article goes on to say that in 2003, as many as 98,000 people in the United States will die as a result of medical errors.
- “System of Secrecy Potentially Puts Patients at Risk” Seattle Post Intelligencer, November 25, 2003

The Bitter Bottom Line of Medical Errors



Kidney transplant on the wrong side (U.C.L.A.)

Unnecessary radical jaw surgery

Surgical sponge and gauze left in a breast

Surgical tool left in stomach

The New York Times Magazine, March 16, 2003

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Virginia Mason Medical Center
November 23, 2004

***Investigators*: Medical mistake kills Everett woman**

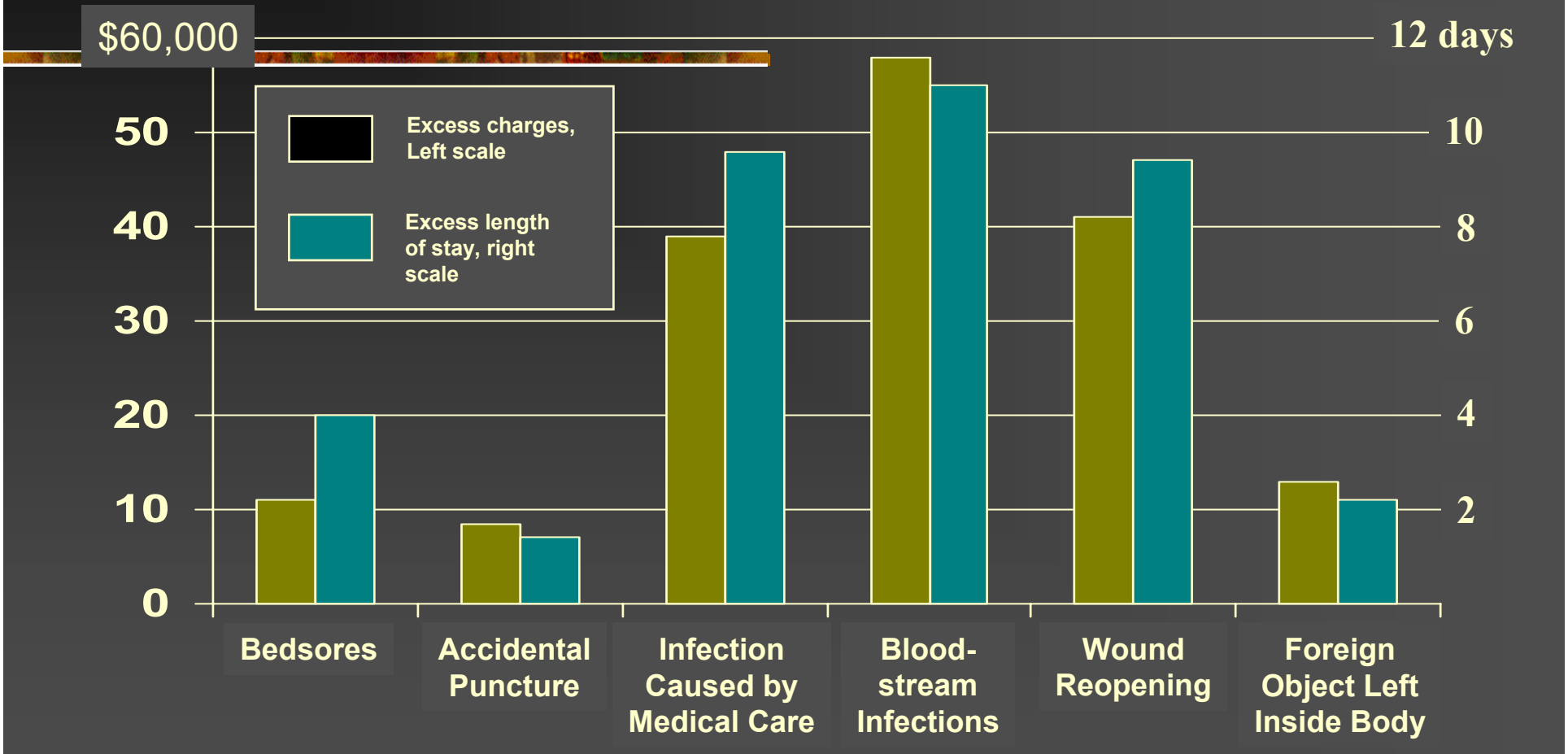
KING5.com
K5 Coverage You Can Count On

Hospital error caused death

The Seattle Times
seattletimes.com

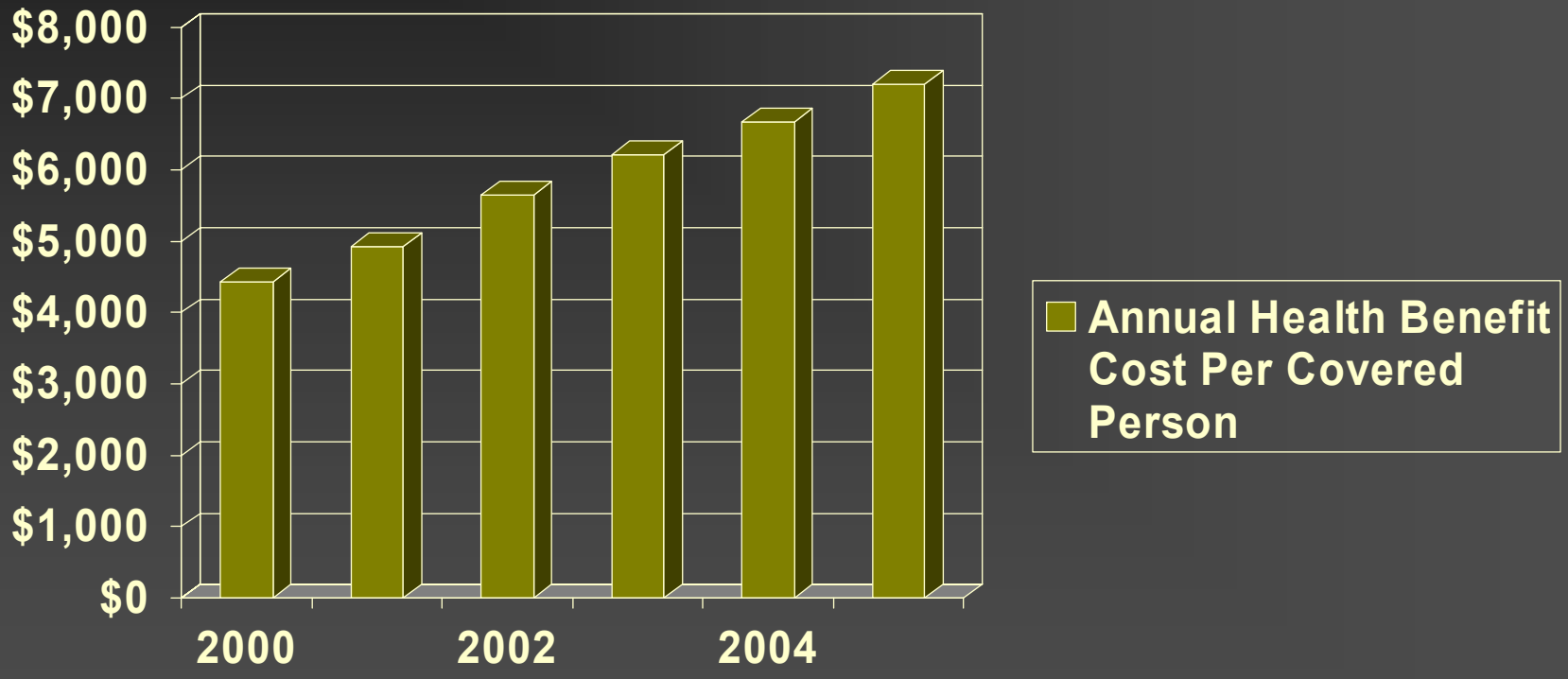
Hospital Complications Exceed $9 Billion

(Study based on data from 994 hospitals in 2000.)



	Bedsores	Accidental Puncture	Infection Caused by Medical Care	Blood-stream Infections	Wound Reopening	Foreign Object Left Inside Body
# Patients affected annually	*41,440*	*11,810*	*11,449*	*2,592*	*843*	*536*
Mortality rate	*7.23%*	*2.16%*	*4.31%*	*21.92%*	*9.63%*	*2.14%*

“Costs Continue to Rise”



Source: Mercer National Survey of Employer-Sponsored Health Plans 2004

Why Zero Defects is the Only Acceptable Standard

- At 99.9% quality levels, here is what happens:
  - 22,000 checks are deducted from the wrong bank accounts every day
  - 16,000 pieces of mail are lost by the Postal Service every hour
  - 2,000 unsafe airplane landings are made every day
  - 500 incorrect surgeries are completed every week

Seeing with our Hands…

Japan 2002

What We Learned

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Air conditioners, cars, looms, airplanes and forklifts...

What do any of these products have to do with health care?

- Health care, too, is full of production processes
- These Japanese products, like our services, involve the concepts of quality, safety, customer satisfaction, staff satisfaction and cost effectiveness
- The completion of a product involves thousands of processes—many of them very complex
- Many products, if they fail, can cause fatality
- They are in many ways, just like us

What We Learned

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- Production processes have much in in common with admitting a patient, having a clinic visit, going to surgery or a procedure and sending out a bill
- To have smooth, high quality continuous flow of our patients is delightful when it happens
- Our vision is that this would happen always for our patients
- We are more convinced than ever that the principles and tools of the Toyota Production System may well become those of the Virginia Mason Production System, the system of management behind the achievement of becoming the Quality Leader

The Plan

The plan for translating what we learned into reality at Virginia Mason has seven areas of focus:

1. "Patient First" as the driver for all that we do
2. *The Virginia Mason Production System* will be our our brand of the Toyota Production System
3. The creation of an environment in which our people feel safe and free to engage in improvement – The adoption of a "No Layoff Policy"

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The Plan

4. Implementation of a company-wide defect alert system called “The Patient Safety Alert System”
5. Encouragement of innovation
6. Creating a prosperous economic organization by primarily eliminating waste
7. Accountable Leadership

VMPS at Virginia Mason

We adopted the Toyota Production System philosophies and practices and applied them to healthcare because this industry and we were so lacking in an effective management approach that resulted in:

- Customer first
- Highest quality
- Obsession with safety
- Highest staff satisfaction
- A successful economic enterprise
- Becoming the Quality Leader

The Impact of Lean

- ½ the human effort
- ½ the space
- ½ the equipment
- ½ the inventory
- ½ the investment
- ½ the engineering hours
- ½ the new product development time

Validated Industry Averages

Direct Labor/Productivity Improved	45-75%
Cost Reduced	25-55%
Throughput/flow Increased	60-90%
Quality (Defects/Scrap) Reduced	50-90%
Inventory Reduced	60-90%
Space Reduced	35-50%
Lead Time Reduced	50-90%

Summarized results, subsequent to a 5-year evaluation, from numerous companies (over 15 aerospace-related). Companies ranged from 1 to >7 years in lean principles application/execution.

Measuring our results

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Target Progress Report – RPIW's

Team Name: Virginia Mason Medical Center		Date: 2002-2005 roll-up as of May 05
Client: NA		TAKT Time:
Product/Process Summary: All 275 RPIW's from 2002-2004measured at 90 days post RPIW		Team Leaders: Gary S. Kaplan, MD, Chairman & CEO J. Michael Rona, President

Metric (units of measurement)	Baseline	Target	Results at 90-days	Percent Change
Space (square feet)	53,954 sq ft	31,921 sq ft	41,359 sq ft	24% Reduction
Inventory (dollars)	$709,731	$135,629	$350,480	51% Reduction
Staff Walking Distance (feet)	481,822 ft	240,314 ft	301,672 ft	38% Reduction
Parts Travel Distance (feet)	486,566 ft	189,079 ft	114,775 ft	77% Reduction
Lead Time (minutes)	1,926,719 min	907,610 min	914,751 min	53% Reduction
Work In Process (WIP) (units)	640,993 units	320,495 units	247,134 units	62% Reduction
Standard Work In Process (SWIP)	---	---	---	---
Quality (defects)(%)	---	---	---	47% Reduction
Productivity Gain (a) (minutes/FTE)	228.87 FTE	137.71 FTE	151.98 FTE	44% Gain
Environmental, Health & Safety (5S)	---	---	---	Organizational Level 3
Set-up Reduction (minutes)	572,203 min	190,092 min	101,882 min	83% Reduction
REMARKS: Other Cash Savings: Saved $5-7M (budgeted) in Capital Expenditures by using 3P effors in Dermatology, Cancer Center, Hyperbaric $200K savings in 30 days by applying tools of VMPS to open positions, use of overtime and temporary labor in overhead areas				

(a) Number includes minutes of work eliminated from multiple operators converted to FTE equivalents.

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A reduction of 34 miles!!

A reduction of 70 miles!!

A reduction of 702 Days!!

Metric (units of measurement)			ys	Percent Change
Space (square feet)	53,954 sq ft			24% Reduction
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Stopping the Line™

Virginia Mason's Patient Safety Alert System™

Stopping the line

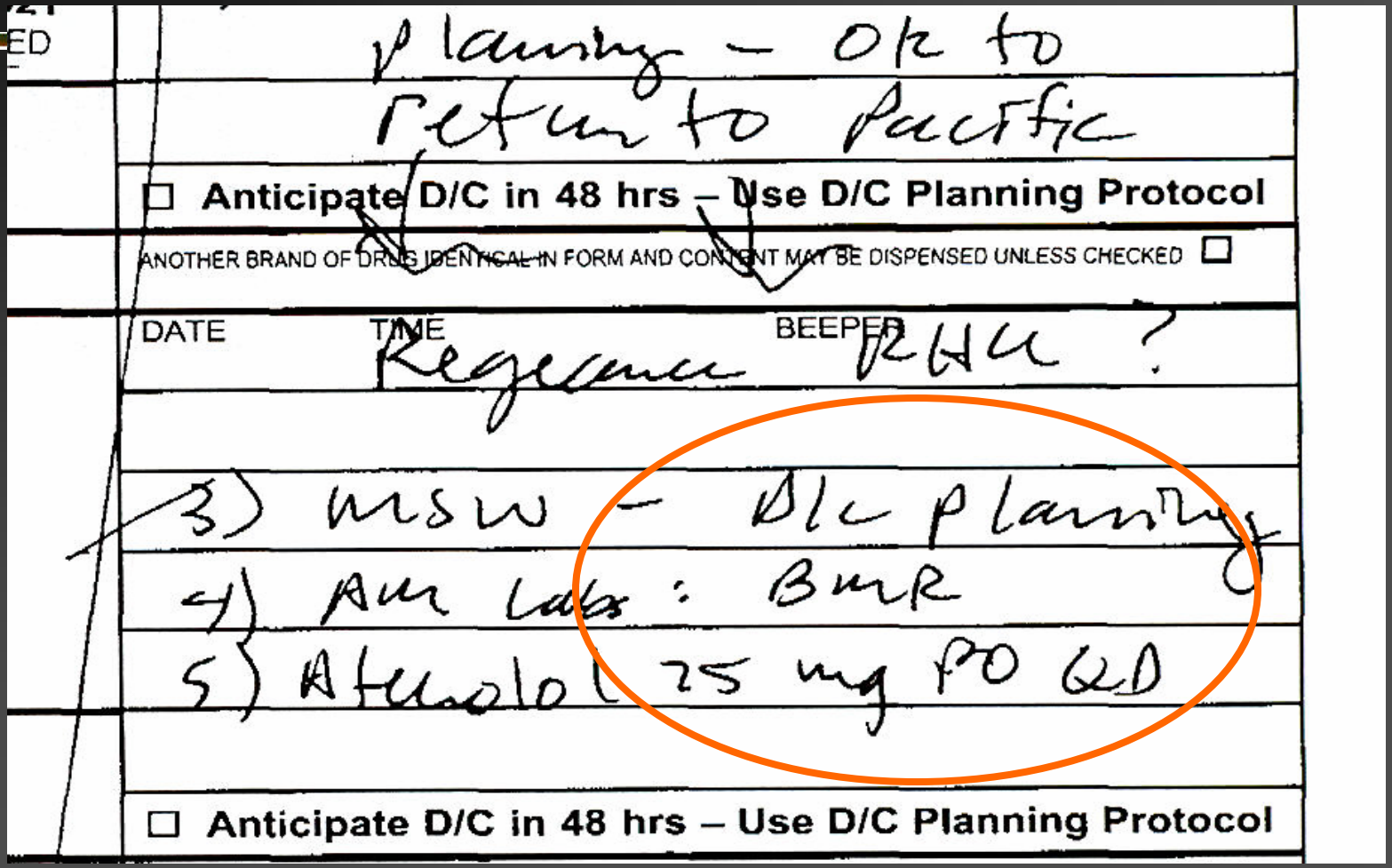
Stopping the Line™ Intervention Concepts

- Safety hazards are process defects
- Process defects are least harmful and easiest to fix *at the time* they arise
- Process defects are more harmful and harder to fix as they go downstream

Stopping the Line™ Concepts and System

- *Everyone* is an inspector
- *Everyone* can stop defects
- If the process cannot be stopped from making defects, *the process must stop*
- Patient Safety Alert Process ™ Created (8/2002)
  - Leadership from the top
  - "Drop and run" commitment
  - 24/7 policy, procedure, staffing
  - Legal & reporting safeguards

Case 1: Numbers and Abbreviations



Patient Safety Alert ™ Case Study 9: Mixing of Medications

1) A patient presented to Dermatology Clinic for removal of a pigmented lesion.
2) A medical assistant prepared two 5 ml syringes containing an intended mixture of:
   4.5 ml 1% lidocaine with epinephrine
   0.5 ml 8.4% sodium bicarbonate.
3) The physician injected the contents of the first 5 ml syringe into the skin. The patient immediately reported unusual discomfort and a lack of numbness in the area of injection.

Case Study: Incident 9
Mixing of Medications

4) The physician suspected that the quantities of lidocaine and bicarbonate had been reversed when the solution was mixed. The procedure was aborted. The patient was informed of the suspected error. Pharmacy was called for advice.

5) The patient's was observed in the clinic for 1 hour and then released to home with continuing follow-up.

Patient Safety Alert ™
Case 9 – Day 1

Notification

- Patient Safety Alert Initiated

  Physician, Dermatology

- Leadership Notified

  CEO, President, Sr. Vice President,
  Vice President Quality and Compliance,
  Chief of Medicine, Administrative Director

Patient Safety Alert ™
Case 9 – Day 1

Stopping the Line

- The “line was stopped” for the current process of
  injectable medication mixing
  involvement of medical assistants
- A “buddy” system was immediately initiated to verify appropriate mixing of injectable medications
- An evaluation team was selected

Patient Safety Alert ™
Case 9 – Day 2 &3

Issues Identified

- High variation in practice
- No standard process for mixing and administration of injectable medications
- High variation in process to assure that medical assistants have appropriate competency and certification for mixing injectable medications

Patient Safety Alert ™
Case 9 – Days 2-12

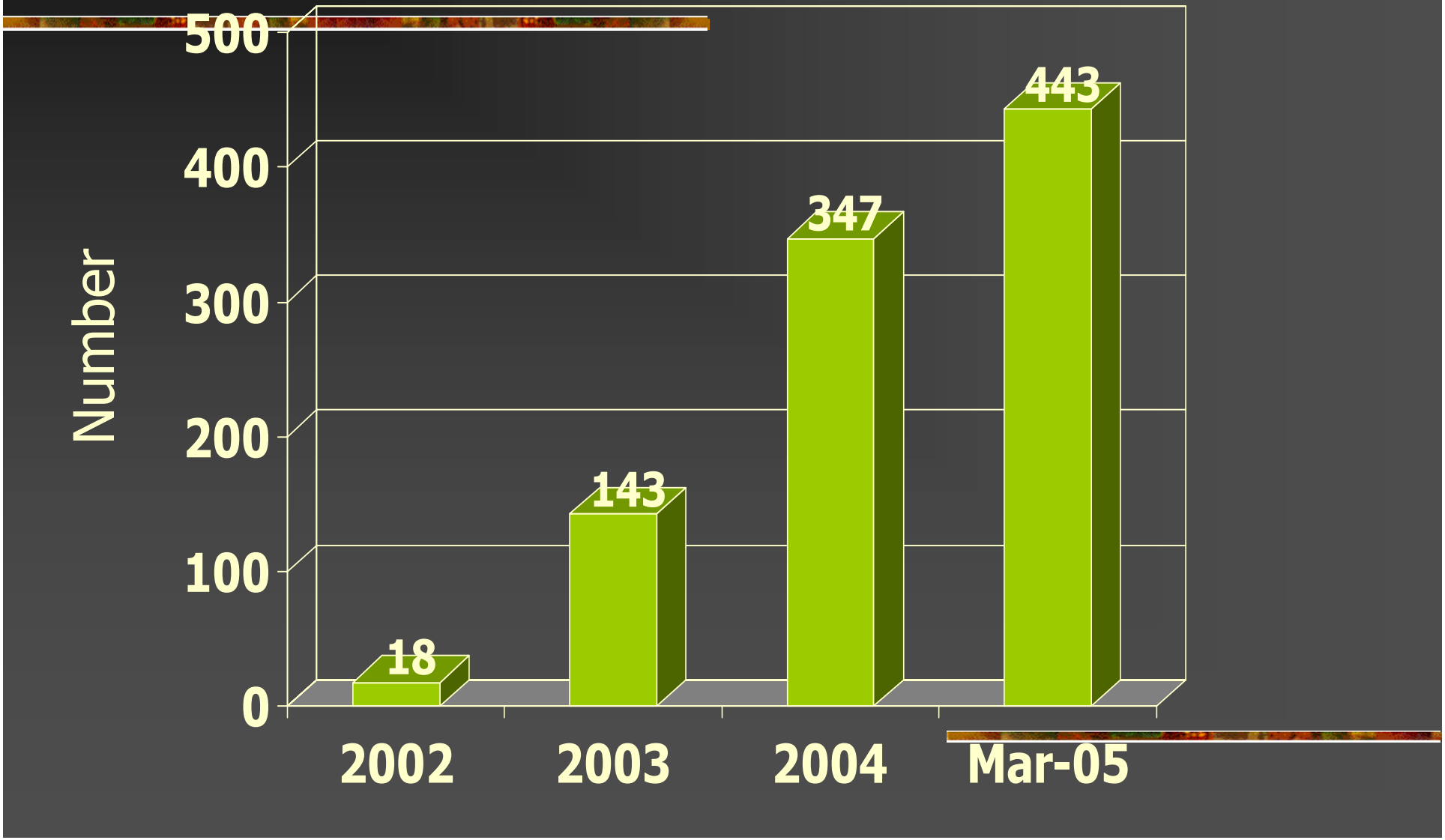
Improvements

- Developed standard process for an acceptable method of mixing injectable medication
- Developed standard process for assuring that medical assistants have appropriate competency and certification for mixing injectable medication

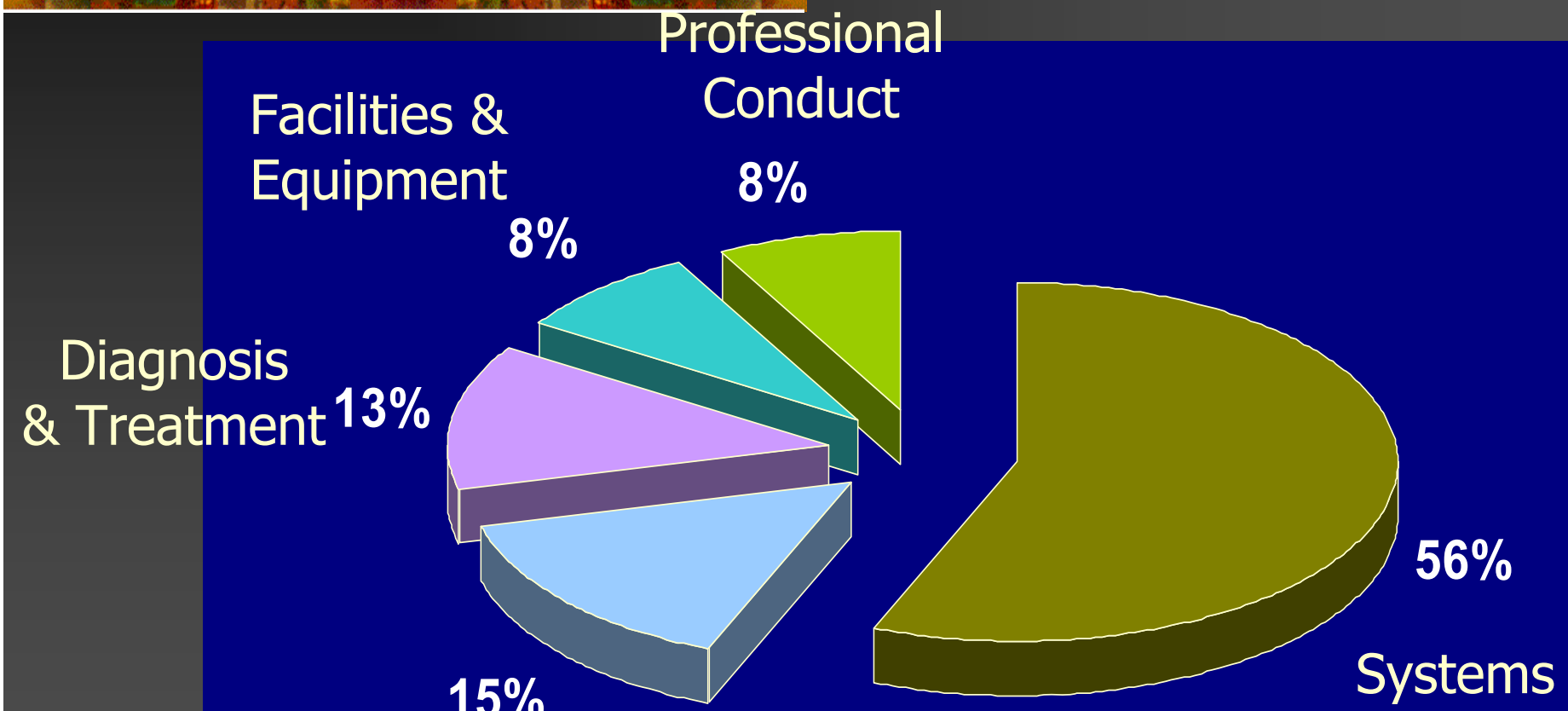
Cumulative Declared PSA's

VIRGINIA MASON TEAM MEDICINE

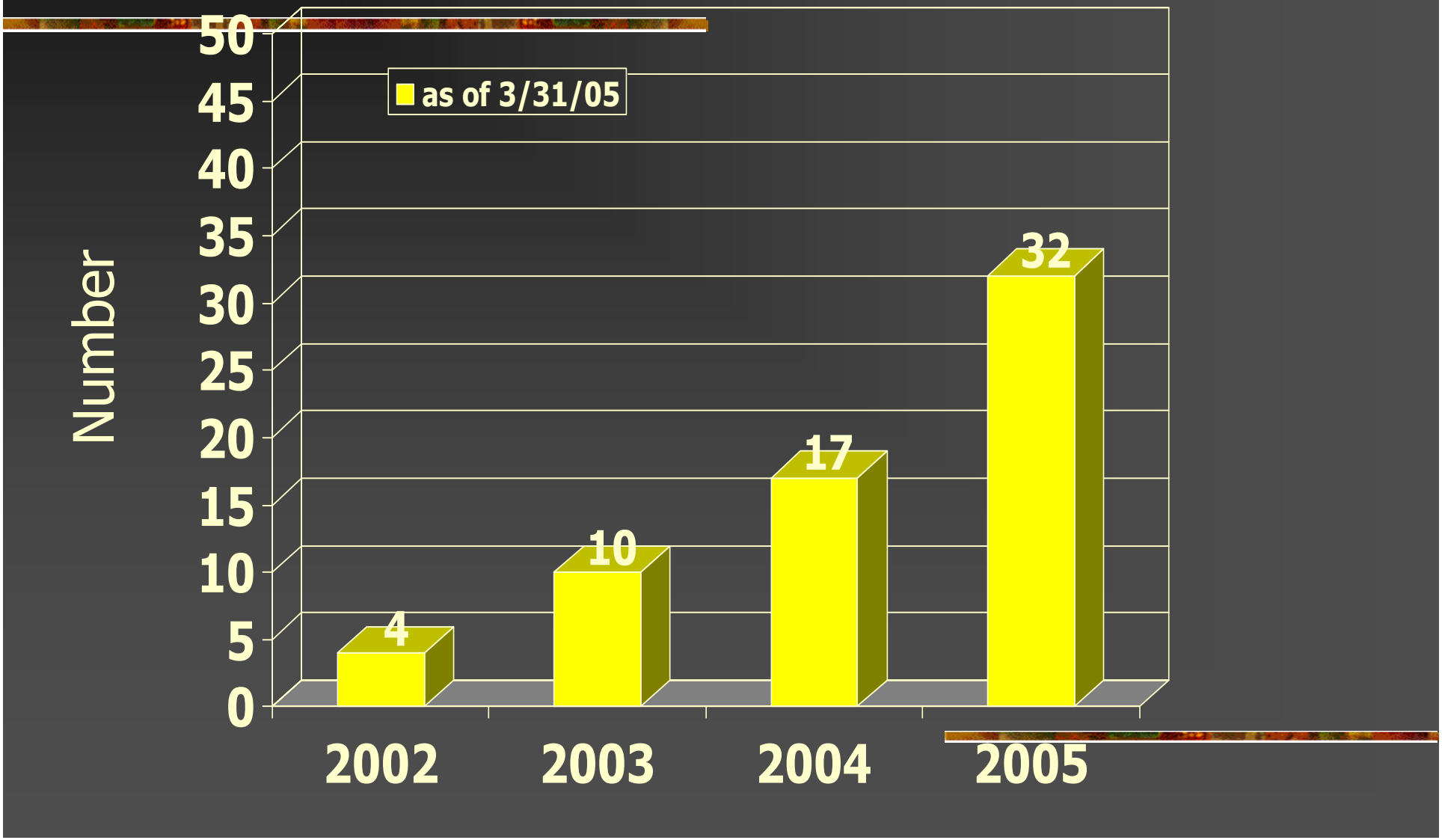
[800]



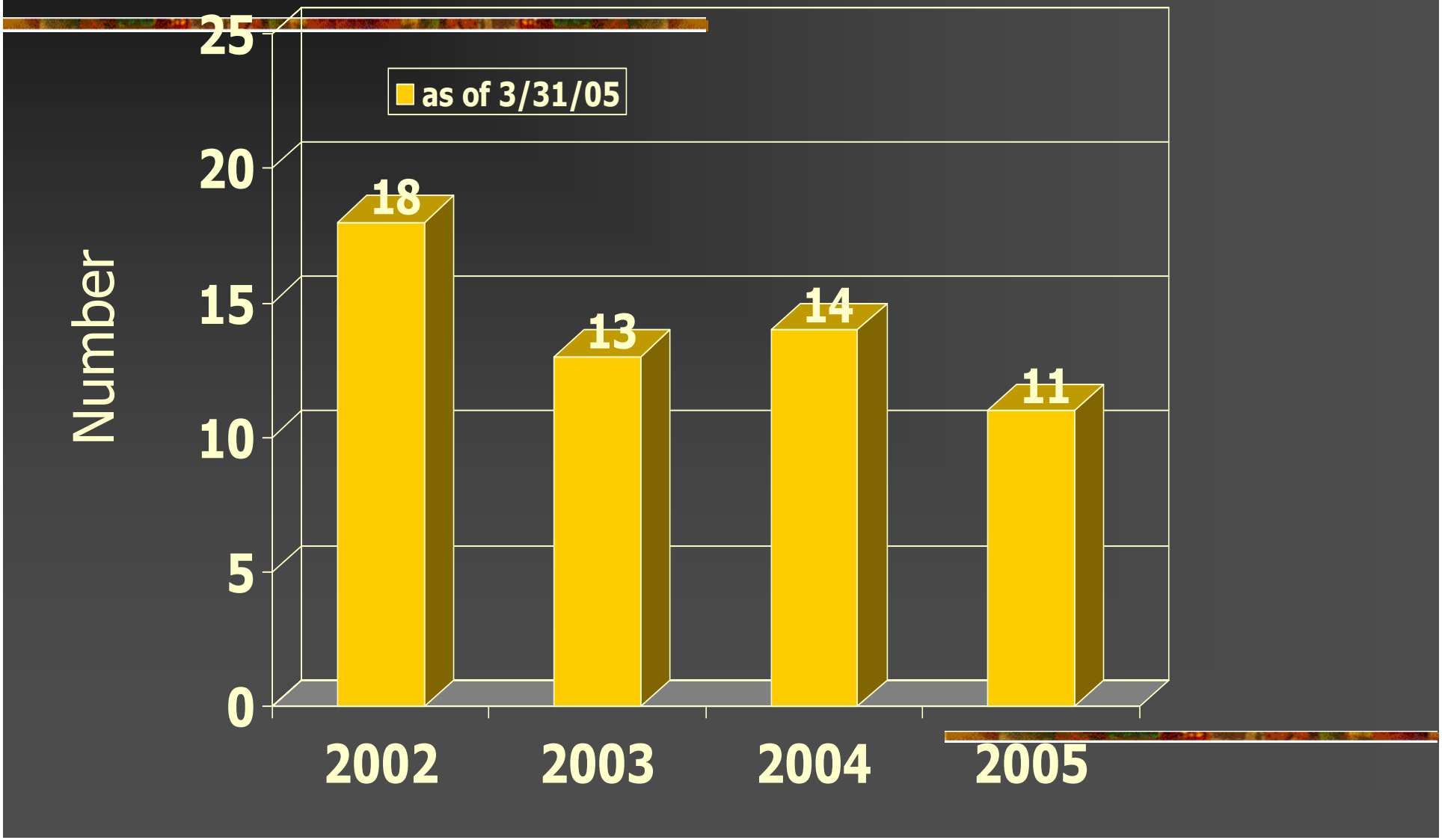
Distribution of Declared PSA's



Average PSA's per Month



Days to Completion of PSA



Offline During Investigation

	2002	2003	2004	2005
Employees	6	5	14	6
Equip/Process	1	4	8	2

as of 3/31/05

Virginia Mason Results

- The Cost of Error
- Mistake Proofing and Improvement
- FTE Trends
- Learnings from Production Preparation Process (3P)
- Cost Avoidance and Savings
- RPIW Roll Up

The Cost of Error

Ventilator Acquired Pneumonia

- 2002 Cases 34 Est. Deaths 5
- 2002 Cost $ 500,000

Professional Liability Expense

- Claims Paid [2] $ 4.6 Million
- Claims Paid [3] $ 4.5 Million

[2] 1999 - 2003 Average

[3] Projected 2004

Mistake Proofing

Ventilator Acquired Pneumonia

- Cases in 2002: 34
- Cost in 2002: $500,000
- Est. Deaths 5

- Cases in 2005: 1
- Cost in 2005: $15,000
- Est. Deaths 0

* Projected 2005

Staffing Trends

Full Time Equivalents

1996:	2890	
1997:	3264	▲
1998:	3467	▲
1999:	3528	▲
2000:	3612	▲
2001:	3647	▲
2002:	3656	▲
2003:	3581	▼
2004:	3562	▼

3P's: Production, Preparation, Process

- Cancer
- Hospital
- Dermatology
- GI
- Hyperbarics

3P Dermatology Model – "Skin"

The patient would enter and exit through a peaceful, quiet "museum like" environment. (See center of model)
Along the walk, the patient would be provided with education about skin care and the services that VMMC Dermatology provides. Images would be projected up on plasma screens projected through frosted glass. (See sample/photos on the next page)
The Concierge (Water Strider) would serve as tour guide through this area, offering the patient information and suggest skin products for purchase. Calming music and aromatherapy will add to the ambiance.
"Circles" of Specialty Dermatology care are placed in specific areas. The Moh's Specialty area, for instance, is located where the patient can enter and exit privately. This model is patterned after the Kitchen Triangle Model where each Specialty Circle would serve 1 provider and 2 MA's. There are no waiting rooms in this model, expecting one-piece flow to Takt time.

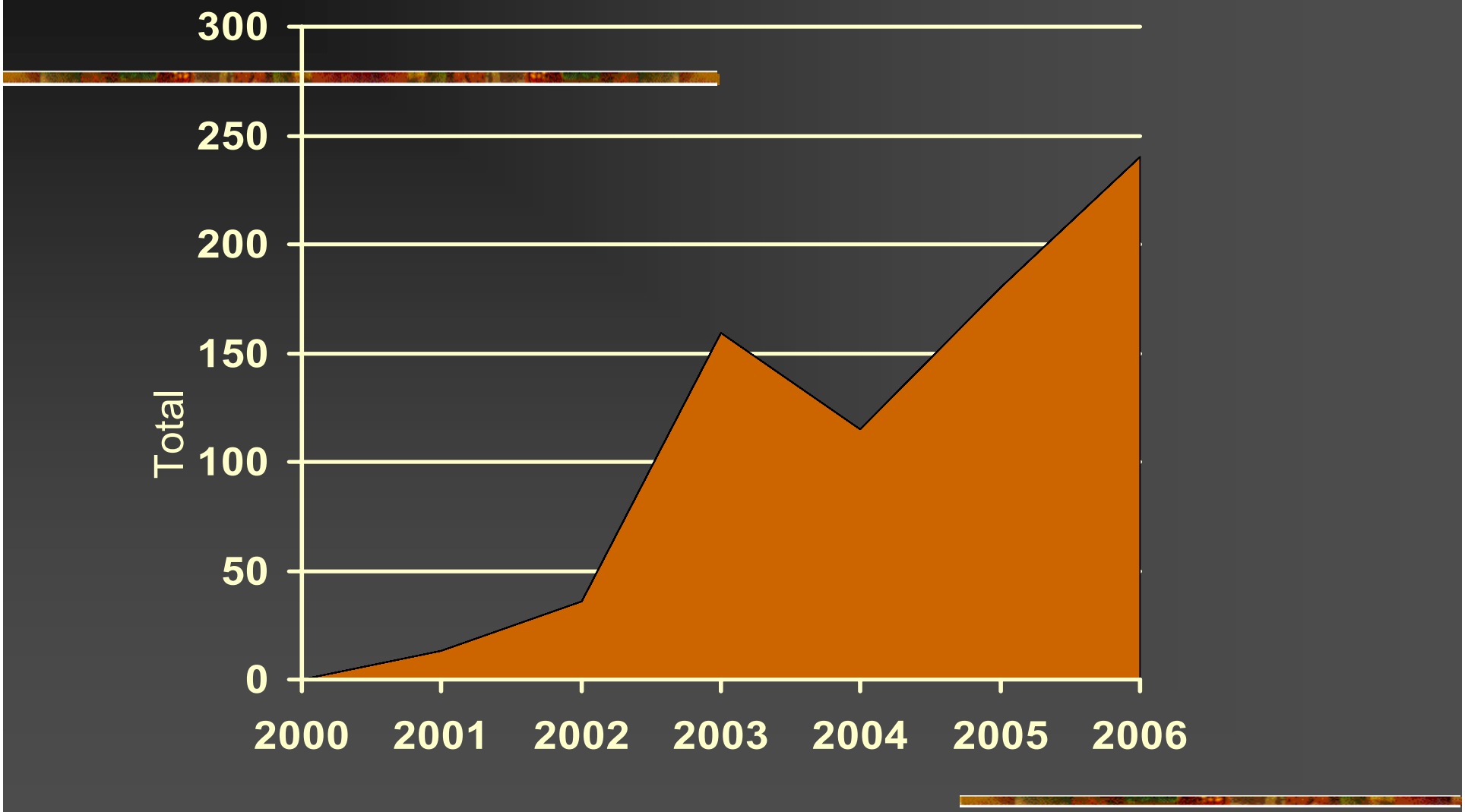
Cost Avoidance

- 1M Capital Savings for Hyperbaric Chamber from 3P
- 1-3M Endoscopy Suites now staying in current location
- 6M Surgery Suites budgeted and planned - now not building
- Hospital 3P
  - Lead Time, Staffing, Space
- Cancer 3P
  - Same amount of space 120 pts per day to 188 pts per day (57% increase)
  - Patient Travel -1600 ft to 375 ft. (76% reduction)

What hasn't worked

- Lots of activity but not enough traction
  - Safety vs. Waste and Flow
- Scope too big
- Hit the wrong target
- Too many targets

Virginia Mason RPIW Activity



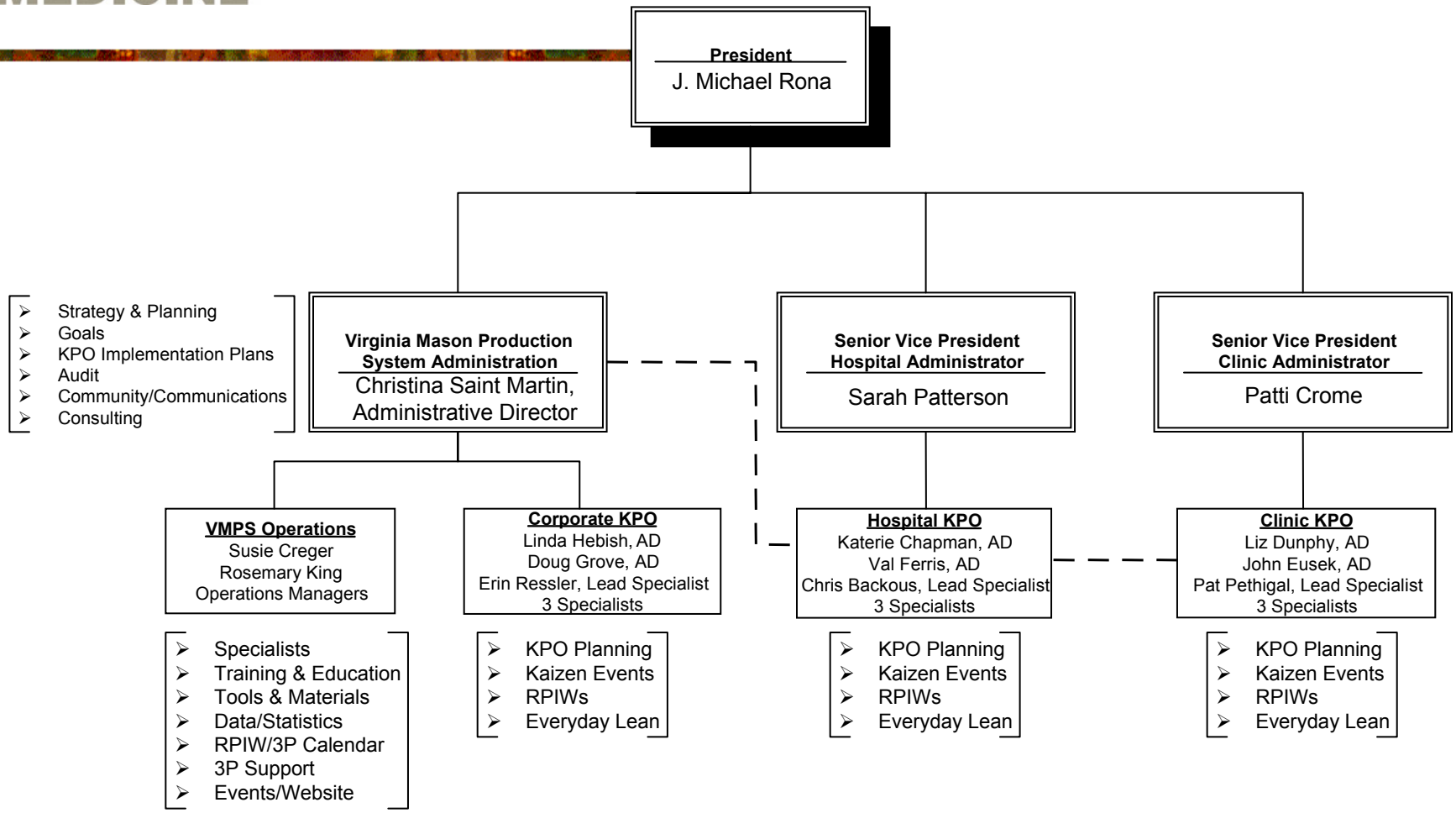
Strategies Revisited: How do we really get there?

- Infrastructure
- Education
- Focus of RPIW's/Kaizen Events
- 3P
- Everyday Lean
- Accountability

Improving the Infrastructure: Critical to implementation

- Focused goals aligned with organizational goals
- Explicit measurable targets
- Accountability for implementation and sustained results
- Enhanced leadership structure
- Enhanced “gemba” support
- Improvement never ends and is full-time work
- Goal is 1%-5% of all staff working in KPO’s

Virginia Mason Production System
2005 Management Structure



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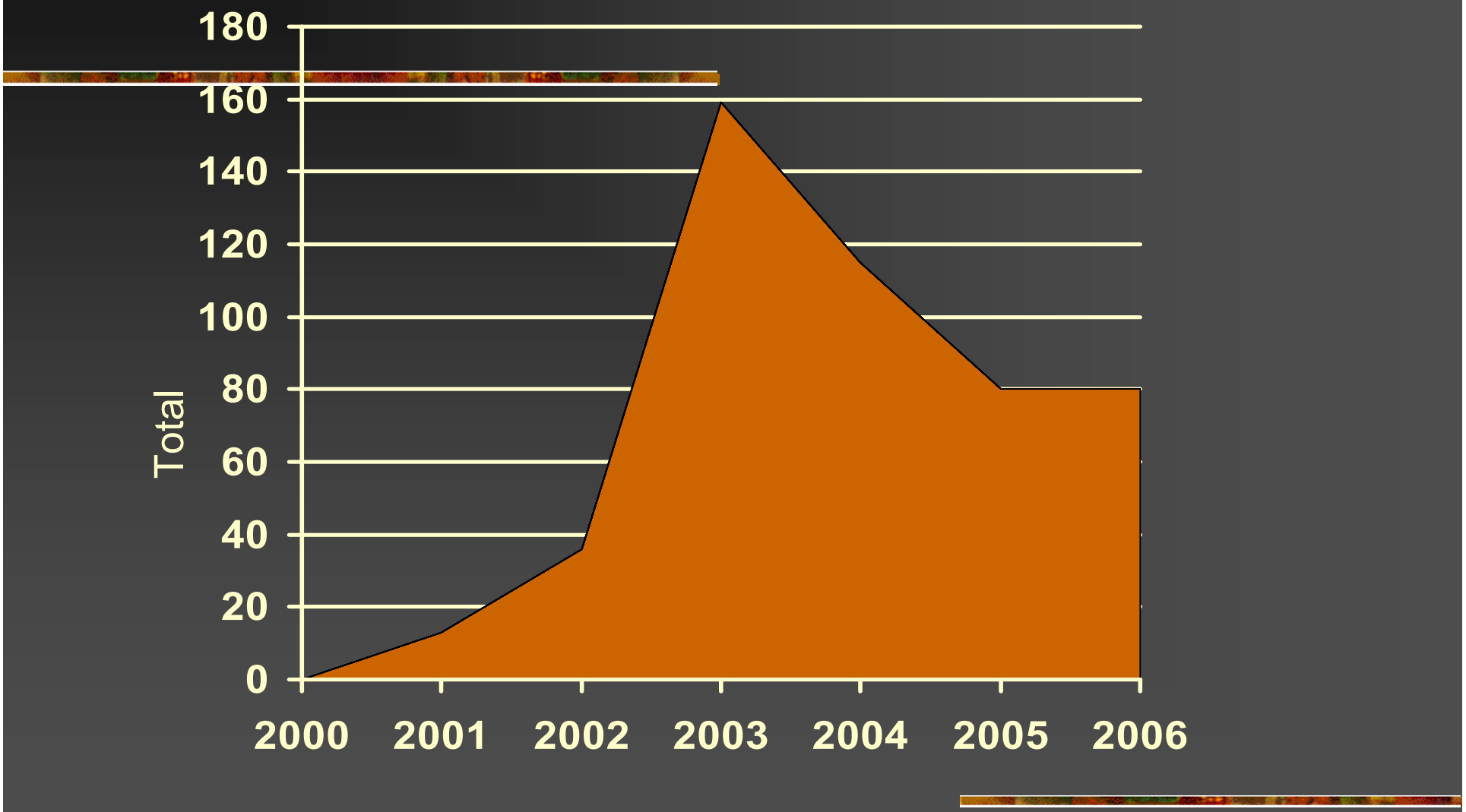


VMPS Educational Strategies

- Everyday Lean Idea Campaign – All Staff
- Intro to VMPS (course) – All Staff HES requirement
- Leading 5S – Management leads and teaches staff
- Value Stream Mapping – Management course/All staff in 2006
- Standard Operations – Management course/All Staff in 2006
- Mistake Proofing – Management course/All Staff HES requirement
- Lean Mastery Track – Management course & collaborative
- Workshop Leader Certification – Senior management requirement
- Kaizen Fellowship – Select senior management
- Japan Gemba Kaizen – Management & staff
- 3P Certification
- On Site Gemba's

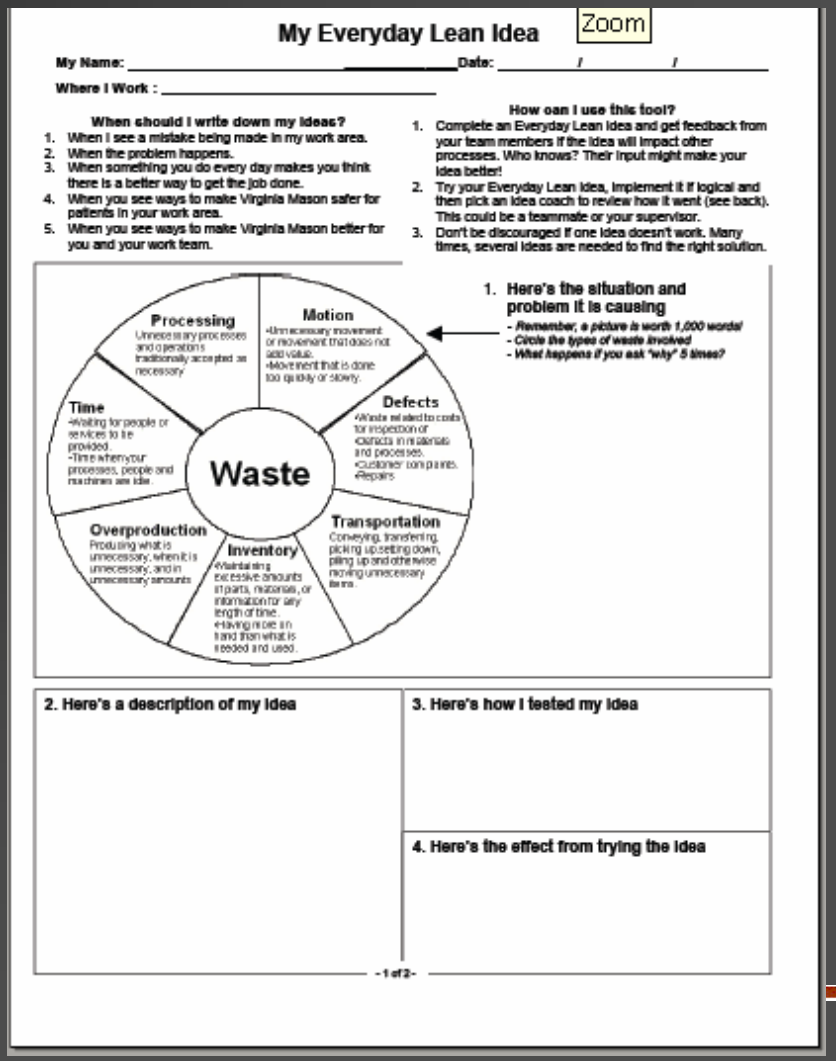
Everyday Lean Idea System

Three Ground Rules

Rule #1:
Proposals involve creatively changing the approach to our jobs or work unit to reduce waste and add value for our patients. Kaizen means we continuously improve using lean thinking principles and strategic plan goals to either eliminate an activity, reduce the steps of an activity, or change the activity.

Rule #2:
Proposals are practical to try out on a small scale ourselves or with our coworkers' help. They can be implemented almost immediately with little or no extra cost.

Rule #3:
If we propose the solution, we help implement it.



To Change Medicine…..
Change Your Mind

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- Provider First
- Waiting is Good
- Errors are to be Expected
- At-risk Employment
- OTJ Training
- Diffuse Accountability
- Add Resources
- Reduce Cost
- Retrospective Quality Assurance
- Management Oversight
- We Have Time

- Patient First
- Waiting is Bad
- Defect-free Medicine
- Guaranteed Employment
- Explicit Training
- Rigorous Accountability
- No New Resources
- Reduce Waste
- Real-time Quality Assurance
- Management On Site
- We Have No Time

Ongoing Challenges

- Culture Change
- Professional Autonomy
- “People are Not Cars”
- Belief in Zero Defects
- Rigor, Alignment, Execution
- Victimization
- Scarcity v. Abundance
- Leadership Constancy

“It is not by accident that you were chosen to be a leader. It is your destiny.”

Sensei Chihiro Nakao