



Internal Medicine Grand Rounds

October 25, 2013

Ethics of Patient Care: Can we protect patients from ourselves?

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.....sex is like humor. Courses in humor, if they are given at all, should be given only by people who have laughed at least once in their lives - and enjoyed it.

Eric Berne, M.D.

This is to acknowledge that Claibe Yarbrough, M.D. has no financial interests or other relationships with commercial concerns related directly or indirectly to this program. Dr. Yarbrough will not be discussing off-label uses in his presentation.

The purpose of this presentation is to point out common heuristics of thinking that can lead to poor decisions about patient care and ethical decisions.

Objectives:

1. To learn some common heuristics of thinking that lead to faulty reasoning in medical practice and ethical decisions.
2. To learn some ways to guard against these heuristics in practice and the ethical concerns of these decisions in protecting our patients from our own faulty reasoning.
3. To learn where intuitive thinking can be used and where it might be dangerous.

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The last time I gave an Ethics Grand Rounds was over a decade ago. The Intensive Care Unit has a high density of ethical opportunities. Over the years, many of the deaths occurring in the hospital come through the ICU. The Intensivist acts as Ethicist, Palliative Care provider, as well as healer. The following table is a snapshot of the patients in the medical ICU at the VA in July, 2002.

Name	Age	Problem	Outcome
L. C.	63	Tetraplegia, Massive Stroke	Full Code, still on vent., >80 days
J. W.	87	Pneumonia, MOF	Withdrawal of Care - died, day 42
D. B.	54	ESRD, IVDA, Sepsis	Full Code, still on vent, >110days
W. H.	75	Hip fx, PTE, syncope	Full Code, still on vent, >91 days
K. P.	75	Syncope	Withdrawal of Care -lived,D/C 45d
B. R.	75	Bilat. Empyema	Withdrawal of Care - died day 21
M. G.	68	Sub-dural on Coumadin	Evacuation - D/C day 10
J. C.	63	ARDS, MOF	DNR, died day 16
C. G.	46	AIDS, CHF, ESRD, Hep C	Left AMA, day 36
J. B.	64	COPD, intubated against wishes	Withdrawal of Care, died day 3
R. D.	80	Dementia, A. fib. CHF	DNR, died day 34
R. P.	69	End-stage COPD	Extubated, D/C day 12

This is another snapshot from July, 2012, 10 years later, for an Ethics lecture for the Koppa Conference, an annual conference for Chest physicians.

- Mr. A – Fibrosing Mediastinitis, massive hemoptysis, resp. failure
- Mr. V – 34yo C5 partial Quad with stroke
- Mr. J – Stage IV CA on vent.
- Mr. D. – Severe anoxic injury on vent.
- Mr. S – end-stage COPD on BiPAP
- Mr. F – 90 yo after PEA arrest, on vent.
- Mr. W – widely metastatic cancer
- Mr. L – 87 yo metastatic cancer on vent.
- Mr. W – multiple infections, S/P ARDS on vent.
- Mr. F – hip infection after hip replacement, infected PM leads

The lists above indicate that a large percentage of patients in the ICU require ethical considerations. Unfortunately, Ethics is not a science, so there are no randomized controlled trials that guide us in making these decisions. However, knowledge of what is medically possible to bring a severely ill patient back to health is necessary to determine when to recommend a switch from trying to give another day of life to making whatever life is left more comfortable.

An article from the New England Journal of Medicine illustrates how variable ethical considerations can be. A case was presented of an unresponsive, homeless man with a high probability of cancer and best prognosis of severe disability in dependent care. There was some evidence that the patient would not wish aggressive care, which was seconded by the patient's mother and brother. However, the patient's son, the legal next of kin, wanted

everything done despite his prior agreement with the mother and brother. Readers of the NEJM were asked to respond with what they would do under these circumstances. The 3167 votes in the United States looked like this:

1. Aggressive care and ethics consultation: 979 votes 31%
2. DNR order and transfer to LTAC: 495 votes 36%
3. Withdraw life support: 1693 votes 53%

The picture across the world was even more divided depending on the continent casting the votes. The percentage range of answers is shown below.

1. Aggressive care and ethics consultation: 14% to 31%
2. DNR order and transfer to LTAC: 17% to 49%
3. Withdraw life support: 24% to 68%

This would suggest that there is no standard of ethics to which we all adhere, even in this country. My own experience suggests that it changes over time. When I was in medical school, it was routine for the Chief of the ICU to remove a dying patient from the ventilator and tell the family that the patient died despite everything being done. This ignores tenants of patient autonomy and substituted decisions that are common today. All of this implies multiple truths, which largely depend on the interaction of "this" physician with "this" patient at "this" time, so dogmatic adherence to individual ethical tenants should be avoided. It is always a balancing act over many ethical considerations.

Rene Dubos called "prolongation of the life of aged and ailing persons" and the saving of lives of children with genetic defects "the most difficult problem of medical ethics we are likely to encounter within the next decade ... To what extent can we afford to prolong biological life in individuals who cannot derive either profit or pleasure from existence, and whose survival creates painful burdens for the community? ... It will be for society to redefine these ethics, if the problem becomes one that society is no longer willing or able to carry." This quote is from an address in Dartmouth College in 1960. It is a long decade!

I would like to briefly go over two subjects that illustrate this balancing act and help with ethical decisions. These were the subject of the Grand Rounds from 10 years ago. I would like to give a short case given by Dr. Josh Kayser, the ICU director at the Philadelphia VA. This case was presented at a Palliative Care Conference earlier this year. I use this case to prevent cherry-picking a case of my own that might fall easily into the structure of the discussion.

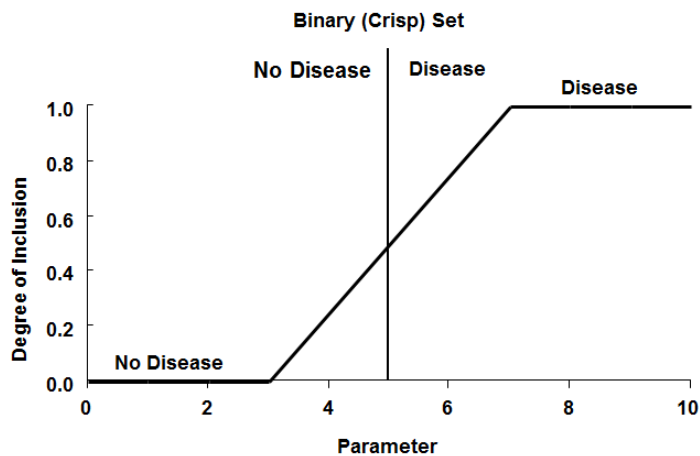
Case #1: LD is an 87 year-old woman with chronic kidney disease, hypertension, diabetes and coronary artery disease admitted to the hospital with community-acquired pneumonia. She is initially treated with antibiotics and oxygen therapy. Despite treatment, over the next 24 hours she develops progressive respiratory failure and is transferred to the MICU on 100% non-re-breather mask. Upon arrival, she remains hypoxic with increased work of breathing, requiring intubation and mechanical ventilation. She has an advanced directive stating that she did not wish to be placed on mechanical ventilation. However, the family at the bedside requests that all life sustaining therapies be offered.

Should the patient be intubated? How do you make your decision?

Fuzzy Sets

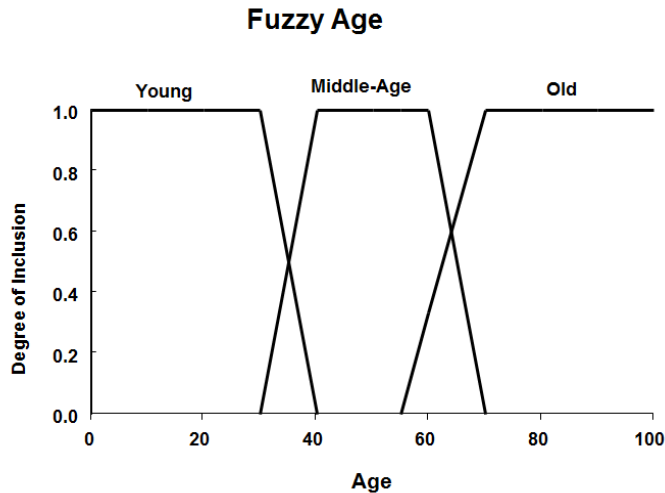
In 1965 Lotfi Zadeh, who was at the time Chairman of the University of California at Berkeley's electrical engineering department, published a paper called "Fuzzy Sets". In this paper, Zadeh set down formal logical operations on fuzzy sets and explained their importance. The key to Zadeh's paper was the concept of graded memberships. A set could have members who belonged to it partly, in degrees. Fuzzy sets discriminate much better and supply more information than "crisp" sets. They are, despite the name, more precise than crisp sets. The figure below demonstrates an example of a fuzzy set.

Fuzzy Set vs Crisp Set



In this instance there is a gradual progression from "no disease" to "disease." The parameter could be diastolic blood pressure for the disease Hypertension. Most diseases can be expressed this way. The slope that indicates the degree of inclusion can be adjusted to span whatever distance of the parameter is necessary. If the slope is completely vertical, then you have a crisp set. From this, one can see that a crisp set is a special case of fuzzy sets (one with infinite slope). If there is more than one "linguistic variable" then there will be more than one sloping line and there can be overlap as well.

"Young", "middle age", and "old" are sets where the variable (or parameter) is "age". The degrees of membership in each set ranges from zero, no membership, to 1.0, exclusive membership. A fundamental element of fuzzy logic is the "linguistic" variable that Zadeh introduced. A linguistic variable is a variable whose values are words instead of numbers. For example, "age" is a linguistic variable if the possible values are "young", "middle age", and "old". Each value refers to a membership function. A membership function assigns a degree of membership to any numerical age fitting the perception of "young", "middle age", and "old". Fuzzy sets appear to more closely reflect the way people naturally categorize the world. In this figure the membership functions overlap so that ages of 57 to 65 years are to a certain degree both "middle aged" and "old" at the same time. An age of 65 is comparatively less "middle aged" and more "old". The transition from "middle age" to "old" is gradual as age increases.



Membership functions are not the same as probabilities. An age of 60 is not “middle age” with a certain probability. Instead, it is both “middle aged” and “old” at the same time. The degree to which it is, “middle aged” and the degree to which it is “old” reflect the context and subjectivity underlying the membership functions. Increased precision in the specification of age or the membership functions would not alter the inherent fuzziness in classifying age.

In comparison with the fuzzy set above, binary sets are a special case of the fuzzy sets. The differences lie at the boundaries between the sets. Membership functions of binary sets do not overlap, so that the transition between sets is abrupt. An age of 62 years is “middle aged” whereas an age of 63 is “old”. In binary logic, people are either old or they are not old.

Fuzzy sets easily resolve the paradox of the heap. With each grain of sand removed, the heap has less membership in the set of heaps. It drops from 1.0 through 0.8 and 0.2 to, finally, 0. Fuzzy sets glide smoothly across the truth continuum. Estimating the memberships in fuzzy sets is a subjective task. However, the placement of the crisp or binary divisions is likewise a subjective task. Fuzzy sets, with their decimal values, yield better estimates than just 1 and 0. Fuzzy sets include crisp sets. A crisp set is just a fuzzy one with membership values of 1 and 0. Crisp sets imply that the crux of the argument is the **existence** of membership, while for fuzzy sets it is the **extent** of membership.

Fuzzy sets can be used by complex disciplines. Zadeh recognized the role of fuzziness in managing complexity and described a law of incompatibility:

As complexity rises, precise statements lose meaning and meaningful statements lose precision.

“...as the complexity of a system increases, our ability to make precise yet significant statements about its behavior diminishes until a threshold is reached beyond which precision and significance (or relevance) become almost mutually exclusive characteristics”.

When people face complex information, they use the strategy of summarization. For example, a patient with bilateral amputations, proteinuria, characteristic retinopathy, and, an extremely elevated hemoglobin A_{1C} on large doses of insulin may be summarized as a “bad diabetic” on rounds, particularly if

diabetes was not the primary reason for hospitalization. Words centralize concepts that may have blurred bounds. Language is our ultimate shorthand, demonstrating our ability to summarize.

Zadeh felt fuzzy logic could handle complexity in a similar way. As members in a set grow, they eventually exceed human comprehension. The brain responds by summarizing the set into "chunks," labeled with words. For instance, it might divide the myriad hues of the spectrum into red, orange, yellow, green, blue, purple, violet, and other categories. Because each of these subclasses is a fuzzy set with degrees of membership, members can describe them. By summing up words mathematically, fuzzy sets could help bring complex systems like the visual apparatus under control.

Fuzzy sets are important when thinking about medical ethics. Fuzzy sets allow more precision and therefore more information than crisp sets.

Metaphysics of Quality

In 1974, Robert M. Pirsig published his novel *Zen and the Art of Motorcycle Maintenance: An Inquiry into Values*. Pirsig tried to highlight exactly what quality was and what significance it had for humanity and society. Pirsig's idea is that Quality is not an object, nor is it inherent in the subject; it is an event that makes the subject aware of the object. He suggests that reality is composed of three things: subject (mind), object (matter), and Quality. By making the self aware of the non-self, both the self and the object are created as entities. This is why Pirsig claims that Quality is indefinable, because it exists before even the creation of subject and object and even further before the names given to these things.

Once a metaphysics is developed, then everything from that point on is not truth but only a way of talking about truth with distortion. Pirsig's metaphysics, called the Metaphysics of Quality, is just a map, and a map is not the terrain itself. However, establishing this metaphysics of Quality allows one to explore Quality to its furthest extents and hopefully gain some real insight into the reality that the Metaphysics of Quality merely mimics.

By suggesting an existence prior to subjects and objects, Pirsig rejects the Subject-Object Metaphysics that has dominated western thought for 2,500 years. By this rejection, he dissolves what he calls Platypi, the paradoxes which arise because of our subject-object metaphysics. These include Mind/matter, body/soul, mental/physical, culture/nature, quality/quantity, etc. However, it is not until his second book that he provides a replacement for our subject-object metaphysics.

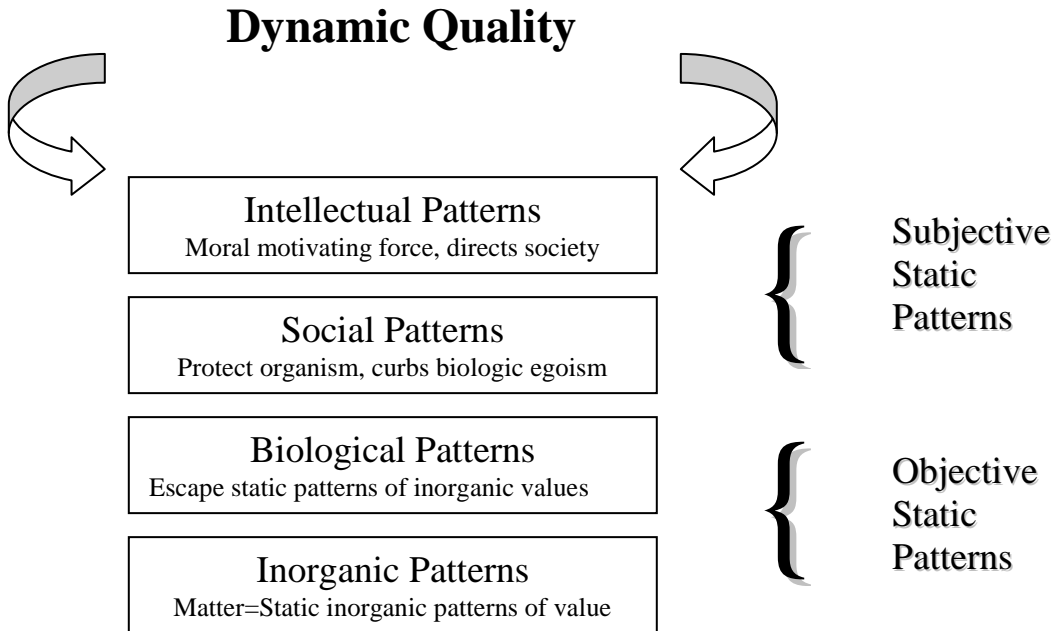
The first proposition of the Metaphysics of Quality is that everything is value. The undifferentiated, undefined, pre-existing source of all things is referred to as Dynamic Quality. Pirsig states that in Subject-Object Metaphysics, the first division after Quality is between subject and object. In his Metaphysics of Quality the primary division is between dynamic value and static value. Dynamic Quality creates patterns of Quality that are stored in static patterns to prevent degeneration and loss of what is good. Driven by Dynamic Quality, static patterns develop in an evolutionary manner. The Metaphysics of Quality recognizes four discrete sets of static patterns of value. They are arranged in

terms of their evolutionary importance, but this is also equated with their inherent good: Inorganic, Biological, Social, and Intellectual. Each of these levels offers freedom from the constraints of the lower level, but each is also dependent on that lower level for its existence. (see figure below)

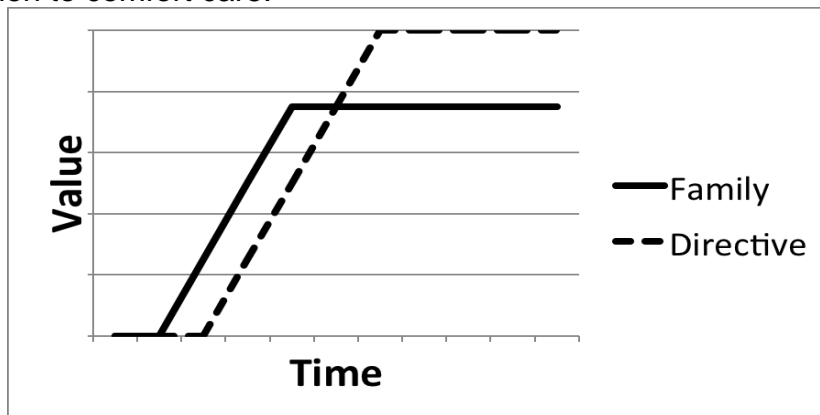
Pirsig uses the example of a computer to illustrate levels of value within his *Metaphysics of Quality*. Silicon fashioned into semiconductor circuits is the start of the computer. The electrons travel through these circuits to activate the computer, but are not of much use at that level, although absolutely necessary for its function. The programmer that writes the program that runs on the computer may not know anything about the circuits. However, the program is as necessary as the circuits themselves for the usefulness of the computer. The word processor program written by the programmer and running on the hardware circuits may have a novel written upon it. Again the author doesn't need to know anything about programming or circuits in order to write the novel. Each level of the computer is essentially built on top of the previous level. There is not much connection between the levels. No matter how hard one looks for the novel in the hardware, it cannot be found there. It is a function of the higher level.

The ethical decision can only be made within the relationship between the physician and patient. The Quality or driving force for the ethical decision comes from the balance between the patient and physician. For the physician to make the decision alone is paternalism or parentalism, both of which imply a static state in the relationship. The patient needs our advice on decisions for a couple of reasons. First, they are not really "themselves" when they are sick. Second, they are lost in statistics and need someone that knows what is going on and can explain it to them. However, today patients want to participate in more informed decisions, rather than be told what to do. Anything that prevents the physician from interacting with the patient, or prevents the physician from taking responsibility for the patient undermines any ethical decisions.

Pirsig used a figure similar to the one below to illustrate these static levels of quality and described the relationship between them:



Case #1 continued: The decision is made to place LD on mechanical ventilation. 72 hours later, she remains fully ventilator dependent. She has developed ARDS and septic shock with multi-organ failure. You call a family meeting to discuss her condition and to establish goals of care. The family feels she would not want continued life sustaining therapy, and the decision is made to transition to comfort care.



How was the decision made to place her on mechanical ventilation rather than exercise the advance directive? Both fuzzy logic and the metaphysics of quality could have been used to come to the decision. Intubation and mechanical ventilation was a higher quality choice than exercising the advanced directive at first. Over time, the advanced directive became more valuable and was the higher quality choice. The effect of choosing one over the other involved fuzzy sets that take into account the patient, family, and provider. The choice had higher quality for this patient, this family, and this provider. Under other

circumstances, with other participants, a different choice might have higher quality. Trying to enforce rules for ethical conduct that are strictly followed does not work. You have to allow play in the decisions, which is the hallmark of fuzzy sets.

Unfortunately, our brains do not think quickly in terms of fuzzy logic and the subject-object metaphysics allows ease of thought through shortcuts using binary or crisp sets. Kahneman suggests that we have two ways of thinking. System 1 is quick and easy and makes use of our memory and intuition. System 2 is slow and methodical, but also extremely lazy. System 2 is said to be the check and balance to the first system, but again, because of its lazy nature, we often go unchecked.

The human brain can achieve amazing feats, but there are systematic errors in our processing that are pervasive and hidden from our consciousness. There are several listed here in no particular order. Please do not think you are immune to any of these systematic errors. They are present in the smartest of us.

Change Blindness – we are blind to changes made while we concentrate. This is illustrated in the two links below. The second is a famous one minute film that has a woman dressed in a gorilla outfit walk across the stage. About 50% of the people asked to focus on a task with the film completely miss the gorilla.

http://www.youtube.com/watch?v=6JONMYxaZ_s

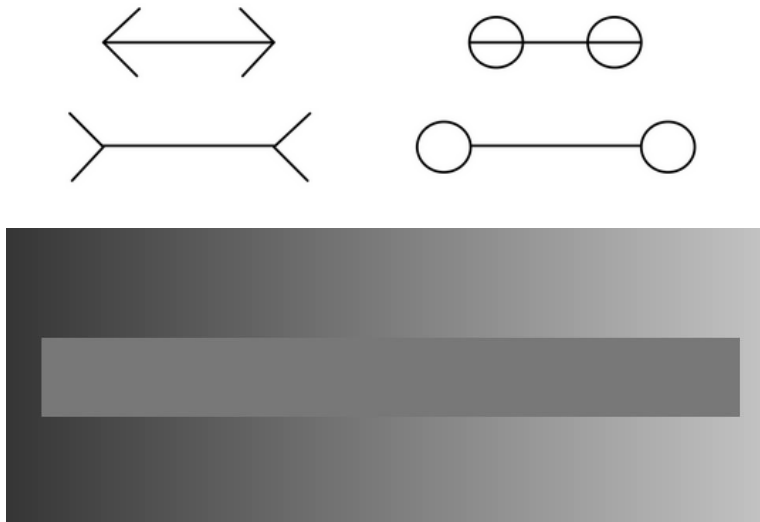
<http://www.youtube.com/watch?v=B80YXYslsW4>

A **Heuristic** is a speculative formulation, serving as a guide in the investigation or solution of a problem. This term refers to methods we routinely use, but may fail us at times.

Our mind is a different kind of computer. We do not know where our thoughts originate. They come unbidden and cannot be turned off. If words appear before us, we will read them without being prompted. We answer different, but seemingly related questions in place of harder questions without being aware what we have done.

The lines below are equal. However, even though you may know this logically and it is in your memory, the lines still look different. You have to remember to distrust your estimation of line length when there are fins or circles associated with them. Likewise, the inner bar is of a uniform shade of gray. Even when you know this to be true, you cannot see it as true. We are fooled by our inability to see absolutes rather than associations.

Optical Illusions



Cognitive Illusions – these are very much like the optical illusions above, but are illusions of our thinking.

- **Illusion of Validity** – by constructing a coherent and clear narrative we make the assumption that the narrative is accurate and complete. Even when we are shown that it is an illusion, we cannot keep from falling for it.
- **Illusion of Understanding** – thinking that we understand the world simply because we can develop a cohesive and clear narrative in hindsight.

Statistics

- We are very poor at using statistics and therefore place way too much weight on causal strategies and neglect statistical base rates altogether, which has been shown to go against Bayesian reasoning.

Availability Heuristic

- The ease of availability of events in our memory causes us to place too high a probability on the likelihood of that remembered event explaining a current situation. We use this in place of true statistical estimates.
- When you hear hoof-beats, the first thing you think of should not be a Zebra.

Narrative Fallacy

- Nassim Taleb (The Black Swan) introduced the concept of a narrative fallacy to describe how flawed stories of the past shape our views of the world and our expectations of the future, fostering an illusion of inevitability.

Rare Events (see table below)

- People overestimate the probability of unlikely events.
- People overweigh unlikely events in their decisions.

Fourfold Pattern

	Gains	Losses
High Probability Certainty Effect	95% chance to win \$10,000 Fear of disappointment RISK AVERSE Accept unfavorable settlement	95% chance to lose \$10,000 Hope to avoid loss RISK SEEKING Reject favorable settlement
Low Probability Possibility Effect	5% chance to win \$10,000 Hope of large gain RISK SEEKING Lottery	5% chance to lose \$10,000 Fear of large loss RISK AVERSE Insurance

Decision Weights

Probability(%)	0	1	2	5	12	20	50	80	90	95	98	99	100
Weight	0	5.5	8.1	13.2	18.6	26.1	42.1	60.1	71.2	79.3	87.1	91.2	100

The table shows preferences for gambles of modest sums of money. The decision weights are identical at the extremes. Unlikely events are over-weighted, a 2% chance is over-weighted a factor of 4. A 2% chance of not winning decreases the utility of the gamble by 13%. We are poor at using statistics and exhibit loss aversion and are subject to fear and greed.

Bad Events

- Loss Aversion – the human brain gives priority to bad news. This might have been advantageous on an evolutionary basis
 - Shave off a few 1/100ths of second to avoid predator
 - Words evoke the same reaction as the site or experience, not in the degree, but certainly in feeling: War / Crime / Vomit
- We are more strongly driven to avoid loss than to achieve gains.

WYSIATI (What you see is all there is) We assume that what we see and know is all there is to consider. It allows fast, easy judgments on very little information. It also allows quick formation of a cohesive narrative based on just what is in front of you or is known at this moment. This heuristic is why “curb-side” consultants can be dangerous, because it leads the consultant to think that you have told them all the pertinent facts.

Impatience - Howard Beckman studied when and how often we interrupt the patient during our interview in the outpatient setting. He found in 1984 that the physician redirected the patient during the interview on average within 18 seconds of the patient’s narrative. A repeat study in 1999 showed that we had improved to 24 seconds, but still not enough. The likelihood that additional concerns were expressed after the redirection was very low at 8%. An additional 6 or 7 seconds would have allowed enough time to elicit all the patient’s concerns in the majority of cases, since the average time to express all concerns was 27.7 seconds.

This interruption likely occurs much more frequently and probably sooner in time-sensitive areas such as the emergency department and the intensive care unit. It also might stem from our desire to quickly form a cohesive narrative that might obviate the need for further inquiry.

Value Rigidity

As hand-offs become more common, the initial impression or diagnosis is much less likely to be questioned. Even when the initial resident comes back on service, the assumption might be that everyone else has looked at the case and agreed with the diagnosis. The diagnosis is assumed correct, so the narrative is carried forward and any assumptions that were used in the original narrative are lost or not communicated. This is why a diagnosis communicated from the E.D. is often carried forward without question and chart lore becomes fact.

Robert Pirsig describes an East Indian Monkey trap as an example of value rigidity. A small hole is cut into a coconut and a small amount of rice is placed into the shell. It is then chained to a stake and left. When the monkey puts his hand into the coconut to remove the rice, his fist will not come out of the hole. The men simply walk up and capture the monkey. If the monkey could re-evaluate the value of the rice, he would see that it did not have as much value as freedom and would open his hand to escape.

Illusion of Confidence (Applied)

The New England Journal of Medicine started a series of reviews centered on critical care in the Intensive Care Unit. Their first article was on Septic Shock and they cited the Surviving Sepsis Campaign as decreasing mortality. Sepsis carries a high mortality rate and is the subject of much discussion about standardization of treatment and improvement of care and outcomes. The Campaign for Surviving Sepsis is a national movement through the Society of Critical Care Medicine and went through its third iterative revision in 2012. The campaign uses two "Bundles" to standardize care, shown below:

Bundle #1

TO BE COMPLETED WITHIN 3 HOURS:

- 1) Measure lactate level
- 2) Obtain blood cultures prior to administration of antibiotics
- 3) Administer broad-spectrum antibiotics
- 4) Administer 30 ml/kg crystalloid for hypotension or lactate ≥ 4 mmol/L

Bundle #2

TO BE COMPLETED WITHIN 6 HOURS:

- 5) Apply vasopressors (for hypotension that does not respond to initial fluid resuscitation) to maintain a mean arterial pressure (MAP) ≥ 65 mm Hg
- 6) In the event of persistent arterial hypotension despite volume resuscitation (septic shock) or initial lactate ≥ 4 mmol/L (36 mg/dL):
 - Measure central venous pressure (CVP)*
 - Measure central venous oxygen saturation (ScvO₂)*
- 7) Re-measure lactate if initial lactate was elevated*

*Targets for quantitative resuscitation included in the guidelines are CVP of ≥ 8 mm Hg; ScvO₂ of $\geq 70\%$, and normalization of lactate.

205,000 Adult Hospital Admissions

5,500 Sepsis Admissions (2.7%)

200,000 other admissions

1400 Deaths from Sepsis (24%)
(25% mortality rate)

4300 deaths from everything else
(2.2% mortality rate)

1 in 4 deaths
11 times the mortality

This information is from Dr. Whippy of Kaiser Permanente from a presentation of care for Sepsis at the Institute for Healthcare Improvement in 2009. It shows the reason for placing Septic Shock in the spotlight.

However, this Surviving Sepsis Campaign is not without detractors and was the subject of a recent “Pro/Con” debate in Chest, The Journal of the American College of Chest Physicians. The following segments taken directly out of the articles suggests that the Campaign is very much a cohesive narrative that is being adopted widely. The narrative allows us to have confidence and validity and gives us an understanding of the world that may or may not be seated in reality.

“Con” Stance (taken or summarized from reference):

The IHI promotes bundles to “help health care providers more reliably deliver the best possible care for patients undergoing particular treatments with inherent risks.” These bundles are a “structured way of improving the processes of care and patient outcomes: a small, straightforward set of evidence-based practices—generally three to five—that, when performed collectively and reliably, have been proven to improve patient outcomes.” The Institute for Healthcare Improvement suggests that, “bundles tie the changes together into a package of interventions that people know must be followed for every patient, every single time.” The suggestion is that if you’ve got four changes in the bundle and you remove any one of them, you wouldn’t get the same results—the patient won’t have as high a chance of getting better, all must all be completed to succeed. The belief is that bundled interventions work synergistically and that the whole represents more than the sum of its parts. The IHI takes the position that “there should be no controversy involved, no debate or discussion of bundle elements.” The argument set forth in the article is that there is insufficient scientific evidence to support the concept of bundling as it is currently being practiced and that the two most widely promoted bundles have elements that may be harmful as applied.

Safety and efficacy of specific bundled interventions are not readily tenable. There was a failure to recognize a lack of efficacy and possible risks of Xigris, recently withdrawn, despite years of its inclusion in sepsis bundles with little hint of the rather dramatic lack of efficacy during observational follow-up. An intervention that produces a positive effect in a particular group of patients cannot be extrapolated to another group or to all patients with a similar condition.

Bundles might actually dilute rather than enhance the benefits of specific treatment elements when combined together. Most alarming is the concept of all-or-none bundle compliance. In other words, credit for delivery is all or none.

Fluid administration is a large component of the Campaign, and is derived from a study by Rivers, termed Early Goal-Directed Therapy. However a study called ARISE (Australasian Resuscitation of Sepsis Evaluation) used a fluid-limited protocol, which produced a lower mortality than River’s study.

- Rivers control group - 46% mortality
- Rivers EGDRx – 30% mortality
- ARISE – 24% mortality

The Surviving Sepsis Campaign and many “bundles” and protocols used in the ICU depend heavily on a correct narrative. We observe stochastic measures and produce a deterministic narrative from these measures that allow us to intervene in patient illness. Sometimes, we get it very correct, such as replacing thyroid hormone for hypothyroidism. Other times we get it very wrong, such as the practice of treating premature ventricular contractions with lidocaine, which was later found to increase arrhythmias, rather than decrease them.

Table 1—Elements of the VAP Prevention Bundle and 6-h Sepsis Bundle and the Level of Evidence

Bundle	Level 1 Evidence	Likely to be Beneficial/ Harmful
VAP bundle (preventing VAP)		
Elevation of the head of the bed to 45°	No	Uncertain, no evidence that 45° is better than 10° ⁵
Sedation vacation	No	No evidence that it reduces VAP, time on ventilator, or ICU stay ⁶
Daily oral care with chlorhexidine	No	May be beneficial; only proven in trauma/cardiac surgery
PPI or histamine-2 receptor blocker	No	Likely to be harmful; increases risk of VAP ²
Anticoagulants or compression devices	No	Anticoagulants likely to be beneficial ⁷ ; no evidence that it reduces VAP
6-h sepsis bundle (decreasing mortality)		
Obtain microbiology samples and lactate measure	No	Almost certain to be beneficial
Administer appropriate antibiotics	No	Almost certain to be beneficial
Administer fluid to achieve a CVP of 8-12 mm Hg	No	Likely to be harmful ⁸
Administer vasopressors to achieve an MAP >65 mm Hg	No	Uncertain ⁹
Maintain a central venous oxygen saturation >70%		
With inotrope therapy	No	Uncertain ⁸
With blood	No	Likely to be harmful ⁸

CVP = central venous pressure; MAP = mean arterial pressure; PPI = proton pump inhibitor; VAP = ventilator-associated pneumonia.

The way that experts think has been studied extensively. Chess masters given 20 chess pieces, in play, can reproduce them exactly. Novice players are unable to get half of them correct. The masters see the board in “chunks” that represent groups. The groups are seen as patterns that are well known to them from systemic study. When the pieces are placed in a random order, the masters are no better than novices at reproducing the board. The expertise is through intuition, which has been said to be nothing more than pattern

recognition. This places intuition, and much of expertise, as a function of memory. Experts do not use calculations or complex reasoning any more than novice practitioners; they simply have a larger bank of cases in their memory.

Another example of a narrative is that limiting duty hours for residents will result in decreased errors. This narrative was tested in a recent study published in the Journal of the American Medical Association. There are three goals for graduate medical education, training excellence, resident well-being, and safe, effective patient care. It was noted as early as 1971 that fatigued interns misinterpreted EKGs. The death of 18 year-old Libby Zion in 1984 was attributed to errors in house-staff secondary to fatigue. Her father's untiring campaign to try to prevent similar incidents resulted in the state of New York adopting recommendations produced by the Bell commission, in 1989, limiting work hours for house-staff. The American College of Graduate Medical Education (ACGME) adopted very similar restrictions in 2003. A study published in 2006, in JAMA, showed that approximately 80% of interns sometimes exceeded the restrictions. Despite evidence that the restrictions did not work, the ACGME further restricted duty hours for interns in 2011.

The recent randomized, crossover study shows that the new restrictions do result in increased sleep, however it also shows decreased continuity of care, increased number of interns taking care of each patient, decreased quality of care estimated by both the interns providing the care and the nurses providing the care, and decreased educational opportunities from both teaching and patient care. This may well be an illusion of validity and confidence. The variable of duty hours is a very simple thing to measure and certainly has the appearance of a deterministic variable in the problem. However, despite evidence to the contrary, we are unable to give up the narrative for this illusion.

What can we do?

Kahneman describes the basic conditions necessary to acquire skill

1. An environment that is sufficiently regular to be predictable
2. An opportunity to learn these regularities through prolonged practice
3. Rapid and unequivocal feedback

The ICU may not possess these conditions. In the case of septic shock, the patients often have multiple organ dysfunction, which greatly clouds the picture of the physiology. When thinking about the central venous pressure, consideration must be given to the oncotic pressure, the compliance of the ventricle, thoracic pressure, usually in patients with stiff lungs and high positive end expiratory pressures, and the cause of the apparent edema. The septic patients show significant variation in presentation, co-morbidities, cause of sepsis, response to therapy, and organ dysfunction. This lack of regularity and predictability makes a deterministic narrative that can be used across the breath of patients admitted to the ICU difficult to trust.

One answer may lie in the use of algorithms. Algorithms greatly outdo humans in noisy environments for two reasons

1. The algorithm is more likely to detect weakly valid cues.
2. The algorithm uses cues more consistently allowing a modest level of accuracy.

In Malcolm Gladwell's book, *Blink*, the chief of medicine held a competition between an algorithm and the judgments (intuitions) of the physicians in determining which patients needed telemetry. The result was no contest. The algorithm was accurate at 97% versus the physicians' score of 73%. This is likely in environments with low validity. Personal impressions are given too much weight over other sources of information. Physicians and many "experts" are over-confident in their intuitions.

In 1953, over breakfast with her residents, the anesthesiologist, Virginia Apgar wrote down a method to systematically assess newborns. She wrote down five variables, each scored with three values. She began using this score to assess newborns and finally delivery rooms had a scoring system to assess the health of newborns. This simple rule is credited with saving countless lives and is still used worldwide today, 60 years later.

However, there is a huge resistance to algorithmic care. It is seen as mechanical, incomplete, rigid, and sterile. The resistance to the use of the algorithm increases if an algorithm results in a poor consequence or outcome. There is an apparent difference in a death caused because of an error made by an algorithm and a death caused because of an error in human judgment. The difference has a different emotional intensity and this leads to a moral preference. One way to use algorithms is widely used in the LDS hospital in Salt Lake City. The algorithm can be overwritten by the physician with a stated cause. However, studies have shown that the outcomes of patients where the physician has overwritten the algorithm are worse than those patients where the algorithm was followed.

Organizations can help by imposing orderly procedure that prevents rampant use of fast, but sometimes wrong intuition. It is much easier to see someone entering a situation where mistakes are likely to be made than it is to recognize that you, yourself are in the midst of one. This is the idea behind interdisciplinary rounds in the ICU. Everyone has different levels of expertise and can add value to the patient care, but only if everyone is given a chance to speak.

Checklists utilizing principles started in the aviation industry can help ensure completeness during rounds or procedures when interruptions are common. Pronovost zealously advocated checklists a decade ago. Today, Gawande has taken up this beacon and has formed an Institute within the Harvard School of Public Health to develop checklists for uses as diverse as Central Line placement and End-of-Life discussions.

Goal sheets and well-designed hand-off tools might help with communication to the next shift. These would include the plans and expectations for the patient's care during the last shift and would be changed as new information or changing conditions occur on the current shift. This becomes increasingly important as we progress toward more "shift" work in medicine. Patients could be monitored electronically in real time for changes that might

indicate an unstable condition in need of attention. This would be like a prospective rapid response call to help avoid deterioration.

However, as long as humans are involved in the process, there is always going to be some degree of error. The systematic, predictable errors in our thinking are not something we can fix. They are like blind spots, they are there, but we cannot detect them. We also cannot protect ourselves, and therefore our patients from the repeated occurrence of these errors. They occur no matter the level of intelligence, but do change under fatigue and depletion of mental stamina, sometimes for the better and sometimes for the worse. Things as simple as holding a pencil in your mouth to “force” a smile will produce different choices and decisions than if you furrow your brow into a frown, even when the happy or angry emotion is absent. The same is true for anchors that we are unaware affect us, and would refute if suggested, but occur none-the-less.

Ben Franklin tried diligently to hold himself to one or more virtues during a period of time, but found that if he tried to hold himself to all 10 or 12 virtues, he was unable to do it. He likened the predicament to trying to polish an axe made of poor metal. No matter how much you were grinding it, more defects and pock marks showed up, preventing any further improvement.

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