Fenice

Gruppo italiano per la ricerca clinica in Medicina d'Urgenza



Decidere nell'incertezza

Vincenzo CRUPI

Università di Torino

5 novembre 2026

ISTITUTO DI RICERCHE FARMACOLOGICHE MARIO NEGRI - IRCCS

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Decidere nell'incertezza
Gruppo FENICE
novembre 2026



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$$5 \times 2 = ?$$

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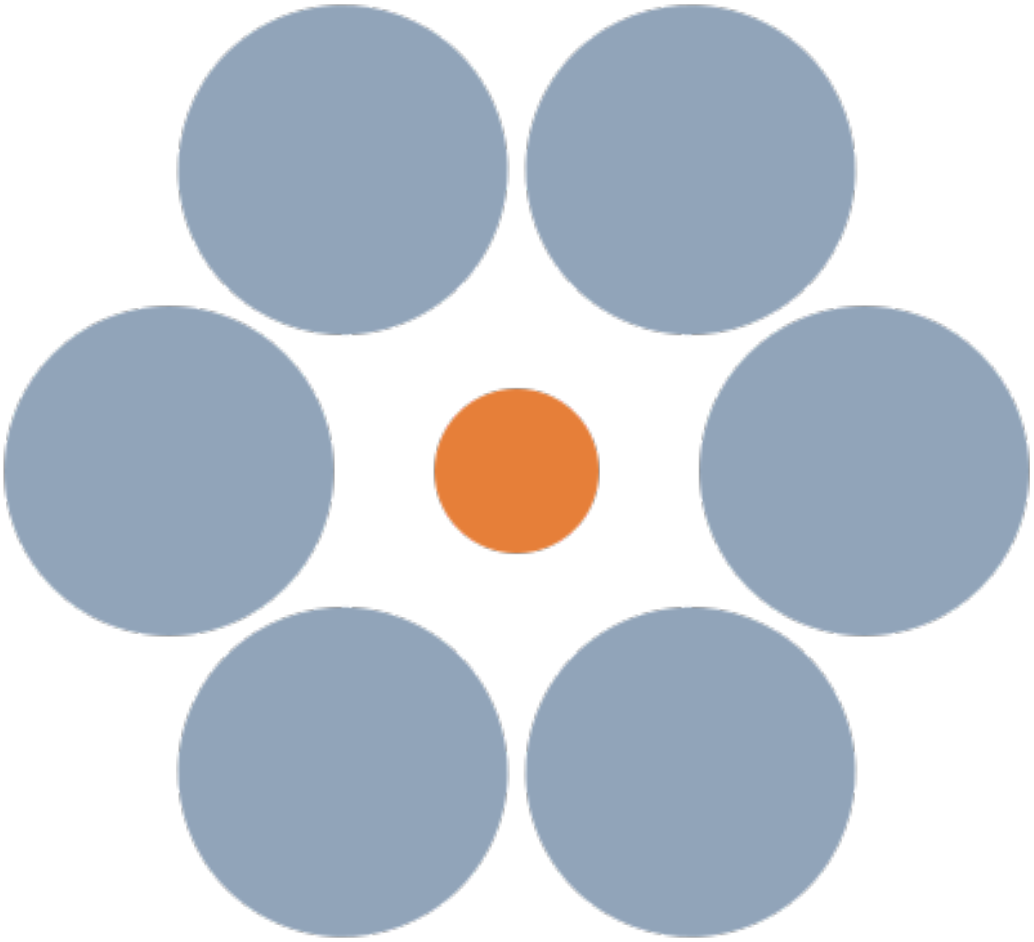



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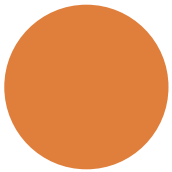

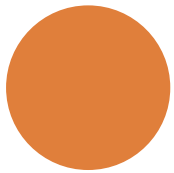

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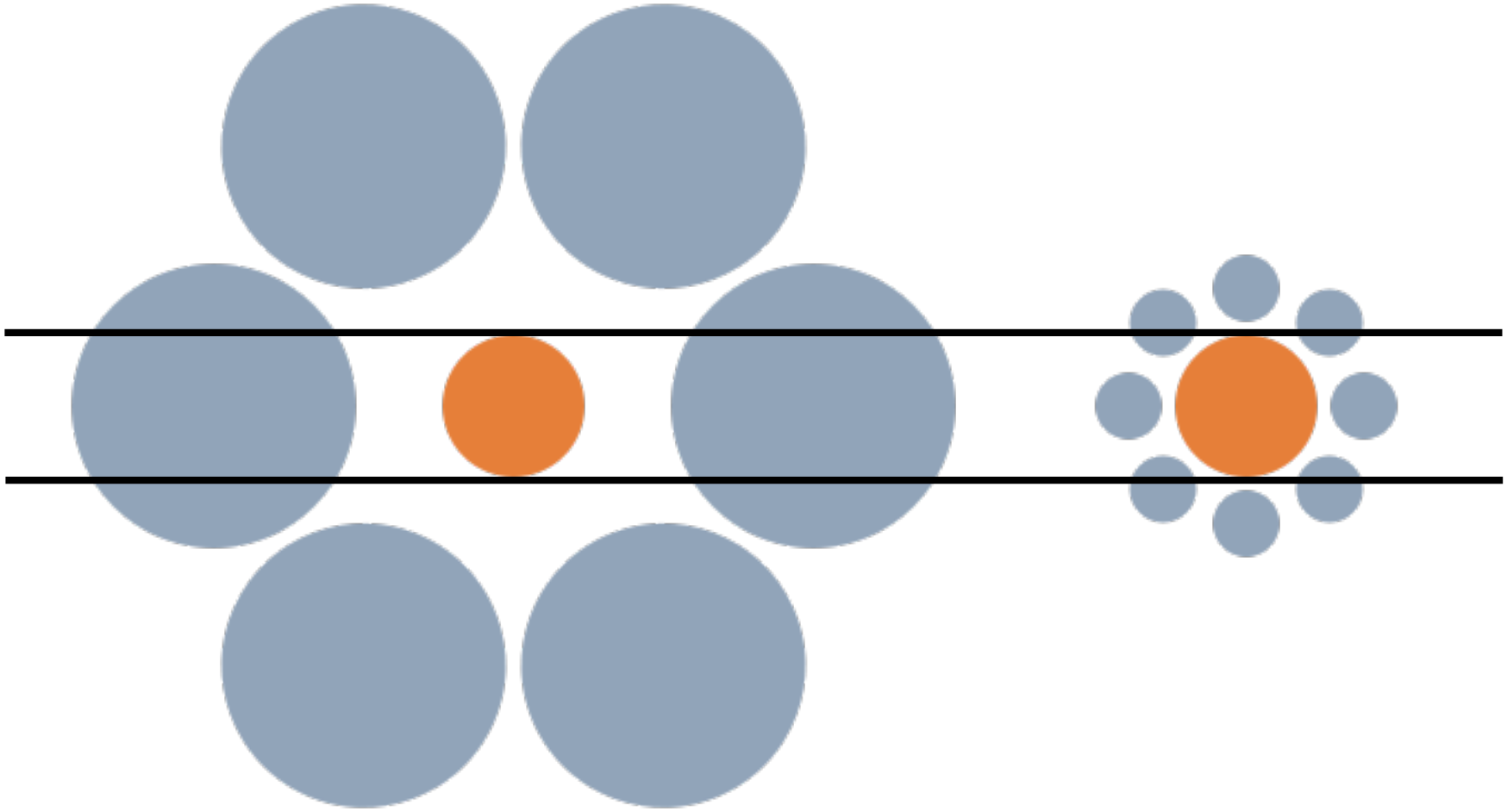
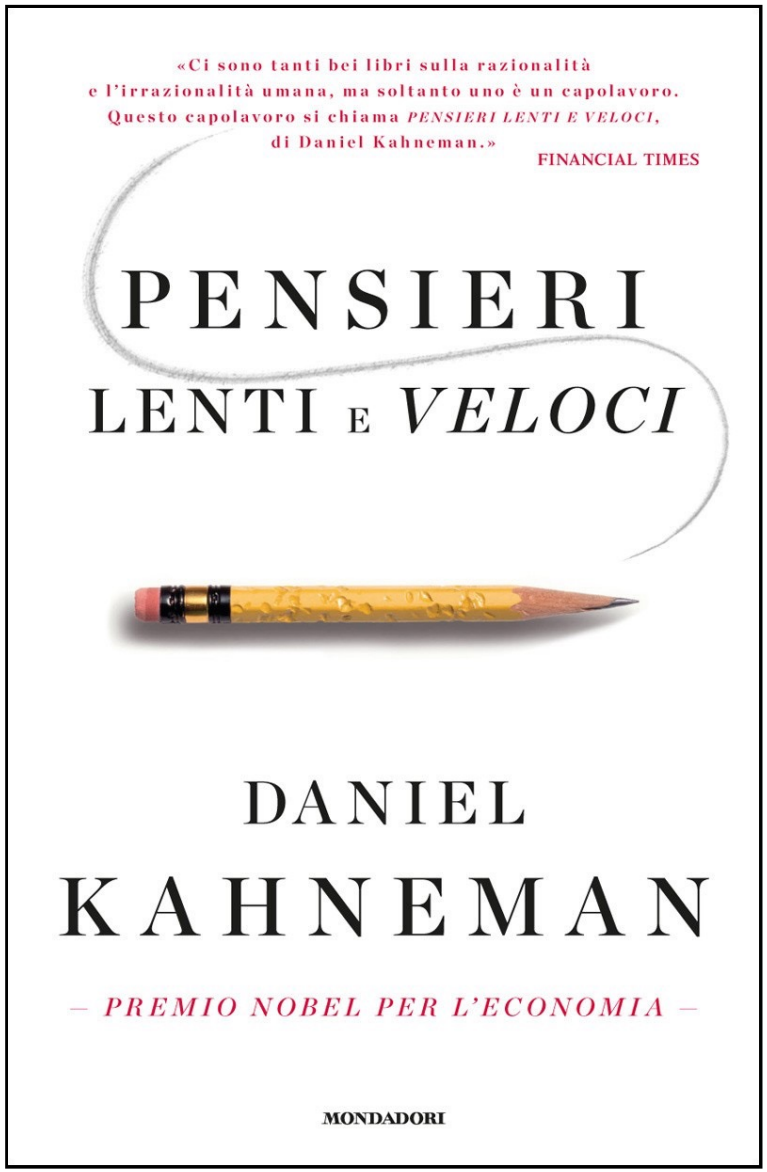


Una racchetta e una pallina costano, insieme, 110 euro.
La racchetta costa 100 euro di più della pallina.
Quanto costa la pallina?


«Ci sono tanti bei libri sulla razionalità
e l'irrazionalità umana, ma soltanto uno è un capolavoro.
Questo capolavoro si chiama PENSIERI LENTI E VELOCI,
di Daniel Kahneman.»
FINANCIAL TIMES
PENSIERI
LENTI E VELOCI
DANIEL
KAHNEMAN
— PREMIO NOBEL PER L'ECONOMIA —
MONDADORI

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test diagnostici

Per donne asintomatiche fra i 40 e i 50 che participano al programma di *screening* mammografico nella regione in cui operi sono disponibili le informazioni seguenti:

– La probabilità che una di queste donne abbia il cancro è dell'1%.
– Se una donna ha il cancro, c'è l'80% di probabilità che la mammografia sia positiva.
– Se una donna *non* ha il cancro, c'è una prob del 10% che la mammografia sia positiva.

Immagina una di queste donne, fra i 40 e i 50 anni, asintomatica, e sottoposta a *screening*, la cui mammografia è risultata positiva.

Alla luce del test, qual è a tuo parere la probabilità che abbia veramente un cancro al seno?

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Alla luce del test, qual è a tuo parere la probabilità che abbia veramente un cancro al seno?

Seleziona la stima che consideri più accurata:

☐ 1%

☐ 10%

☐ 50%

☐ 80%

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test diagnostici

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Alla luce del test, qual è a tuo parere la probabilità che abbia veramente un cancro al seno?

Seleziona la stima che consideri più accurata:

☐ 1%	14%
☐ 10%	27%
☐ 50%	18%
☐ 80%	41%

Intern Emerg Med (2018) 13:449–451
https://doi.org/10.1007/s11739-017-1763-0

CE - CLINICAL NOTES

Understanding and improving decisions in clinical medicine (III): towards cognitively informed clinical thinking

Vincenzo Crupi[1] · **Fabrizio Elia**[2] · **Franco Aprà**[2]

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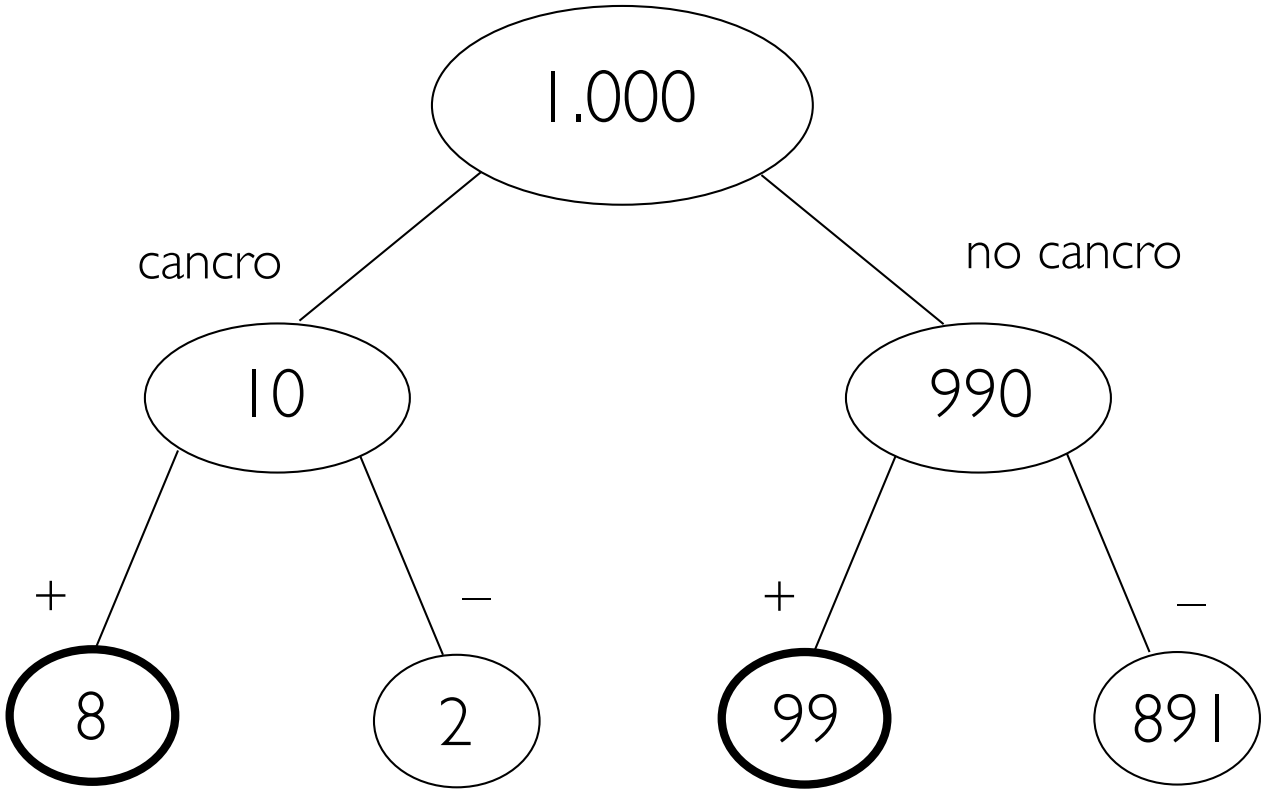
Clinical judgment under uncertainty

Clinical practice is often associated with judgment and with uncertainty, and rightly so. Since the logic of uncertainty is probability theory, understanding clinical judgment requires consideration of how clinicians assess probabilities. Suppose, for instance, that you are involved in a mammography screening program for the early detection of breast cancer. A 50-year-old woman with no symptoms has a positive test result. The pretest probability of breast cancer in her age group is 1%, and the sensitivity and specificity of the test are striking and unsettling when researchers first found out that physicians' intuitive assessments were largely off the mark. As early as 1982, David Eddy (credited for having introduced the expression "evidence-based medicine"), reported that physicians' estimates of breast cancer turned out to be mistaken by up to one order of magnitude: close to 80%, the correct answer being about 7.5% (see below) [1].

The cognitive mechanism leading to so high an estimate is a variant of so-called *representativeness heuristic*. Many clinicians derive their inflated judgment of the positive predictive value—*P*(cancer|test+)—from the consideration that



$$Pr(\text{cancro}|+) = \frac{8}{8 + 99} = 7{,}5\%$$

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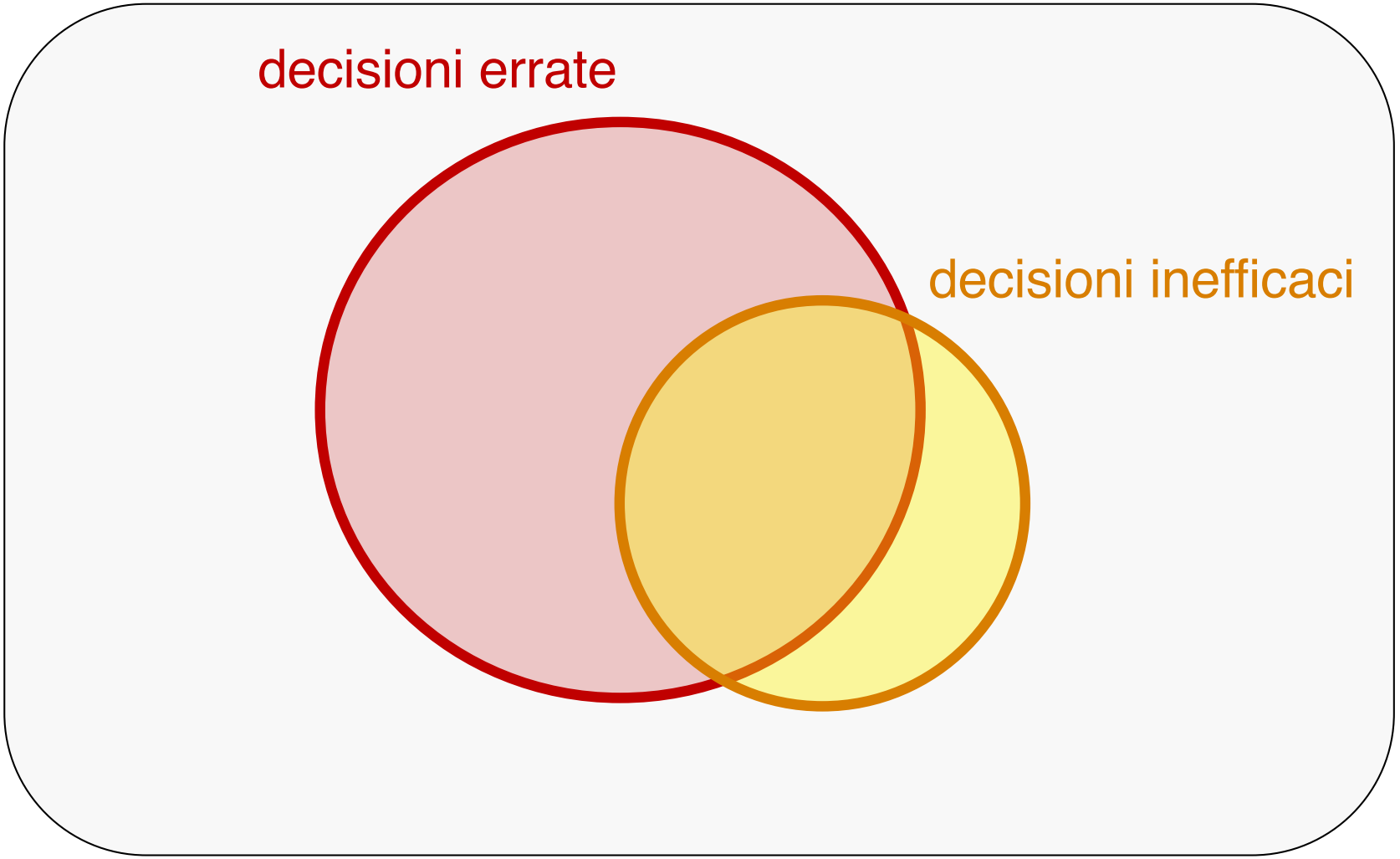
decisioni cliniche



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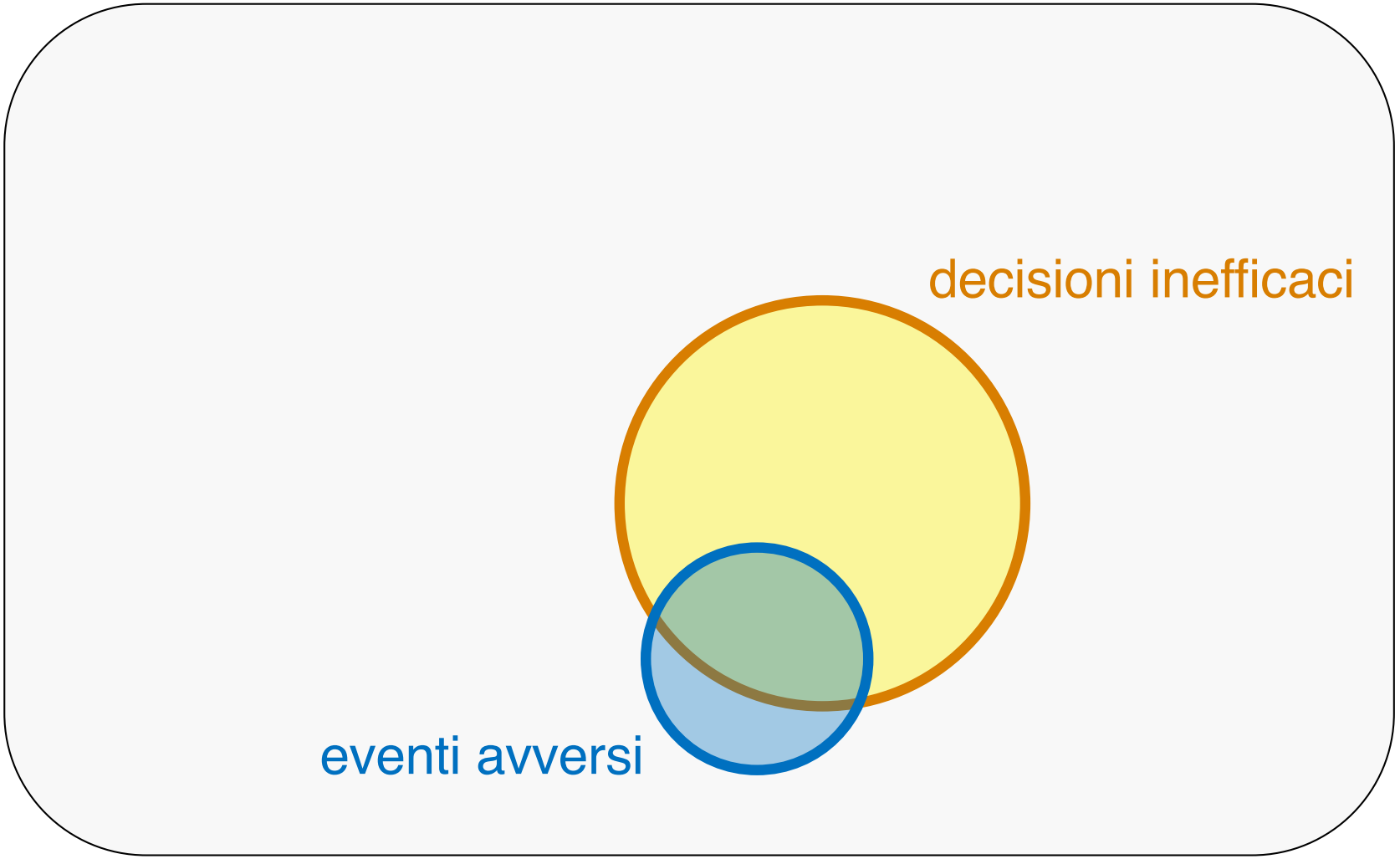
decisioni cliniche



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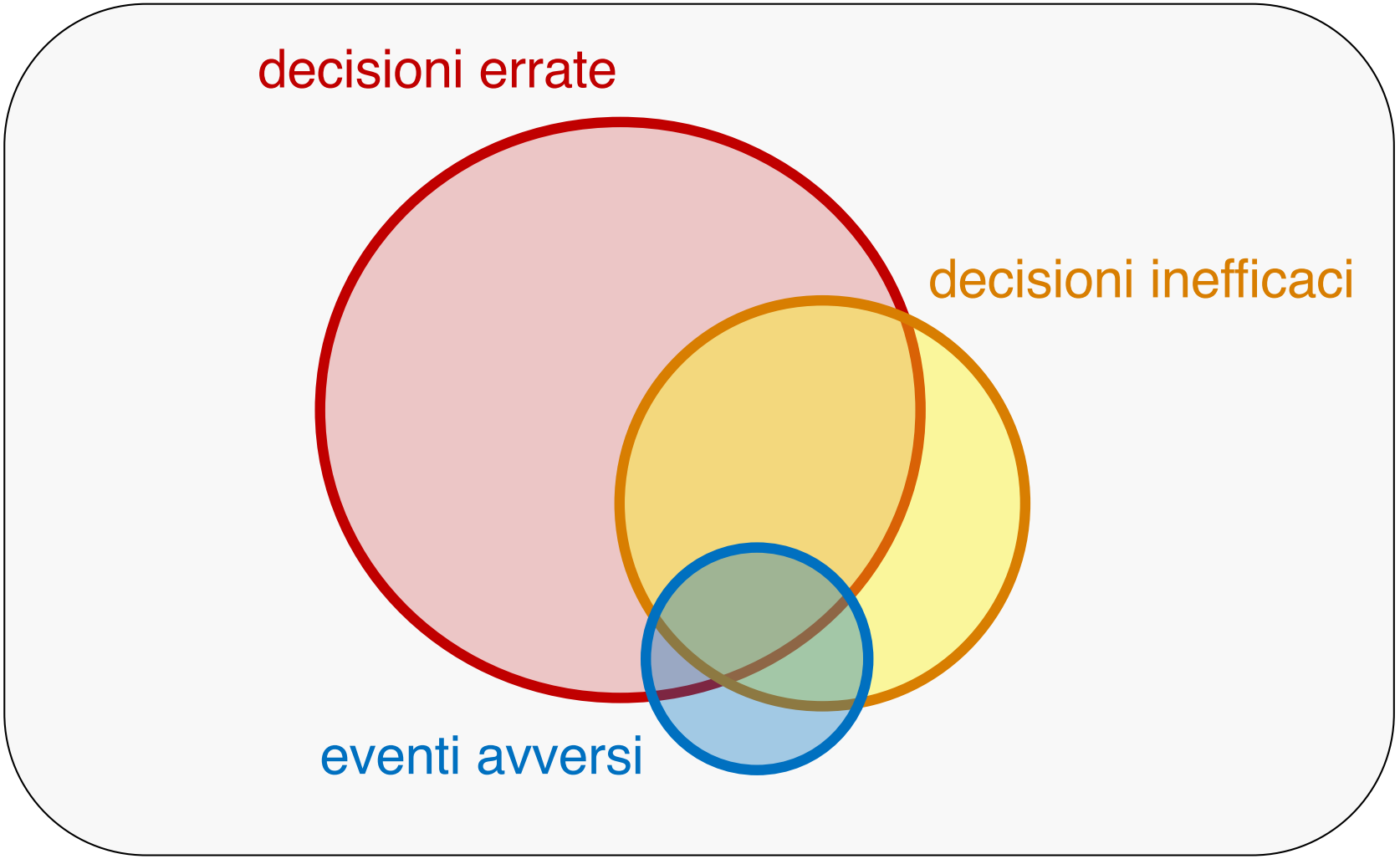
decisioni cliniche



il senno di poi

Due casi di una stessa operazione chirurgica (es., un taglio cesareo) nei quali viene effettuato un certo intervento anestesiologico (es., anestesia spinale). Supponiamo che i due casi siano fra loro identici (condizioni cliniche della paziente, tipo di intervento praticato, dosi impiegate ecc.), tranne che per un aspetto: in un caso si verifica una complicazione che produce un esito clinico avverso temporaneo (per esempio, un arresto cardiaco durante l'operazione, a seguito del quale la madre e il neonato si riprendono pienamente); nell'altro caso, invece, lo stesso tipo di complicazione produce un esito clinico avverso permanente (per esempio, l'arresto cardiaco causa la morte della partoriente e danni cerebrali al neonato).

Ventuno coppie di casi simili a quella appena descritta, centododici anestesisti divisi in due gruppi. Per ciascuna delle ventuno coppie di casi, uno dei due gruppi, selezionato casualmente, riceveva il caso con esito avverso temporaneo; l'altro gruppo riceveva invece il caso con esito avverso permanente.

Risultati: Nel 71% delle coppie di casi (15 su 21) la valutazione è stata prevalentemente positiva ("intervento appropriato") se il danno descritto era temporaneo, e prevalentemente negativa ("intervento inappropriato") se il danno descritto era permanente

Caplan, R.A., Posner, K.L.., Cheney, F.W., "Effect of Outcome on Physicians' Judgements of Appropriateness of Care", *Journal of the American Medical Association* (1991), 265, pp. 1957-60

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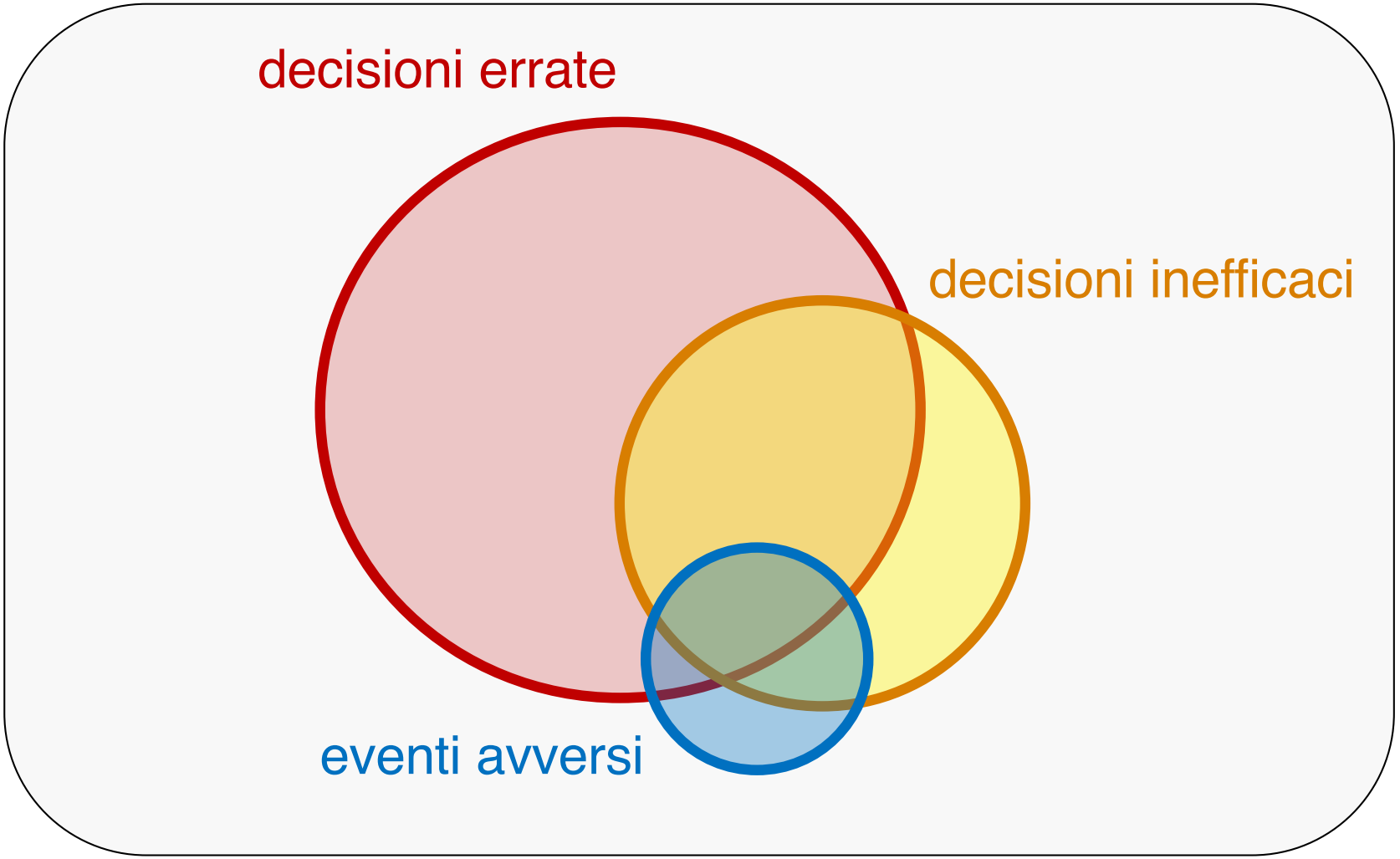
COME STANNO LE COSE

decisioni cliniche



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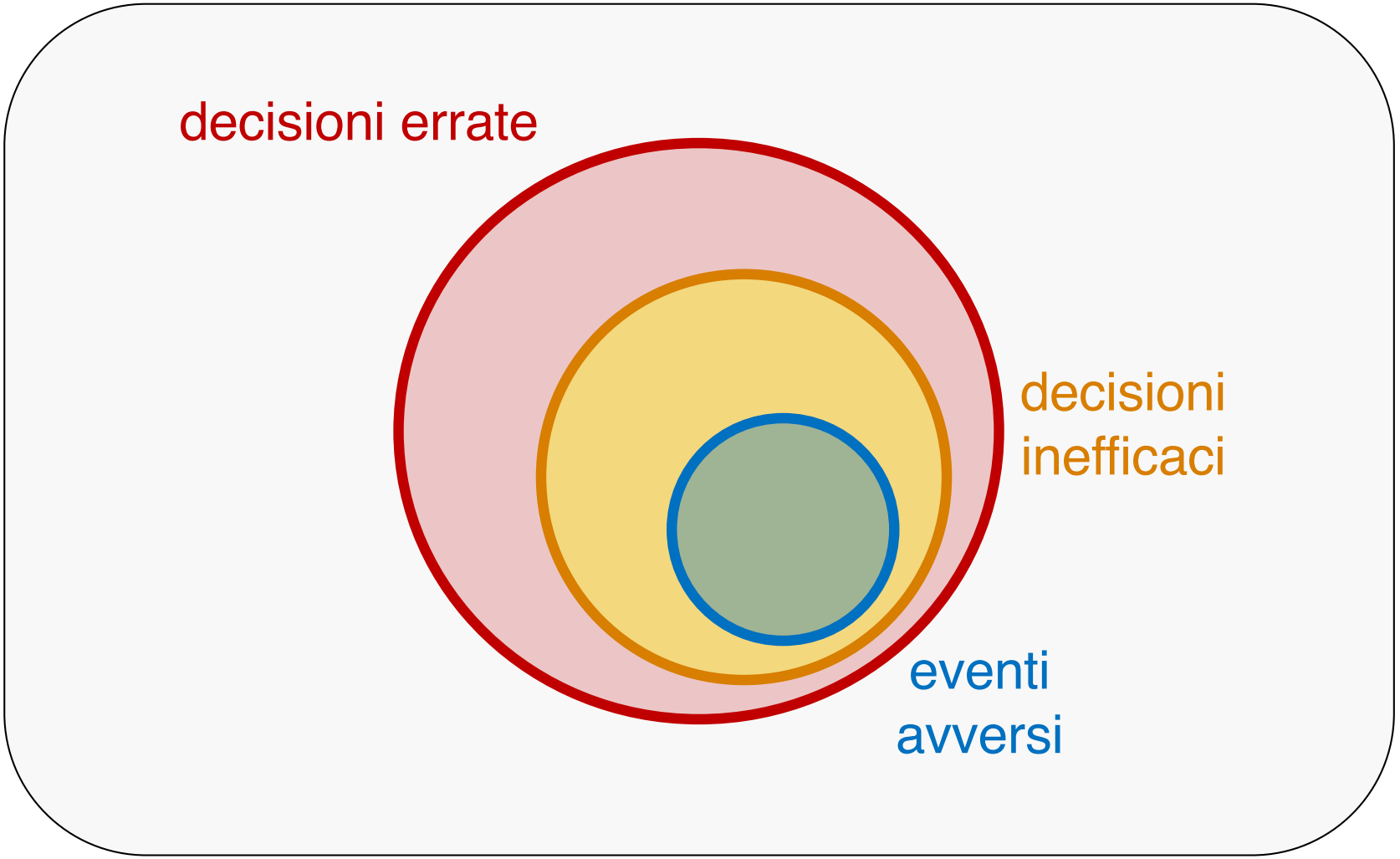
CHE COSA CI DICE L'INTUIZIONE…

decisioni cliniche



Changes in Rates of Autopsy-Detected Diagnostic Errors Over Time

A Systematic Review

Kaveh G. Shojania, MD
Elizabeth C. Burton, MD
Kathryn M. McDonald, MM
Lee Goldman, MD, MPH

Context Substantial discrepancies exist between clinical diagnoses and findings at autopsy. Autopsy may be used as a tool for quality management to analyze diagnostic discrepancies.

Objective To determine the rate at which autopsies detect important, clinically missed diagnoses, and the extent to which this rate has changed over time.

Data Sources A systematic literature search for English-language articles available on MEDLINE from 1966 to April 2002, using the search terms *autopsy*, *postmortem changes*, *post-mortem*, *postmortem*, *necropsy*, and *posthumous*, identified 45 studies reporting 53 distinct autopsy series meeting prospectively defined criteria. Reference lists were reviewed to identify additional studies, and the final bibliography was distributed to experts in the field to identify missing or unpublished studies.

Study Selection Included studies reported clinically missed diagnoses involving a primary cause of death (major errors), with the most serious being those likely to have affected patient outcome (class I errors).

Data Extraction Logistic regression was performed using data from 53 distinct autopsy series over a 40-year period and adjusting for the effects of changes in autopsy rates, country, case mix (general autopsies; adult medical; adult intensive care; adult or pediatric surgery; general pediatrics or pediatric inpatients; neonatal or pediatric intensive care; and other autopsy), and important methodological features of the primary studies.

Data Synthesis Of 53 autopsy series identified, 42 reported major errors and 37 reported class I errors. Twenty-six autopsy series reported both major and class I error rates. The median error rate was 23.5% (range, 4.1%-49.8%) for major errors and 9.0% (range, 0%-20.7%) for class I errors. Analyses of diagnostic error rates adjusting for the effects of case mix, country, and autopsy rate yielded relative decreases per decade of 19.4% (95% confidence interval [CI], 1.8%-33.8%) for major errors and 33.4% (95% [CI], 8.4%-51.6%) for class I errors. Despite these decreases, we estimated that a contemporary US institution (based on autopsy rates ranging from 100% [the extrapolated extreme at which clinical selection is eliminated] to 5% [roughly the national average]), could observe a major error rate from 8.4% to 24.4% and a class I error rate from 4.1% to 6.7%.

Conclusion The possibility that a given autopsy will reveal important unsuspected diagnoses has decreased over time, but remains sufficiently high that encouraging ongoing use of the autopsy appears warranted.

JAMA. 2003;289:2849-2856 www.jama.com

Author Affiliations: Department of Medicine, University of California, San Francisco (Drs Shojania and Goldman); Department of Pathology and Laboratory Medicine, Baylor Health Care System, Dallas-Fort Worth, Tex (Dr Burton); and Center for Primary Care and Outcomes Research, Stanford University, Stanford, Calif (Ms McDonald).
Corresponding Author and Reprints: Kaveh G. Shojania, MD, Department of Medicine, University of California, 533 Parnassus Ave, Room U137, Box 0131, San Francisco, CA 94143 (e-mail: shojania@medicine.ucsf.edu).

See also Patient Page.

BEGINNING IN 1912[1] AND CONTINUING TO 2002,[2-6] researchers have documented substantial discrepancies between clinical diagnoses and findings at autopsy. Time series from single institutions have examined trends in these diagnostic discrepancies and, with only 1 exception,[7] have found no significant decreases over time.[8-12]

A possible explanation for the stability of these rates is increased selection by clinicians. In 1994, the last year for which national data exist, the autopsy rate for all nonforensic deaths decreased to less than 6%[13] compared with average rates of 30% to 40% in the 1960s.[14] With progressively fewer autopsies performed over time, clinical selection for diagnostically challenging cases might offset true gains in diagnostic accuracy. However, several prospective studies have shown clinicians to have little ability to identify cases that will yield "diagnostic surprises,"[15-18] so clinical selection might exert little effect on rates of autopsy-detected diagnostic errors.

As part of a broader report on the autopsy as a tool for quality measurement and improvement,[19] we systematically reviewed the literature to estimate the fre-

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Diagnostic errors in the intensive care unit: a systematic review of autopsy studies

Bradford Winters,[1] Jason Custer,[2] Samuel M Galvagno Jr,[1] Elizabeth Colantuoni,[3] Shruti G Kapoor,[1] HeeWon Lee,[4] Victoria Goode,[5] Karen Robinson,[6] Atul Nakhasi,[3] Peter Pronovost,[1] David Newman-Toker[7]

► An additional appendix is published online only. To view this file please visit the journal online (http://dx.doi.org/10.1136/bmjqs-2012-000803).

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Accepted 24 June 2012
Published Online First 24 July 2012

ABSTRACT

Context: Misdiagnoses may be an underappreciated cause of preventable morbidity and mortality in the intensive care unit (ICU). Their prevalence, nature, and impact remain largely unknown.

Objectives: To determine whether potentially fatal ICU misdiagnoses would be more common than in the general inpatient population (~5%), and would involve more infections or vascular events.

Data sources: Systematic review of studies identified by electronic (MEDLINE, etc.) and manual searches (references in eligible articles) without language restriction (1966 through 2011).

Study selection and data abstraction: Observational studies examining autopsy-confirmed diagnostic errors in the adult ICU were included. Studies analysing misdiagnosis of one specific disease were excluded. Study results (autopsy rate, misdiagnosis prevalence, Goldman error class, diseases misdiagnosed) were abstracted and descriptive statistics calculated. We modelled the prevalence of Class I (potentially lethal) misdiagnoses as a non-linear function of the autopsy rate.

Results: Of 276 screened abstracts, 31 studies describing 5863 autopsies (median rate 43%) were analysed. The prevalence of misdiagnoses ranged from 5.5%–100% with 28% of autopsies reporting at least one misdiagnosis and 8% identifying a Class I diagnostic error. The projected prevalence of Class I misdiagnoses for a hypothetical autopsy rate of 100% was 6.3% (95% CI 4.0% to 7.5%). Vascular events and infections were the leading lethal misdiagnoses (41% each). The most common individual Class I misdiagnoses were PE, MI, pneumonia, and aspergillosis.

Conclusions: Our data suggest that as many as 40 500 adult patients in an ICU in USA may die with an ICU misdiagnoses annually. Despite this, diagnostic errors receive relatively little attention and research funding. Future studies should seek to prospectively measure the prevalence and impact of diagnostic errors and potential strategies to reduce them.

INTRODUCTION

Diagnostic errors are an underappreciated cause of preventable mortality and morbidity in hospitalised patients, accounting for an estimated 40 000–80 000 annual deaths in USA.[1] Patients in an intensive care unit (ICU) may be especially prone to suffer harm from diagnostic errors. They have limited reserve, often require fast diagnosis and treatment, are cared for by multiple clinicians and undergo frequent laboratory and imaging evaluations.[2] Harm may result from delay or failure to treat the correct underlying disease, complications of unnecessary diagnostic testing or treating a condition that is not actually present.[1]

Diagnostic errors are missed, wrong or delayed diagnoses that are detected by some subsequent definitive test or finding.[3] Autopsy-detected misdiagnoses are typically classified by the Goldman criteria and based on their clinical relevance and the potential that timely therapy would have changed the outcome. The Goldman criteria for autopsy confirmed discrepancies stratify misdiagnosis errors as major (Class I and II misdiagnosis) and minor (Class III and IV misdiagnosis). A Class I error is a major missed diagnosis with a potential adverse impact on survival (likely was the cause of death or contributed to the patient's death) and had that diagnosis been known would have changed management and outcome. A Class II error is a major missed diagnosis that did not have an impact on survival (was not the cause of death nor directly contributed to the patient's death). A Class III error is a minor missed diagnosis related to a terminal disease but not related to the cause of death, and Class IV errors are other missed minor discrepancies.[4]

thebmj

BMJ 2016;353:i2139 doi: 10.1136/bmj.i2139 (Published 3 May 2016)

ANALYSIS

Medical error—the third leading cause of death in the US

Medical error is not included on death certificates or in rankings of cause of death. **Martin Makary** and **Michael Daniel** assess its contribution to mortality and call for better reporting

Martin A Makary *professor*, Michael Daniel *research fellow*

Department of Surgery, Johns Hopkins University School of Medicine, Baltimore, MD 21287, USA

Unreliable Research on Error-Related Hospital Deaths in America

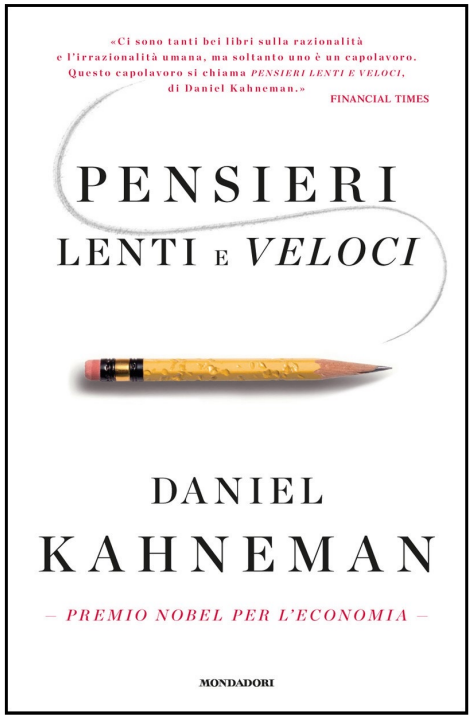
Gerard J. Gianoli, M.D.
John Dale Dunn, M.D., J.D.

Journal of American Physicians and Surgeons, 21 (2016), pp. 104-108

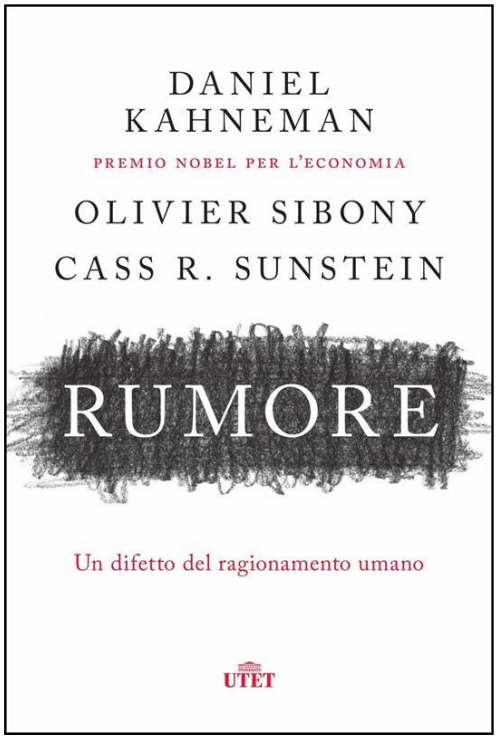
"Consider the case of someone falling from a tree. In running to catch him, you trip over a stone. The person hits the ground and dies. Did your tripping over the stone cause that person's death or was it the fall? According to the reasoning behind the BMJ article, the death was your fault. No distinction is made from unintended actions and intended actions, performed well, resulting in undesired outcomes, that is, complications."



Daniel KAHNEMAN (1934–2024)



2011



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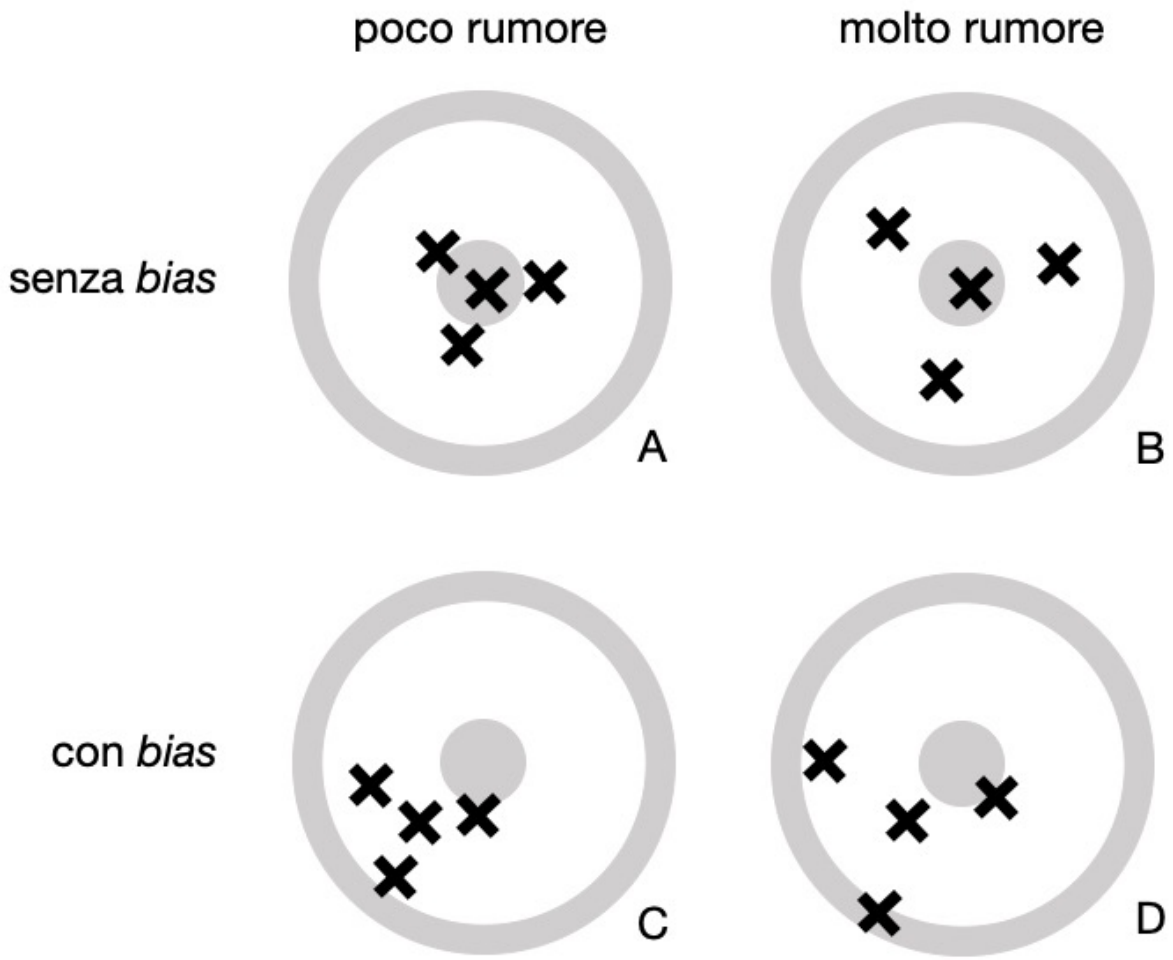
poco rumore
molto rumore
senza *bias*
con *bias*
A
B
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D

Man versus model of man: A rationale, plus some evidence, for a method of improving on clinical inferences.

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Goldberg, Lewis R.

Citation

Goldberg, L. R. (1970). Man versus model of man: A rationale, plus some evidence, for a method of improving on clinical inferences. *Psychological Bulletin, 73*(6), 422–432. https://doi.org/10.1037/h0029230

Abstract

Clinical psychologists, physicians, and other professionals are typically called upon to combine cues to arrive at some diagnostic or prognostic decision. Mathematical representations of such clinical judges can often be constructed to capture critical aspects of their judgmental strategies. An analysis of the characteristics of such models permits a specification of the conditions under which the model itself will be a more valid predictor than will the man from whom it was derived. To ascertain whether such conditions are met in natural clinical decision making, data were reanalyzed from P. E. Meehl's (see 34:3) study of the judgments of 29 clinical psychologists attempting to differentiate psychotic from neurotic patients on the basis of their MMPI profiles. Results of these analyses indicate that for this diagnostic task models of the men are generally more valid than the men themselves. Moreover, the finding occurred even when the models were constructed on a small set of cases, and then man and model competed on a completely new set. (29 ref.) (PsycINFO Database Record (c) 2016 APA, all rights reserved)

Man versus model of man: A rationale, plus some evidence, for a method of improving on clinical inferences.

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Citation

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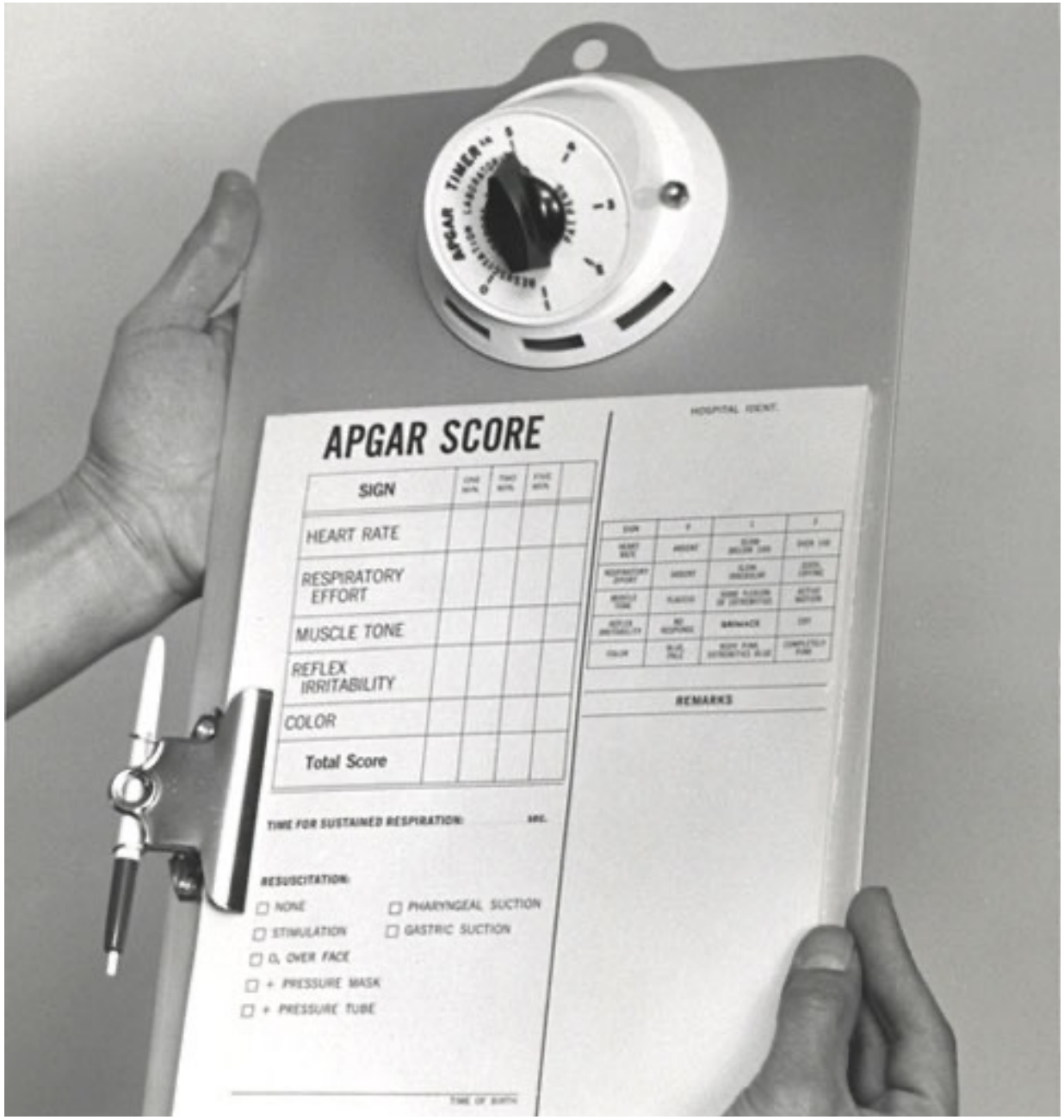
APGAR TIMER
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HEART RATE
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REMARKS
TIME FOR SUSTAINED RESPIRATION:
RESUSCITATION:
NONE
STIMULATION
O2 OVER FACE
+ PRESSURE MASK
+ PRESSURE TUBE
PHARYNGEAL SUCTION
GASTRIC SUCTION

Grazie per l'attenzione!

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