



*ISQua's 5<sup>th</sup> International Summit on Indicators Paris November 4-5, 2002*

Vahé A. Kazandjian, Ph.D., MPH  
 President, Center for Performance Sciences, Inc.  
 Elkridge, Maryland  
 A/ Professor  
 The Johns Hopkins University School  
 of Hygiene and Public Health  
 Baltimore, Maryland



*When Do You Think It Started?*

Babylon nearly 4,000 years ago, during the reign of Hammurabi. The penalty for surgeons who failed to meet the government's standard of care was straightforward: "If a physician shall make a severe wound with an operating knife and kill [the patient] or shall open an abscess with an operating knife and destroy the eye, [the surgeon's] hand shall be cut off."



*The first "benchmarking" on processes?*

Using his authority as Klein's assistant, Semmelweis instituted the simple measure of washing the hands in a chlorine solution until the skin was slippery and the cadaver smell was gone. In 1848, the first full year of this prophylaxis, Division I had a puerperal death rate of 1.2 percent and Division II of 1.3 percent, completely comparable and unprecedented.

From "Doctors: The Biography of Medicine." Shermin Nuland, Vintage Books, 1988.



In April 1847, the last month without hand-washings, the percentage of postpartum mothers who had died (quite literally) at the hands of their doctors had been 18.3 percent. The cause and prevention of puerperal fever was thus established.

From "Doctors: The Biography of Medicine." Shermin Nuland, Vintage Books, 1988.

Table 1. Compliance with hand hygiene in different hospital settings.

Year	Setting	Average compliance	Author	Ref.
1981	Open ward	16%	Preston	11
	ICU	36%		
1981	ICUs	41%	Albert	5
	ICUs	28%		
1983	All wards	45%	Larson	12
1987	PICU	30%	Donowitz	13
1990	ICU	32%	Graham	6
1990	ICU	81%	Dubbert	14
1991	SICU	51%	Pottinger	15
1992	NICU/others	29%	Larson	16
1992	ICUs	40%	Deobbeling	7
1992	ICUs	40%	Zimakoff	17
1994	Emergency room	32%	Moengs	18
1999	All wards	48%	Pittet	9
	ICUs	38%		

ICUs = intensive care units; PICU = pediatric ICU; NICU = neonatal ICU.

Source: Pittet D. Improving adherence to hand hygiene practice: a multidisciplinary approach. *Emerg Infect Dis.* Mar-Apr 2001;7(2):234-240



*"Scotts believe death is imminent. Canadians, on the other hand, believe death is inevitable. Americans believe death is optional. And the approach to health care . . . Expectations and use . . . Reflect these points of view"*

Ian Morrisson  
 Institute for the Future, Palo Alto

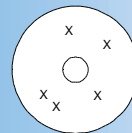


*If errors are predictable, how come we are not avoiding them?*

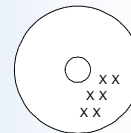


Variable and Constant Errors

Unpredictable



Accurate



**The Medication Error World in Two Dimensions**

<p style="text-align: center;">% <b>Right Things WRONG</b></p> <ul style="list-style-type: none"> <li>✓ Dose (magnesium sulfate IV drip 100mg/ml @30ml drip/hour volume vs. rate of infusion)</li> <li>✓ Time (lispro insulin → no more than 15 min. before meals)</li> </ul>	<p style="text-align: center;">%</p> <p style="text-align: center;"><b>Right Things RIGHT</b></p>
<p style="text-align: center;">% <b>Wrong Things WRONG</b></p> <ul style="list-style-type: none"> <li>✓ Prescribing (indications, allergies, route, concentration, etc.)</li> <li>✓ Monitoring (review regimen for appropriateness)</li> </ul>	<p style="text-align: center;">% <b>Wrong Things RIGHT</b></p> <ul style="list-style-type: none"> <li>✓ Prescribing, time, monitoring, dose, etc . . . Error but;</li> <li>✓ No patient harm; and,</li> <li>✓ Good/expected outcomes.</li> </ul>

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Patient safety and learning about errors (actual or potential) has become a passionate pursuit in recent years.



*“ALL PASSIONS EXAGGERATE;  
it is because they exaggerate that  
they are passions”*

—Chamfort



Some have suggested that the question of errors has been taken out of context, even exaggerated.



*We learn from our mistakes.*



*N a a h!*



### *Candidate Denominators for Medication Error*

- Number of orders written
- Number of doses dispensed
- Number of doses written and number of doses omitted
- Number of doses administered

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### *Medication Errors (ME): A Global Formulation of Institutional Performance*

$$\frac{\text{Institutional Performance Profile}}{\# \text{ of ME}} = \% \text{ ADE due to ME}$$

The % ADE due to ME can be estimated through a point prevalence study or chosen from available literature. (e.g., 1/5 to 1/7)

<b>Key</b>
ADE = Adverse Drug Effect
ME = Medication Errors

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### *Inter-Institutional Comparison*

- Cannot be achieved if error is variably defined.
- Numerators alone do not adjust for risk.
- "Risk" as the denominator, can be formulated in many ways.
- An Adverse Drug Effect (ADE) rate means little if the goal is to assist institutions improve their process.

Thus, we need a rate and some comparison statistic that relates an outcome to a process and shows magnitude of difference between institutions.

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### *Inter-Institutional Comparisons (cont.)*

Assume:

- Outcome is HARM.
- Process is dispensing of prescribed drugs.
- Medication error has been identified.

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### The Relationship Between ME and ADE At the Institutional Level

	ME	Without ME
ADE	2 (a)	0 (b)
Non-ADE	8 (c)	10 (d)

Predictive Value of an ADE =  $\frac{a}{a+b} = \frac{2}{2+0} = 100\%$   
 Predictive Value of a Non-ADE =  $\frac{d}{c+d} = \frac{10}{8+10} = 55\%$   
 Accuracy =  $\frac{a+d}{a+b+c+d} = \frac{12}{20} = 60\%$   
 Sensitivity =  $\frac{a}{a+c} = \frac{2}{10} = 20\%$   
 Specificity =  $\frac{d}{b+d} = \frac{10}{10} = 100\%$   
 Prevalence =  $\frac{a+c}{a+b+c+d} = \frac{10}{20} = 50\%$

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### Validity of Indicator

	ADE	Non-ADE
Error	a	b
Non-Error	c	d

Sensitivity =  $\frac{A}{A+C}$  (Ability to identify outcomes correctly)  
 Specificity =  $\frac{D}{B+D}$  (Ability to recognize the absence of an outcome correctly)

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### Validity of Indicator (cont.)

	ADE with harm	Non-ADE without harm
Error	a	b
Non-Error	c	d

Sensitivity =  $\frac{A}{A+C}$

This table can be replicated for each of the error severity types.

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