

# Structural and Organizational Issues About Simulation in Healthcare

- **David M. Gaba, M.D.**
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  - Director, Patient Simulation Center of Innovation, VA Palo Alto HCS
  - Treasurer, AIMS 501c6
  - EIC, *Simulation in Healthcare*



## **It Is An Incredible Honor to Deliver the 2007 Peter & Eva Safar Lecture**

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- **Peter Safar was a giant who created a prestigious organization**
- **Prestigious institution and audience**
- **Ultra-prestigious list of prior speakers**
  - **Anesthesiologists & Physiologists: Too numerous to list - some my teachers & colleagues**
  - **Physicists: Bethe, Weisskopf, Dyson**
  - **Bernard Lown, inventor of DC countershock**

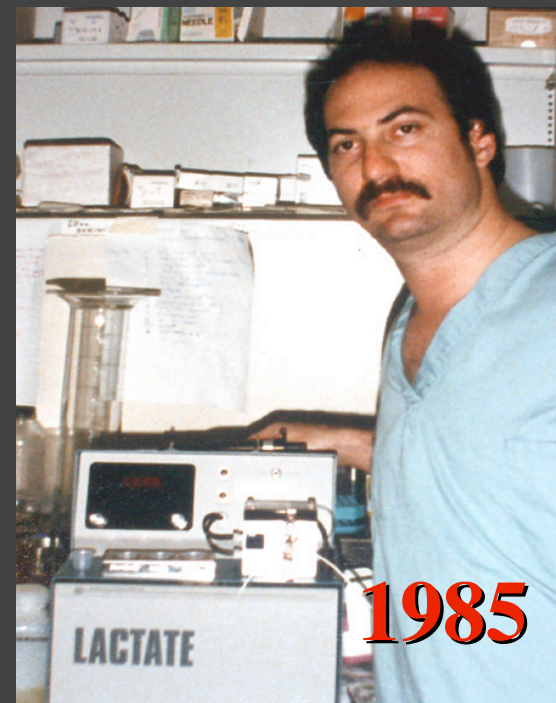
# Electric Countershock Research My First Scientific Paper (+ 5 more til 1991)

**Pediatric  
Cardiology**

**Myocardial Damage Following Transthoracic Direct Current Countershock  
in Newborn Piglets**

David M. Gaba and Norman S. Talner

1982





# This Month is the 21<sup>st</sup> Anniversary of My Pioneering Simulation Work



Pre-prototype Simulator -  
May, 1986 ... Gaba &  
DeAnda, VA/Stanford

But this talk is NOT  
about MY simulation  
activities...



# Talking about Simulation in Pittsburgh

## This is Like:

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- Carrying coals to Newcastle
- To bring owls to Athens {German}
- Bringing straw to Ofarayim {Hebrew}
- To carry water to the sea {Dutch & Spanish}
- To go to Tula & bring a samovar {Russian}
- You know the rationale for simulation
- You know how to do simulation
- I'll talk about some of the bigger picture

# Structural Features of the Health Care Industry Are Important

## Structural and Organizational Issues in Patient Safety:

A COMPARISON OF HEALTH CARE TO OTHER HIGH-HAZARD INDUSTRIES

David M. Gaba



California  
Management  
Review

*California  
Management  
Review*  
**43:83-102, 2000**

## Structural Features of the Health Care Industry



- Health care structures largely stem from “traditional” roles & organizations
  - Autonomous “healers”– knowledge & skill were personal & idiosyncratic
  - Few interventions, few acutely dangerous
  - Hospitals were like “guild workshops” for the autonomous healers {Paul Starr: *Social Transformation of American Med.*}



# Structural Features of the Health Care Industry



- **But... by now**
  - Many interventions, many are highly lethal
    - »(High lethality/m<sup>2</sup> in OR, ICU, ED, Chemo)
  - Complex care involving many personnel in many different work units
  - Knowledge & skill expected to be uniform & guaranteed
  - Yet, structures (not \$\$) still traditional

## The Results of the Current System (Throughout the Western World)

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- **Huge variation in health care practices**
  - Some outstanding, some inadequate
- **No clinician and no institution is as good as they could be or should be**
  - Including our major academic centers
- **Medical errors occur too frequently**
  - See Institute of Medicine Report, 1999



# Health Care is Intrinsicly Hazardous How Do Others Manage Hazard?

- **High Reliability Organizations**

Under the right circumstances, appropriate organizational control can yield nearly failure-free results despite incredibly high intrinsic hazard and high tempo

- **Prototypical HROs**

- A/C Carrier Flight Deck,  
Commercial Aviation, Nuclear Power

Karlene  
Roberts,  
Berkeley





Photo Copyright Jan Mogren

AIRLINERS.NET

Aviation  
is clearly  
an HRO

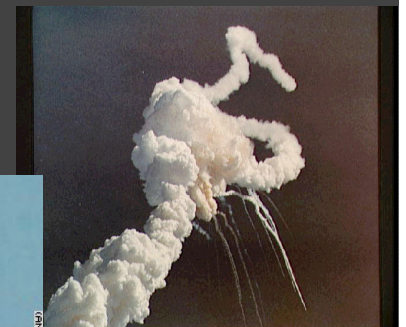
## Fatalities – U.S. Scheduled Airlines (> 10 million departures per year)

Year	Fatal Accidents	Deaths
2002	0	0
2003	2	22
2004	1	12
2005	3	22



## **HRO is not “Perfect Reliability” Nearly Failure-free is NOT Absolute**

- **High reliability organizations rarely do have accidents (sometimes catastrophically)**
- **Most accidents have substantial organizational roots even in an HRO**
- **High reliability/safety is a never-ending process**



# AND... Health Care is Different...



- We do not design or build people; we don't even get the instruction manual
- Alternatives to providing medical care are often untenable, regardless of risk
  - Sometimes can't delay, cancel, "re-route"
- Stronger societal, moral, ethical aspects in health care than in other industries

## Health Care is Different -- Industrial Structure is Very Different

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- Health care is extremely decentralized, both in daily ops & in industrial structure
  - $\approx$  22 million operations w anesthesia / yr.
  - $\approx$  6000 hospitals, owned by  $>1000$  firms)
- The work of clinicians is extremely unregulated (the \$\$ are regulated); loose organizational control

## **Key Principles From HRO Theory** **{adapted in part from Sagan}**

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- **Maintain a powerful and uniform culture of safety**
- **Use optimal structures & procedures**
- **Provide intensive and continuing training of individuals and teams**
- **Conduct thorough organizational learning & safety management**



# Current Healthcare Training Not Optimized for Learning



- **Not systematic – has gaps**
- **Training occurs nearly all on real people**
  - But nothing will replace apprenticeship
- **Learners are very (too?) rapidly teachers**
  - “See one, do one, teach one”
- **Focused solely on individuals not teams**
- **Ends abruptly when formal training stops**

# Current Training Not Optimized for Learning

- Experience depends on the patients seen in a given period
- Many situations are handled repeatedly; others only rarely
- The inexperienced receive less hands-on experience to protect patients & their preferences



## Five {good} “F”s of Training in High Reliability Organizations

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- **Frequent** – every year or more often
- **For everyone** – regardless of discipline or domain
- **Forever** – no matter how senior
- **Focused** – about real challenges of individual and team performance
- **Fit into routines of work** – not an “add on”

# Education & Training is a Low Priority in Healthcare

ANNALS OF **SURGERY**  
EDITORIAL

To Simulate or Not to Simulate

What Is the Question?

Sanjeev Dutta, MD,\* David Gaba, MD,† and Thomas M. Krummel, MD\*

- Unlike in other industries, accidents
  - Occur 1 pt. at a time, not hundreds at a time
  - Are often considered personal failings of the individual healer(s) not systems problems
  - Do not often harm high-status workers
  - Do not destroy the means of production



# Pedagogical Challenges to Applying Simulation Optimally



- **Doing simulations well {of any kind}**
- **Applying training (+sims) comprehensively**
- **Integrating different types of simulation-based training**
- **Optimally integrating simulation with other forms of training**

# Simulation is Theater: A Participant in a Simulation is Also an Actor

- **Playing roles:**
  - Primary participant (in the “hot seat”)
  - “First helper”
  - Cross-disciplines
  - Suspension of disbelief
  - Staying in role



## “Realities” are Interleaved

{Dieckmann, Gaba, Rall, In Press *Simul Healthcare*}

Learner  
 Clinician  
 Actor

- Participants in a {e.g. mannequin-based} simulation are:
  - Physically in a {real} place {sim ctr}, often with real human interactions, *but that is*
  - Instantiated by “instructors” for a {real} meaningful socially contextual purpose, *and*
  - That represents {real} patient care “as-if” the simulation were the “real thing”

# Simulation is a “Social Practice”

{Dieckmann, Gaba, Rall, In Press: *Simul Healthcare*}



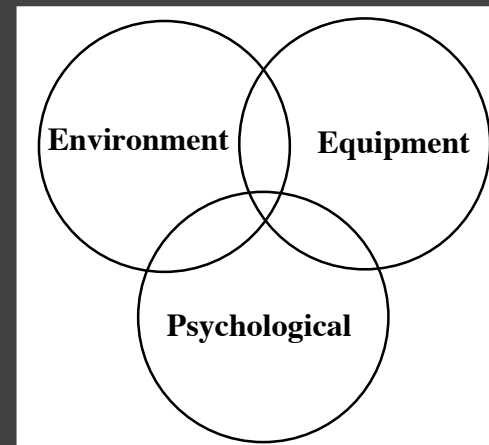
- There is a *social contract* between participants and instructors
- We are allowed to “manipulate them” for the higher purpose of teaching or performance assessment
- This is a serious responsibility
  - Ethical issues in “simulations”
    - » e.g. Stanford Prison Experiment



# What is Reality (or *Fidelity*) in Simulation?

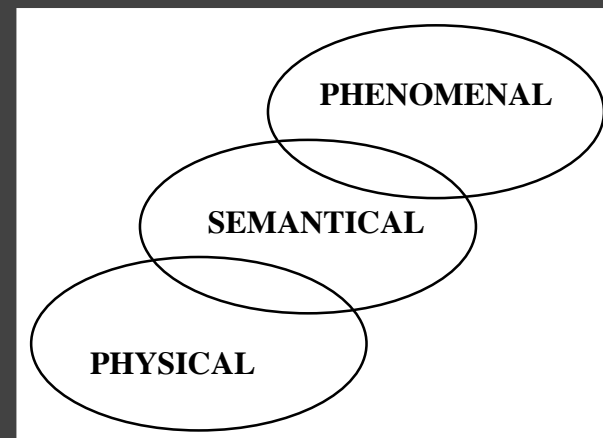
- **Rehmann ↷  
Beaubien & Baker**

(Qual Safety in Healthcar: {Suppl} October, 2004)



- **Uwe Laucken ↷  
Dieckmann, Gaba, & Rall**

(Simul in Healthcare; In Press, 2007)



## Why is Perfect “Reality” Not Always Necessary?

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- **Teaching goals may not require perfect reality at any level**
- **Engagement at a “higher level” is often accomplished with minimal reality at a lower level**
  - **Stories/books/movies are very engaging**
  - **Experienced people can fill in the gaps; the inexperienced may be blissfully ignorant**

## Why is Perfect “Reality” Not Always Desirable?

- Simulations aim to “complement” learning from “real” situations; thus, seek ways to leverage “unreality”, e.g.
  - Cognitive Scaffolding: Instructor in Cues & Clues; Embedded assistance
  - Stop/Pause/Restart/FF/Restore
  - Time compression/expansion
  - “Crash protection” {Fly underground} = “Death Spiral Disable” in pt. simulation

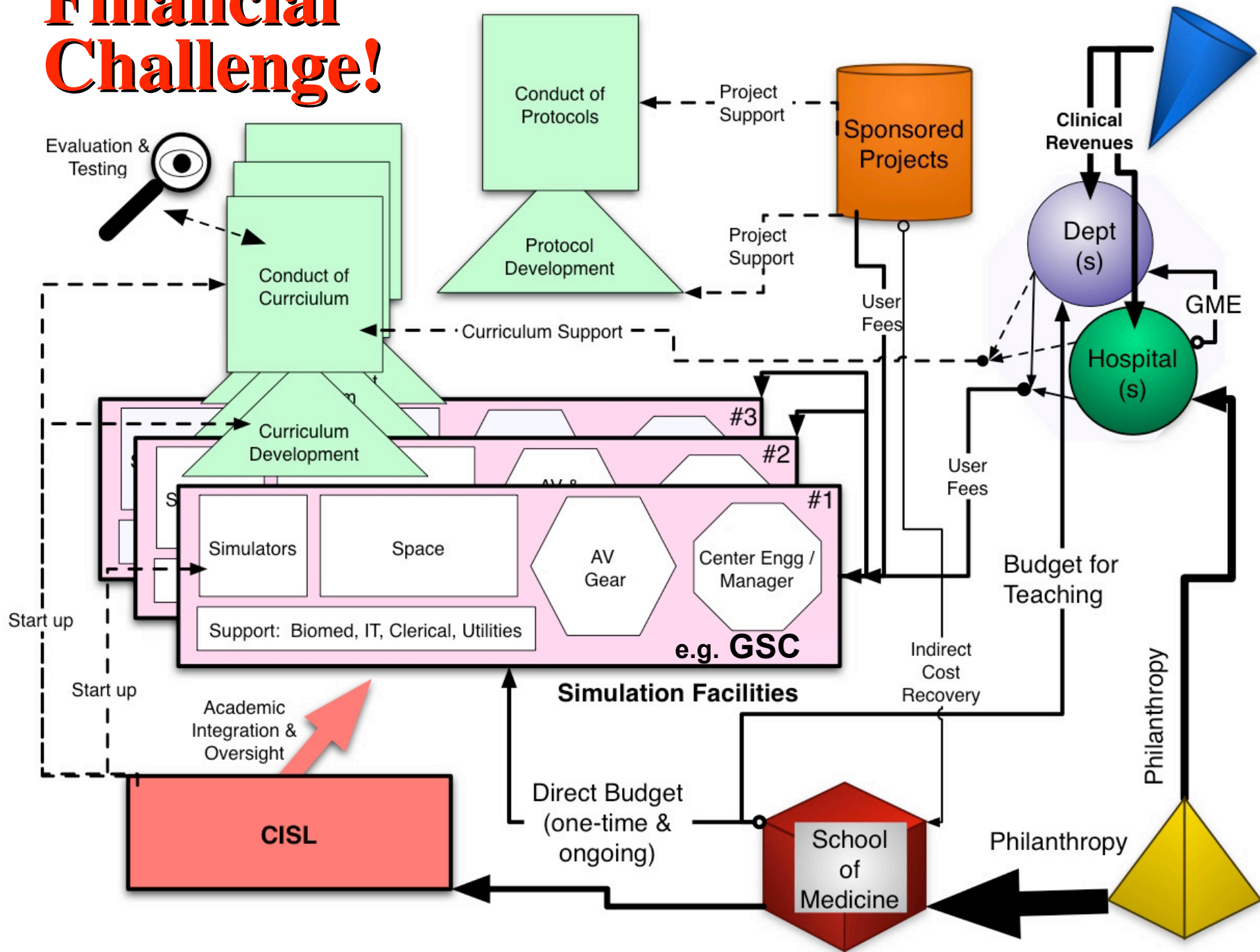


## Cultural/Organizational Challenges to Simulation's Impact

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- **The (real) clinical world must reinforce what is taught in (simulation) training -- *currently it often does not***
  - **Design and culture trump training (always!)**
  - **Much more time spent in real world than in training sessions**
  - **Incentives and disincentives of various kinds play out in the real world**

# Financial Challenge!



Wide agreement capital costs born by philanthropy

Ongoing infrastructure is the tough arena

Agreed that marg. costs of applications born by users

Source of Funds		Categories of Costs																	
		Startup Capital Costs*				Ongoing Costs			Startup		Ongoing Costs					Application & Curriculum		Operational Costs	
		Simulator(s)	Clinical Equipment	A/V Equipment	Mobile A/V	Repairs	Replacement & Upgrades	Capital Upgrades	Software Licensing & Upgrades	Construction or Renovation	Occupancy Cost (if any)	Rent or Manager	Center Clerical	Biomed Eng Support	IT Support	Facility	Facility	Direct costs	Faculty time
R.1 School	Central Sources																		
	Director's Office (Via CISL)						10%	10%		30%	20%	20%	20%	50%	25%	25%			
	Medical Education																		
	Medical student teaching																		
R.2 Department	Medical student teaching																		
	Medical student teaching						20%	10%	20%		10%	20%	20%	10%	10%	50%	50%	100%	100%
	Medical student teaching																		
	Medical student teaching																		
R.3 Hospital	Medical student teaching																		
	Resident training																		
	Physician-faculty training																		
	Clinical teams training						20%	10%	20%		10%	20%	20%	10%	10%	50%	50%	50%	50%
R.4 Grant	GME Funds																		
	Management / insurance																		
	Joint with Departments for clinical teams		10%		10%		20%	10%	20%		10%	20%	20%	25%	10%	50%	50%	10%	10%
	Medical student teaching																		
R.5 Phila	Medical student teaching																		
	Medical student teaching																		
	Medical student teaching																		
	Medical student teaching																		
Direct support		90%	75%	75%	75%				100%										
Endowment						20%	30%	10%		30%			25%	10%	25%	25%			
In-kind support		10%	15%	25%	15%		20%												

Categories of Funds

\* For New Facilities like the Immersive Learning Center in the LKC

X% = Estimate of fraction of support for cost category summed across user fees from this entire block of users

Y% = Estimate of fraction of support for this revenue source compared to all others

## Simulation in Healthcare –2007 Where are We Today?

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- Many hospitals/medical schools have sim centers or simulators (*in-situ*), but..
  - Simulation is commonplace only in pockets of locale, domain, & discipline
  - Content coverage is sparse
  - The number of clinicians who have been through a meaningful simulation is probably  $< 50,000$  out of a total of  $> N \times 10^6$

## **Does Simulation “Work”?**

### **What does it mean “to work”?**

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- **Can it present a meaningful, socially contextual experience? YES**
- **Can it engage learners “as-if” real? USUALLY**
- **Can it teach/assess the target issues? OFTEN**
- **Does it change performance or behavior of individuals or teams? MAYBE**
- **Does it change patient outcome? HARD TO TELL**



## Does Simulation Work? Surgery

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- In surgery, several studies suggest that
  - Simulation training speeds learning & improves safety for early learners of laparoscopic surgery (esp. chole), BUT...
    - » Meta-analyses are equivocal
    - » Uncertain of effects for experienced surgeons, or for other operations

## Does Simulation Training Improve Safety?

- For complex endovascular procedures, the FDA seems to think so...
  - Not level 1A evidence or meta-analyses, but... a novel procedure & implanted device with palpable risk



### Approval of Virtual Reality Training for Carotid Stenting

What This Means for Procedural-Based Medicine

Anthony G. Gallagher, PhD

Christopher U. Gates, MD

**JAMA**<sup>®</sup>

## Does Simulation Training Improve Safety?

- **For mannequin-based & team simulation**
  - Many types of qualitative data and small studies of isolated applications
  - Definitive proof for many applications may be impossible due to logistics and cost
  - **Real test requires long-term adoption of comprehensive, integrated model of career-long (sim-based) training, with evaluation over long time horizon**

## **If “Low-Reliability” is a “Disease” it Requires Long-term Sustained Therapy**

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- **Who would treat hypertension to reduce negative cardiovascular events like this:**
  - Use a low dose of a given antihypertensive
  - 3 - 5x per week (variable compliance)
  - 1 - 3 weeks per year
  - In between, heighten stress, take cocaine, eat high fat, high salt diet, stay sedentary

## **The Use of Simulation Has Been Similar** (with some exceptions, a few here @ Pitt)

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- **Rare - occasional training sessions -- often with low-impact curriculum**
- **Rarely coupled with programs of performance assessment**
- **In only a few disciplines/domains**
- **Little training/assessment for “experienced” personnel -- mostly aimed at “trainees”**

## Structural Issues: Who Pays for the “Proof”?

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- **In clinical trials, often the manufacturer**
  - Large companies, huge research budgets, many trials but few successes is “usual”
  - Huge profits for successful drugs
- **Simulator manufacturers or centers are:**
  - Small, on tiny margins, not used to many expensive trials with few successes
  - No “blockbusters”, few “lock” patents even if trials are successful

## **Who Pays for the “Proof”? How about the “Government” (NIH)?**

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- **For some diseases the NIH does fund large and long trials (NCI, NHLBI)**
  - **Very few as long, large, and hard to control as the definitive simulation studies**
  - **AHRQ currently covers quality & safety but with tiny budget relative to NIH**
  - **No agency covers clinical education rsch**
  - **To-date small \$\$ & short limited studies**

## Incidentally: What is the Evidence for Simulation in Commercial Aviation?

- **There is mandatory yearly training & checking of flying performance**
  - Studies can be grafted onto these activities
- **Nothing like level 1A evidence**
  - No randomized trials; would probably be considered unethical to conduct trials
  - {pilots are 1st ones at an accident}





# The future vision of simulation in health care

D M Gaba

Qual Safety in Healthcar: {Suppl} October, 2004



- **11 dimensional space describing simulation applications 4 - 40 x 10<sup>6</sup> cells**
- **What will the history of the next 20 years (now 17) look like from 2025?**
  - **Optimistic view**
  - **Pessimistic view**

"All the News  
That's Fit to Print"

# The New York Times

Late Edition  
New York Today, news columns on  
p. 10; High 10; Tonight, classic programs,  
p. 41; Tomorrow, classic, world,  
middle, high 41; Tomorrow, high 39,  
p. 28; Weather, p. 10; Page 18.

VOL. CLII... No. 5147

NEW YORK, WEDNESDAY, JANUARY 1, 2025

2025

TEN DOLLARS

## Simulation Key to Progress in Health Care Safety

### The Power of Theater

By **Benedikt David Rall**



Patient safety was first recognized as an important single focus in the late 1990s. Over the last 25 years there has been slow but steady progress toward the “zero vision” goal of “no patient injuries by medical care.” In the current era these risks have finally dropped to the level of risk the public accepts in transportation, including the hypersonic aircraft and sub-oceanic maglevs.

A critical component of this success story is the widespread use of simulation techniques

## Mars Explorers to Land Next Week

A preview of the exploration  
(First of three parts)



By **Rachel Damewood Howard**

Since its launch in 2019 the work of the crew of Mars 1 exploration vessel has been purely routine and of little interest to most of mankind. With the upcoming landing on the surface of Mars of the first human explorers, interest is growing rapidly. Although public attention has been focused on the spectacle of this upcoming milestone of human achievement, the scientific goals and methods for the mission have largely been forgotten.

The current surface and atmosphere of Mars is now well understood after more than 30 years of unmanned probes and samples returned to Earth.

"All the News  
That's Fit to Print"

# The New York Times

Late Edition

New York Today, news columns on  
p. 10; Tonight, about 20 minutes,  
p. 41; Tomorrow, about 10  
minutes, p. 41; Yesterday, p. 10;  
p. 20; Weather, p. 10; Page 10.

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2025

TEN DOLLARS

## Simulation Training a Costly Failure for Health Care Safety

Why it worked for aviation and  
maglevs but not in health care

By **Benedikt David Rall**

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One sad story in the development of patient safety has been the abject failure of simulation techniques to contribute effectively to patient

## Mars Explorers to Land Next Week

A preview of the exploration  
agenda (first of three parts)

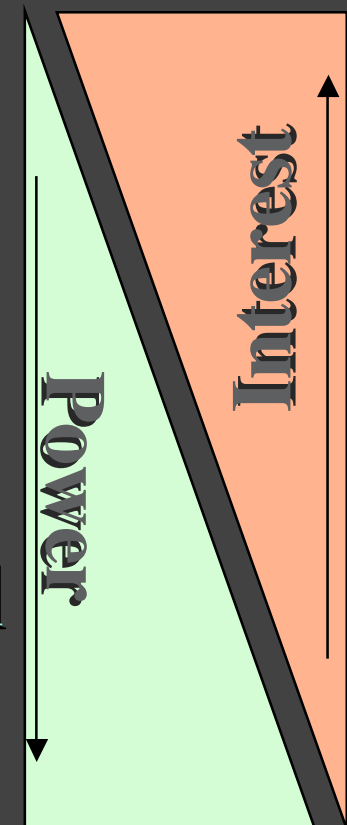
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# Potential Drivers for Further Adoption of Simulation in Health Care

- Simulation community
- Professions
- Insurers / risk managers
- Payors for medical care
- Government - local/state/federal
- Public



# Potential “Implementors” of Simulation Activities or Requirements

- Professional societies  
- Specialty boards (Colleges) 
- Hospitals/networks   
- Professional schools
- Accreditors (JC) 
- Government - regulators / legislators 
- Simulation organizations 

# How Do We Engage the Public?

{I don't have the magic answer}



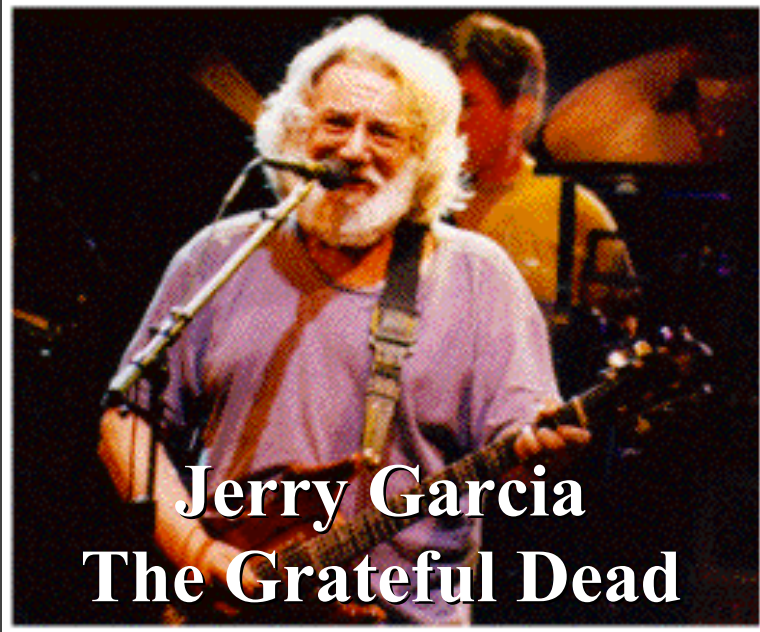
- **If the public really knew the difference in training & assessment between aviation & healthcare, would they care?**
  - Historically, public more interested in access to & cost of care than in quality
  - Everyone wants to save money on everybody else's healthcare (Wildavsky)
- **How do we attract them without unduly scaring them? {counterproductive}**

## Bottom Line

- ...no industry in which human lives depend on the skilled performance of responsible operators has waited for unequivocal proof of the benefits of simulation before embracing it... Neither should anesthesiology {health care} (Gaba, Anesthesiology 76:491-494, 1992)

*And whoever saves a life, it is as though he had saved  
all mankind*

(appearing in various forms in the Talmud & the Koran)



Jerry Garcia  
The Grateful Dead

Role of Leaders in  
“Somebody has to do  
the Simulation Vision?  
something and it is just  
incredibly pathetic it  
has to be us.”

— Jerry Garcia of  
The Grateful Dead

(Quote & Photo courtesy of M. Hindery)

“History’s page will be  
neatly carved in stone.  
The future’s here, we are it,  
we are on our own.”

— From “Throwing Stones,”  
1982, Lyrics by John Barlow,  
Music by Bob Weir, played by  
The Grateful Dead



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The End