

**Impact of Physician and Hospital Expertise on the
Application of Evidence-Based Guidelines in
Pediatric Abdominal Trauma**

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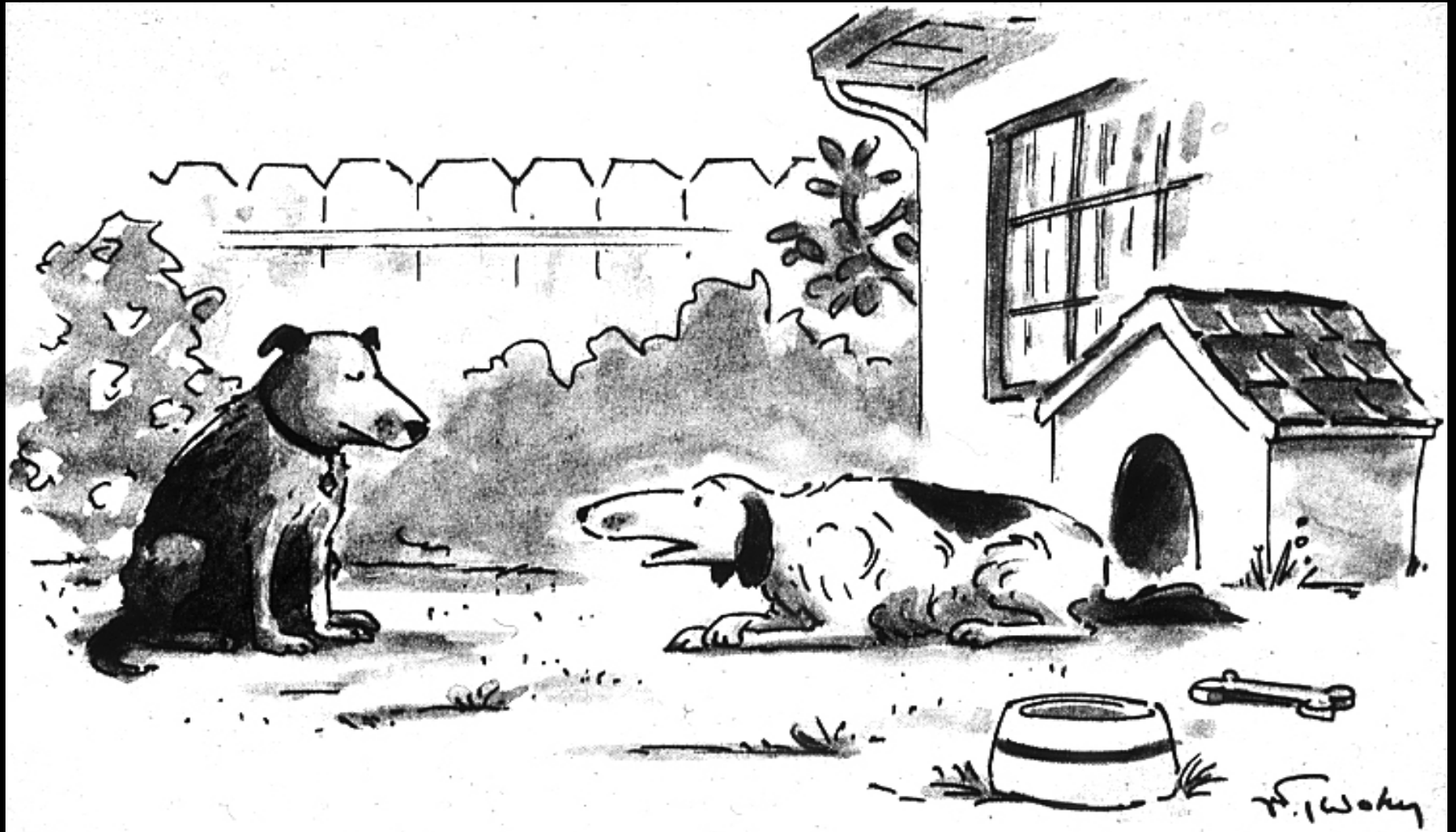
Children's Hospital of New York

Columbia University Medical Center



Miami Children's Hospital





"I've got the bowl, the bone, the big yard. I know I should be happy."

BRAINS

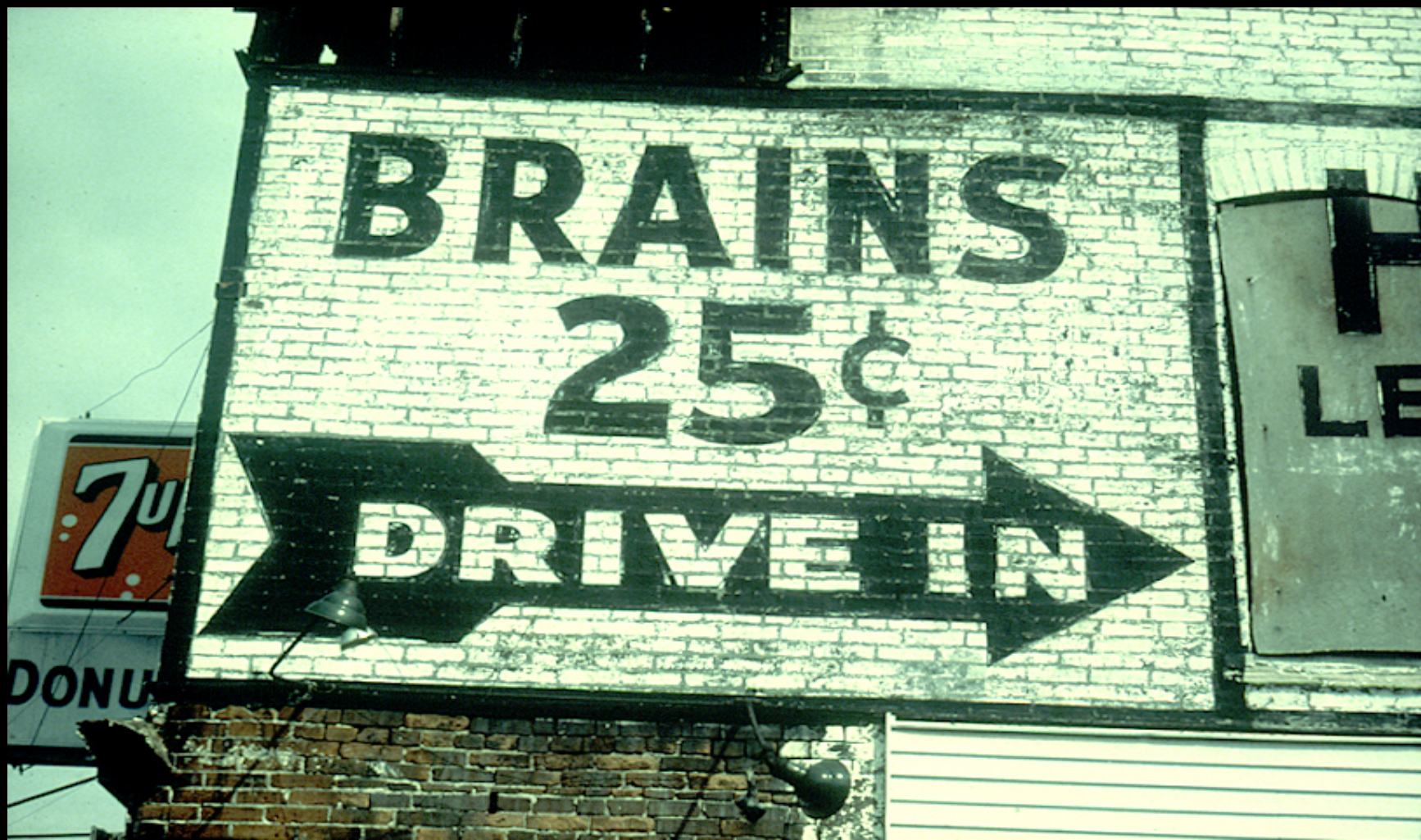
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Evidence-Based Medicine

Goals

- **Relevant and engaging topic**
- **Increase/Maintain quality**
- **Decrease variability**
- **Decrease cost**

EAST Practice Guidelines

Summary: 1998 -2005

- **Twelve major trauma topics reviewed**
- **Multiple clinical questions within each topic**
- **136 recommendations supported by literature**
- **Only 15 (11%) Level I recommendations**

Pediatric Liver/Spleen Injury

Background

- **Despite uniform success, there is wide variation in treatment of pediatric liver and spleen injury**
- **No randomized trials**

Non-Operative Treatment

>30 year history for pediatric spleen injury



Publications

Liver/Spleen Injury Protocols

- **National Pediatric Trauma Registry**
- **Am Pediatric Surg Assoc (APSA) surveys**
- **Single center/multi-year reports**

Length of Stay

Spleen injury in 268 pts - NPTR

1 day	4%
2-3 days	13%
4-5 days	26%
6-7 days	32%
>7 days	25%

Activity Restriction

Spleen injury - APSA survey 1995

1 month	4%
2 months	22%
3 months	46%
6 months	14%
“Healed” on imaging	14%

APSA Trauma Study Group

Goals

- **Detail current treatment**
- **Review available literature**
- **Define evidence-based guidelines**
- **Encourage prospective validation**

Evidence-Based Guidelines

Methodology

- **Topic selection**
- **“Expert” panel**
 - **Define goals**
 - **Assess evidence**
 - **Propose guidelines**
- **Presentation**
- **Implementation**
- **Evaluation**
- **Revision**

Question #1

Do all children with blunt spleen or liver injury require PICU admission?

Question #2

**Should length of stay be guided by
injury Grade in routine patients?**

Question #3

Do children require follow-up imaging
after non-operative treatment of
blunt spleen or liver injury?

Question #4

**Should interval of physical activity
restriction be guided by injury Grade
in routine patients?**

Methods

- **32 pediatric surgery centers**
- **Case records of 856 pts (1995-97)**
- **Isolated spleen or liver injury**
- **Grade V injuries excluded**

Methods

- **CT Grade**
- **ICU/Hospital days**
- **Transfusion/Operation**
- **Pre/post-discharge imaging**
- **Activity restriction interval**

Results

Literature Search

No prospective, randomized trials exist regarding resource utilization in children with isolated spleen/liver injury

Resource Utilization

832 patients

<u>CT Grade</u>	<u>I</u>	<u>II</u>	<u>III</u>	<u>IV</u>
Admit to ICU	55%	54%	72%	85%

Resource Utilization

856 patients

<u>CT Grade</u>	<u>I</u>	<u>II</u>	<u>III</u>	<u>IV</u>
Admit to ICU	55%	54%	72%	85%
Transfusion	2%	5%	10%	27%
Operation	none	1%	3%	13%

Who “Requires” PICU Admission?

<u>CT Grade</u>	<u>I - III (n=743)</u>	<u>IV (n=113)</u>
Transfusion	6.4%	27%
Operation	1.5%	13%

p < 0.001

Question #1

Do all children with blunt spleen or liver injury require PICU admission?

No

Question #2

**Should length of stay be guided by
injury Grade in routine patients?**

Yes

Question #3

Do children require follow-up imaging
after non-operative treatment of
blunt spleen or liver injury?

No

Activity Restriction?



Activity Restriction

832 patients

Grade I	2 - 6 weeks
Grade II	2 - 8 weeks
Grade III	4 - 12 weeks
Grade IV	4 - 16 weeks

Question #4

Should interval of physical activity restriction be guided by injury Grade in routine patients?

Yes

Proposed Evidence-Based Guidelines

<u>CT Grade</u>	<u>I</u>	<u>II</u>	<u>III</u>	<u>IV</u>
ICU stay	none	none	none	1 d

Proposed Evidence-Based Guidelines

<u>CT Grade</u>	<u>I</u>	<u>II</u>	<u>III</u>	<u>IV</u>
ICU stay	none	none	none	1 d
Hospital stay	2 d	3 d	4 d	5 d

Proposed Evidence-Based Guidelines

<u>CT Grade</u>	<u>I</u>	<u>II</u>	<u>III</u>	<u>IV</u>
ICU stay	none	none	none	1 d
Hospital stay	2 d	3 d	4 d	5 d
Imaging (F/U)	none	none	none	none

Proposed Evidence-Based Guidelines

<u>CT Grade</u>	<u>I</u>	<u>II</u>	<u>III</u>	<u>IV</u>
ICU stay	none	none	none	1 d
Hospital stay	2 d	3 d	4 d	5 d
Imaging (F/U)	none	none	none	none
Activity restriction	3 w	4 w	5 w	6 w

Conclusions

1. **Diversity and variation in treatment of pediatric spleen/liver injury confirmed**
2. **Lack of Class I evidence to propose standards of care**
3. **Safe reduction in resource utilization is suggested by multi-center case review**

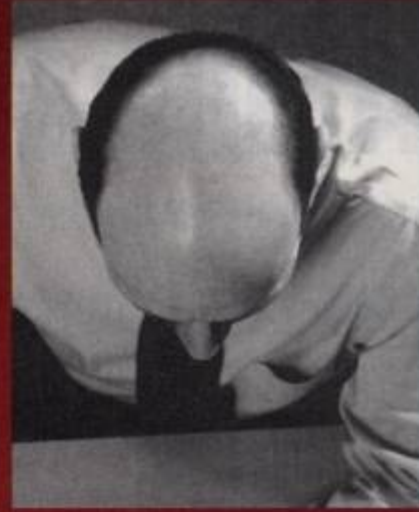
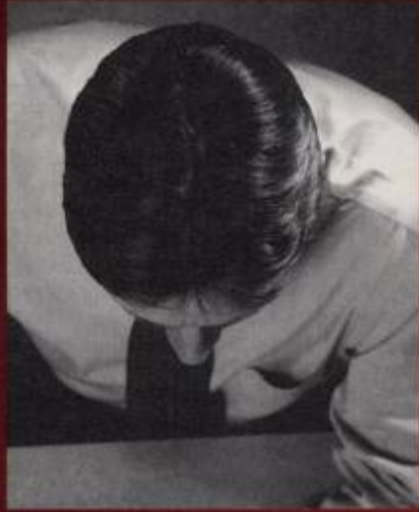
Conclusions

- **Prospective study needed to validate the proposed guidelines**
- **Validation would result in conformity, safety, and optimal resource utilization**

Evidence-Based Guidelines

Methodology

- Topic selection
- “Expert” panel
 - Define goals
 - Assess evidence
 - Propose guidelines
- Presentation
 - JPS Feb 2000
- **Implementation**
- Evaluation
- Revision



CHANGE IS BAD

Participating Centers

Boston Children's Hospital

Children's Hospital of New York

Children's Hospital of Wisconsin

Children's National Med Ctr, DC

Children's Healthcare, Atlanta

Children's Med Ctr, Dallas

Children's Hospital, Greenville, SC

Connecticut Children's Med Ctr

Johns Hopkins Med Ctr

Kosair Children's, Louisville

Med Univ of S Carolina

Mercy Hospital, Pittsburgh

Rainbow Babies, Cleveland

Riley Children's, Indianapolis

St Louis Children's Hosp

Univ of Iowa Hospitals

Application of Proposed Guidelines

Goals

- **Promote conformity of care**
- **Optimize resource utilization**
- **Ensure patient safety**

Application of Proposed Guidelines

Methods

- 16 pediatric trauma centers
- Prospective study
- 316 patients (1998-2000)
- 4 month follow-up

Resource Utilization/Outcome

316 pts

Transfusion: 16 pts (5.1%)

Operation: 4 pts (1.3%)

Survival: 100%

Results

Guideline compliance in 312 pts

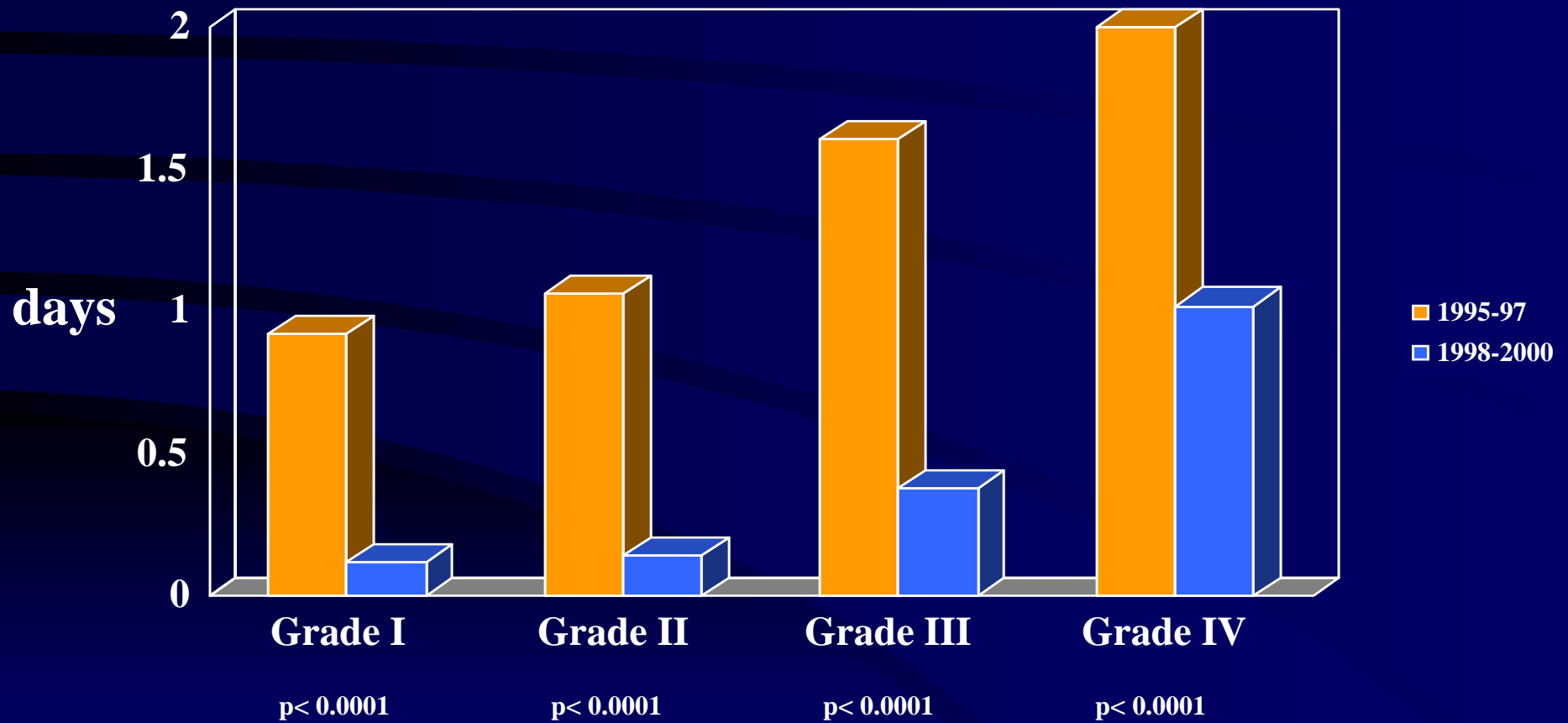
	<u>Year 1</u>	<u>Year 2</u>
ICU stay*	77%	88%
Hospital stay	81%	82%
F/U imaging	87%	87%
Activity restriction*	73%	87%

*p < 0.01

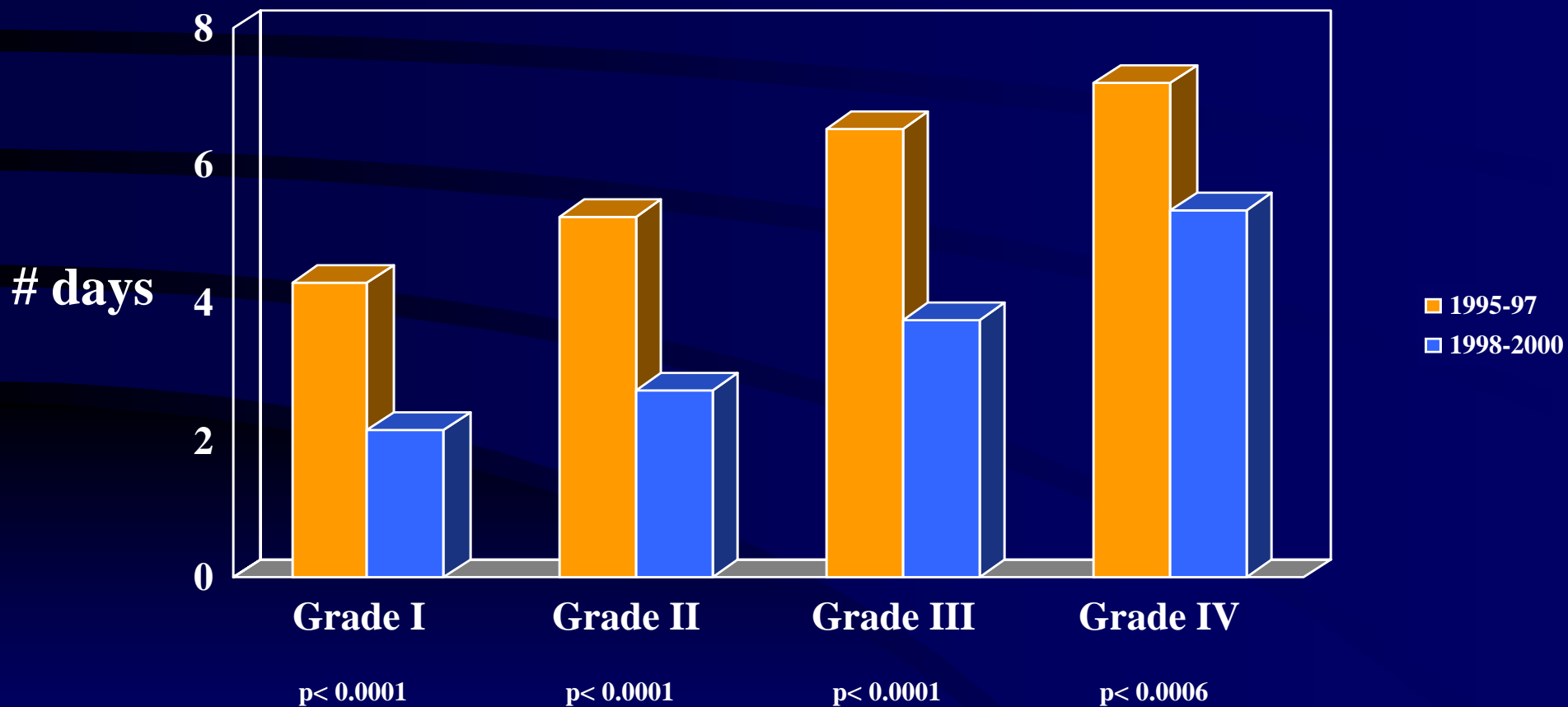
Guideline “Violations”

- **Surgeon’s “choice”** **90%**
- **Patient related** **10%**
 - **abd pain, fever, poor appetite**
- **Six (1.9%) re-admitted; No operations**

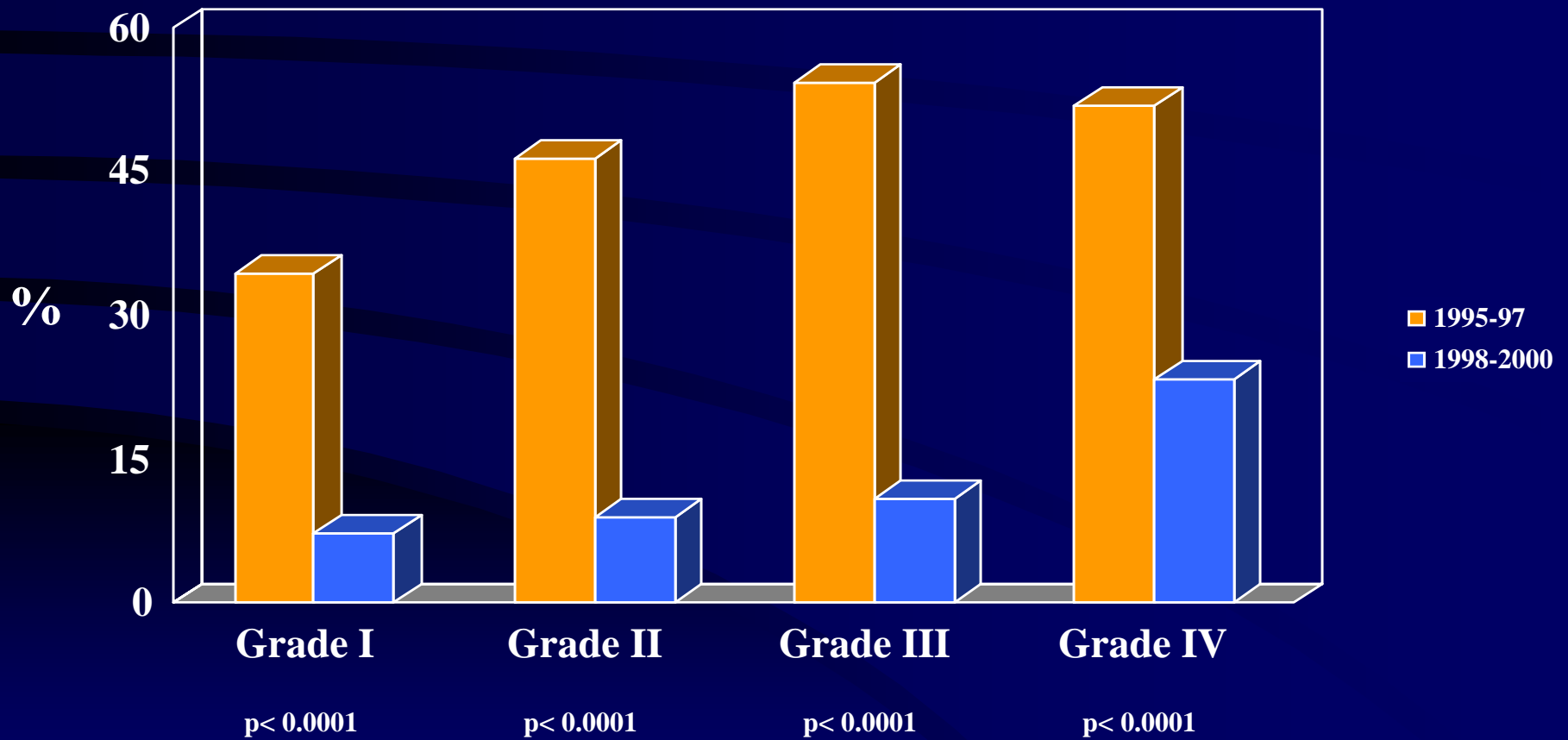
Impact on ICU Stay



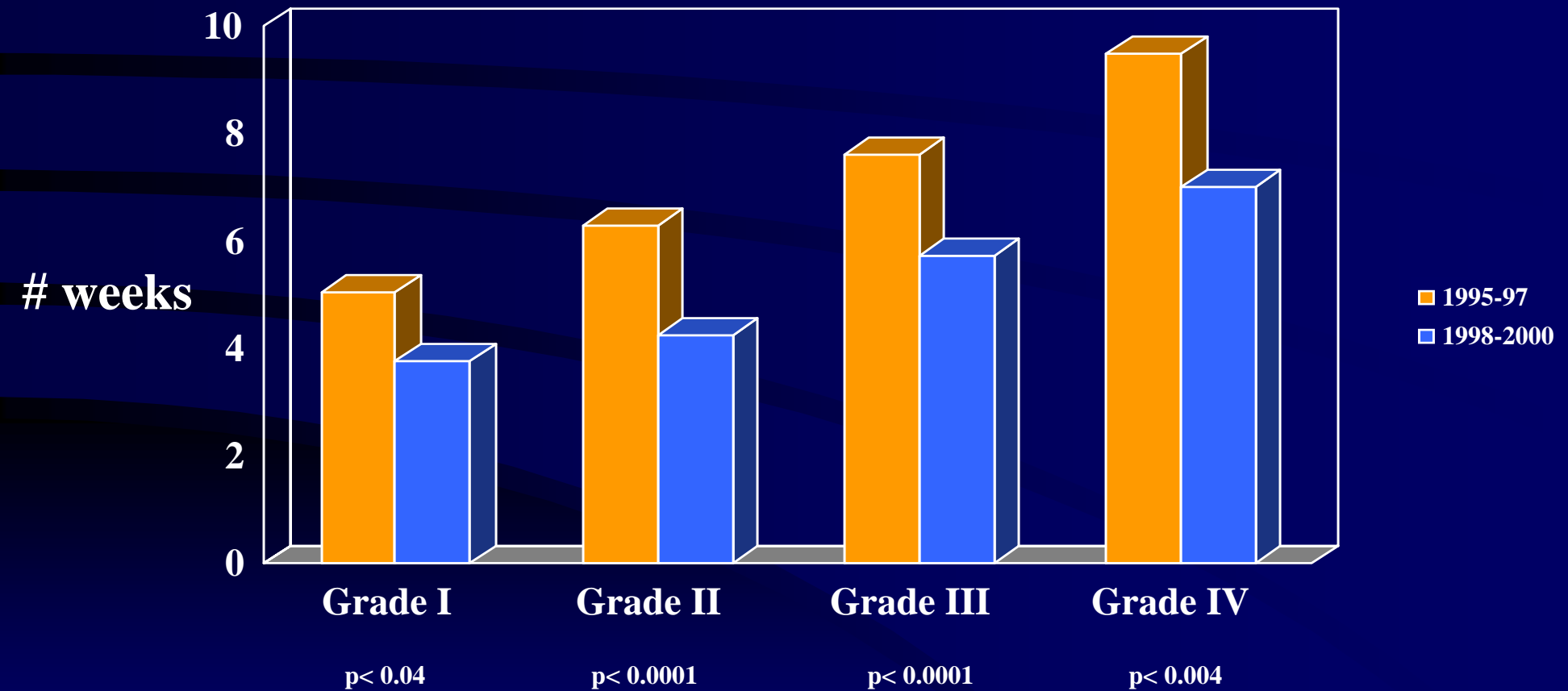
Impact on Hospital Stay



Impact on Imaging



Impact on Activity Restriction



Conclusions

- **Prospective application of consensus guidelines has resulted in conformity of care and improved resource utilization**
- **Guidelines have been implemented without adverse sequelae**



“Development and Dissemination of Outcome Measures for Injured Children”

**EMS-C Partnership Grant
1999-2005**





Evidence-Based Guidelines

Methodology

- **Topic selection**
- **“Expert” panel**
 - **Define goals**
 - **Assess evidence**
 - **Propose guidelines**
- **Presentation**
 - **JPS Feb 2000**
- **Implementation**
- **Evaluation**
 - **JPS March 2002**
- **Dissemination**

Comparing Operative Rates

Pediatric Spleen Injury

First Author	Study Period	# pts	Study Site	Rate of Operation	P value
Keller	1985-1991	41	Single center	PS 17% vs 61% NPS	< 0.01
Frumiento	1985-1990	127	State UHDDS	TC 64% vs 92% RH	<0.001
	1990-1995	140	State UHDDS	TC 23% vs 43% RH	<0.001
Mooney	1991-1994	126	Single center	PTC 10% vs 41% GH	<0.005
Potoka	1993-1997	772	PTOS	PTC 9% vs 32% ATC	<0.001
Jacobs	1992-1998	54	Single ATC	PS 8% vs 23% NPS	n.s.
Myers	1993-1998	35	Single ATC	NPTR 8% vs 61% NPS	n.s.

Processes of Pediatric Trauma Care

Spleen - Mooney, et al J Trauma 2004

- New England Pediatric Trauma Database (1990-98)
- Spleen injury in 2631 pts (68% treated by NPS)
- Operative treatment:

PS **11%** vs **35%** NPS, $p < 0.0001$

- Odds Ratio for Spleen Operation (NPS vs PS):

3.1 (2.3 – 4.4), $p < 0.0001$

Processes of Pediatric Trauma Care

Spleen - Davis, et al Pediatrics 2005

- Pennsylvania UHDDS (1991-2000)
- Spleen injury in 3245 pts admitted to 175 hospitals
- Only 16% of patients treated at PTC
- Odds Ratio for Spleen Operation (ATC vs PTC):

6.2 (4.4 – 8.7), $p < 0.0001$

Processes of Pediatric Trauma Care

Spleen - Bowman, et al JAMA 2005

- **KID 2000 Database (HCUP-AHRQ)**
- **Spleen injury in 2851 pts**
- **Only 13% of patients treated at CH**
- **Odds Ratio for Spleen Operation (GH vs CH):**

5.0 (2.2 – 11.4), $p < 0.001$

Processes of Pediatric Trauma Care

Liver Injury - Potoka, et al J Trauma 2000

- 13,000 injured children; PTOS (1993-97)
- Liver injuries in 414 pts
- Operative treatment:

PTC 4% vs 16% ATC, $p < 0.05$

- Mortality (due to liver injury):

PTC 9% vs 27% ATC, $p < 0.05$

Comparing Operative Rates

Pediatric Spleen Injury

First Author	Study Period	# pts	Database	Adjust Odds Ratio for Operation	Ratio	P value
Mooney	1990-1998	2631	Regional PTR	3.1 NPS vs PS	68:32	p<0.0001
Bowman	2000	2851	KID 2000	5.0 GH vs CH	87:13	p<0.001
Davis	1991-2000	3245	State UHDDS	6.2 ATC vs PTC	84:16	p<0.0001
Stylianos	2000-2002	3232	State UHDDS	2.1 NTC vs TC	34:66	p<0.0001



“Variation in Treatment of Pediatric Spleen Injury at Trauma Centers versus Non-Trauma Centers”

**APSA Outcomes and Clinical Trials Center and
International Center for Health Outcomes Research,
Columbia University**



Pediatric Spleen Injury

Background

- The majority of children with spleen injury follow a predictable course
- Wide variation in rate of operation
- Most patients are not admitted to pediatric hospitals
- APSA Trauma Committee guidelines/benchmarks have had limited dissemination to date

Variation in Pediatric Spleen Injury

APSA Outcomes Center - Goals

- Establish large, non-selected database
- Compare adjusted risk of operation at

Trauma centers vs Non-Trauma centers

- Identify a target for education and dissemination of APSA benchmarks and guidelines

Variation in Pediatric Spleen Injury

APSA Outcomes Center - Methods

- **UHDDS from 4 States (NY, NJ, FL, CA)**
- **3232 pts with spleen injury (2000-02)**
- **Independent risk factors**
- **Trauma center designation**
- **ICDMAP-90**

Processes of Pediatric Trauma Care

Spleen – APSA Outcomes J Am Coll Surg 2006

- NY, NJ, FL, CA UHDDS (2000-2002)
- Spleen injury in 3232 pts
- 66% of patients treated at TC
- Odds Ratio for Spleen Operation (NTC vs TC):
2.1 (1.4 – 3.1), $p < 0.0001$

Variation in Treatment of Pediatric Spleen Injury

	<u># Pts</u>	<u>Adjust Odds Ratio</u>
General Hospital vs Children's Hospital	2851	5.0 (p<0.0001)
General Surgeon vs Pediatric Surgeon	2631	3.1 (p<0.0001)
Adult or Non-TC vs Peds Trauma Center	3245	6.2 (p<0.0001)
Non-Trauma Center vs Trauma Center	3232	2.1 (p<0.0001)

Variation in Treatment of Pediatric Spleen Injury

	<u># Pts</u>	<u>Patient Ratio</u>
General Hospital vs Children's Hospital	2851	87:13
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Adult or Non-TC vs Peds Trauma Center	3245	84:16
Non-Trauma Center vs Trauma Center	3232	34:66

Conclusions

Pediatric Spleen Injury

- **Alarming variation in treatment persists**
- **Pediatric surgeons and pediatric trauma centers treat the minority of patients**
- **State/regional trauma systems may be the most practical and effective targets for dissemination of benchmarks**

Dissemination Strategies

- **Publish in Gen Surg/Trauma journals**
- **Extramural funding**
- **State Trauma Systems (QA/QI)**
- **Site verification audit**
- **Audio/Video Educational Tools**

Evidence-Based Studies

- **Identify areas of variability**
- **Employ methodology**
- **Define/disseminate guidelines**
- **Evaluate guideline application**
- **Encourage research/funding**

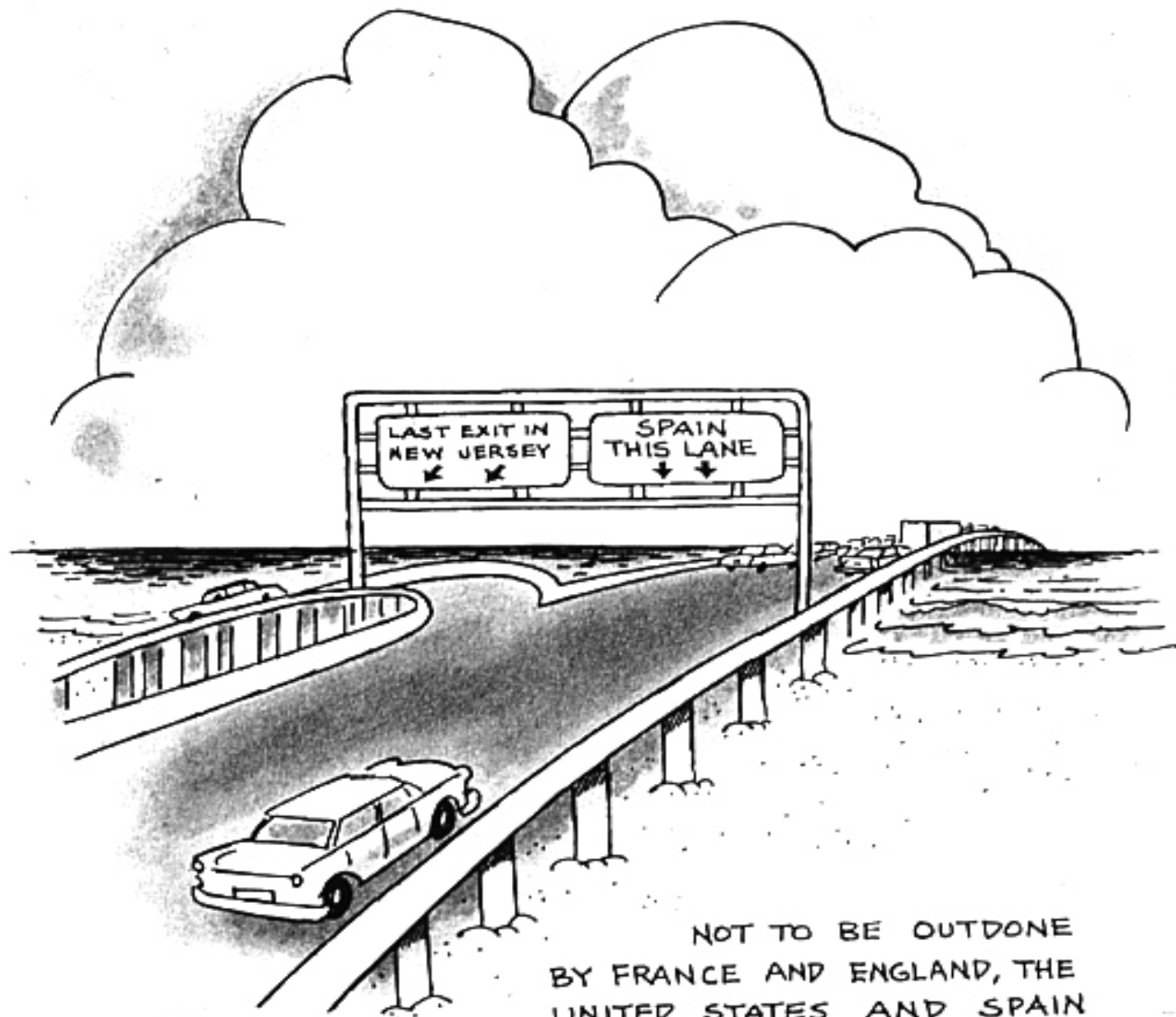
Evidence-Based Practice in Pediatric Surgery

“Even a journey of a thousand miles
begins with a single step”

Lao-Tsu

Future Studies

Evidence-based studies will allow pediatric surgeons to define optimal care rather than respond to the concerns of others with less expertise and different motivation



NOT TO BE OUTDONE
BY FRANCE AND ENGLAND, THE
UNITED STATES AND SPAIN
BUILD A BRIDGE.

Published Pediatric Surgery Benchmarks

Study Period	# pts	Database	Operative Rate Pediatric Surgeon +/- Children's Hospital-PTC	Spleen Injury
2000	339	Kid 2000 - AHRQ	5%	all
1991-2000	507	Penn Trauma Outcome Study- UHDDS	5%	all
1990-98	866	New England Pediatric Trauma Database-UHDDS	11%	all
1995-2000	652	APSA Trauma Committee- Multi-center registry	3%	isolated
1993-99	82	Children's Hospital - Boston Trauma registry	0%	isolated

APSA Trauma Committee

Benchmarks for Isolated Spleen Injury in 652 pts

Transfusion: 7.9%

Operation: 2.5%

Survival: 100%

Treatment of Spleen Injury

Rate of Operation in 3232 patients

	<u>Trauma</u>	<u>Non-Trauma</u>	<u>p-value</u>	<u>APSA</u>
Multiple injuries	15.3%	19.3%	<0.001	10-17%
Isolated injury	9.2%	18.5%	<0.0001	0-3%
TOTAL	12.1%	18.8%	<0.0001	5-10%

Risk Factors for Splenectomy

3232 patients

<u>Independent Risk Factors</u>	<u>Odds Ratio (95%CI)</u>	<u>p-value</u>
Age 15-19	4.2 (1.9 - 8.9)	<0.0002
Injury Severity		
- Tears	1.57 (1.0 - 2.4)	<0.04
- Laceration	3.4 (2.4 - 5.0)	<0.0001
- Massive	10.6 (6.9 - 16.1)	<0.0001
Multiple Injuries	1.38 (1.0 - 1.9)	<0.04
Adjusted odds ratio:	2.12 (1.4 - 3.1)	<0.0001

Treatment of Isolated Spleen Injury

1933 patients

	<u>TC (n=1083)</u>	<u>Non-TC (n=850)</u>	<u>p-value</u>
Mean ISS	8.6	9.2	ns
Rate of Operation	9.2%	18.5%	<0.0001
- Hematoma (865.01)	3.4%	3.9%	ns
- Capsular Tear (865.02)	4.8%	12.4%	<0.02
- Parenchymal Laceration (865.03)	12.2%	26.6%	<0.004
- Massive Disruption (865.04)	33.3%	46.7%	<0.02

Variation in Treatment of Pediatric Spleen Injury

	<u># Pts</u>	<u>Adjust Odds Ratio</u>
General Hospital vs Children's Hospital	2851	5.0 (p<0.0001)
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Variation in Treatment of Pediatric Spleen Injury

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APSA Trauma Study Group

US Dept of Health/EMSC Grant

- **Resource Utilization in Liver/Spleen Injury**
- **Functional Outcome after Pelvic Fracture**
- **Impact of New Burn Wound Treatment Options**
- **Diagnostic Evaluation for Suspected Renal Injury**