Quixotic Medicine: Physical and Economic Laws Perilously Disregarded in Health Care and Medical Education

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Abstract

Wise medical practice requires balancing the idealistic goals of medicine with the physical and economic realities of their application. Clinicians should know and employ the rules, maxims, and heuristics that summarize these goals and constraints.

There has been little formal study of rules or laws pertaining to therapeutics and prognosis, so the authors postulate four physical and four economic laws that apply to health care: the laws of (1) finitude, (2) inertia, (3) entropy, and (4) the uncertainty principle; and the laws of (5) diminishing returns, (6) unintended consequences, (7) distribution, and (8) economizing. These laws manifest themselves in the absence of health, the pathogenesis of disease, prognosis, and the behaviors of participants in the health care enterprise. Physicians and the public perilously disregard these laws, frequently producing misdiagnoses, distraction, false expectations, unanticipated and undesirable outcomes, inequitable distribution of scarce resources, distrust, and cynicism: in short, quixotic medicine. The origins and public reinforcement of quixotic medicine make it deaf to calls for pragmatism. To achieve the Accreditation Council of Graduate Medical Education competency of systems-based practice, the authors recommend that premedical education return to a broader liberal arts curriculum and that medical education and training foster didactic and experiential knowledge of these eight laws.

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Quixotic, *adj.*(< *Don Quixote*), extravagantly chivalrous or romantically idealistic; impractical.

Very few apply this word, from *Webster's New World Dictionary, School and Office Edition* (1967), to medicine. After all, medicine is first and foremost a moral enterprise devoted to the welfare of the person treated.[1] It ethically aspires to a personal healing relationship between a knowledgeable caregiver and a distressed person in the context of uncertainty.[2] So, how could medicine possibly be quixotic?

The knowledge needed to practice effectively has empirical and scientific roots and is increasingly evidence-based, but it must be logically and judiciously applied to the particular patient in his or her context. Kathryn Montgomery[2] has recently emphasized the need for better understanding of how physicians acquire excellent clinical judgment. She and many others stress the case narrative and the use of maxims, aphorisms, and heuristics as fundamental to the development of clinical judgment. Aristotle's *phronesis*, or practical reasoning, is the ability to successfully apply general rules to the specific needs of an individual, such as a patient, at a point in time.

Although some may argue against the very existence of natural laws, typical rules of medicine have included ideals that arise from natural law, such as beneficence, nonmaleficence, autonomy, and justice, which have been emphasized in the codes or covenants of professionalism. Typical operational rules of thumb for practicing physicians have included *Primum non noncere,* Ockham's Razor, Sutton's Law, "Don't think zebras," and numerous favorites of professors and clinicians.[3]

Doctors, however, practice in a world with physical limitations and increasingly pressing economic demands, which concern not only patients and caregivers but also governmental and commercial health policy makers, as well as society as a whole. Medicine has become health care, a capitalistic enterprise composing greater than 16% of the U.S. gross domestic product, with no foreseeable decrease in demand.[4] The laws and goals of health care as an economic entity in a tangible, physical world are important to clinicians and patients as recognized by the systems-based practice competency of the Accreditation Council on Graduate Medical Education. The council and other constituents such as the Institute of Medicine are exuberantly attempting to engineer health care to meet the overt profit and customer aims of satisfaction, effectiveness, efficiency, timeliness, standardization, and zero defects.[5]

The purpose of this article is to demonstrate that in the shifting paradigm from medicine to health care, a quixotic neglect of important natural laws of both physics and economics has occurred. This neglect has challenged the precepts of medicine, generated false hopes and unrealistic expectations among the public as well as clinicians, and imperiled medicine, society, and individuals. Herein we give examples of laws, currently denied, that should not only become part of the phronesis of medical education and practice but also serve to educate—and to modify the perceptions and actions of—the public. We surmise reasons why the public,

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clinicians, and educators blind themselves to these laws. Finally, we propose that these laws be pragmatically balanced with the lofty ideals of medicine early in medical education—not to quench the ideals, but to enhance their luster in the age of health care.

The Laws and Their Antinomes

The most studied heuristic rules in medicine are those used in diagnosis. Physicians widely use the pattern recognition and deductive heuristics, and their success often distinguishes experts from novices.[6] Heuristic rules are subject to bias and can be misused and fail, particularly in the hands of inexperienced clinicians.[7,8] There has been little formal study of the outcome of rule application to pathogenesis, therapeutics, prognosis, physician behavior, and the health care system.

We propose eight laws that should be applied to all aspects of health care and health care delivery: the physical laws of (1) finitude, (2) inertia, (3) entropy, and (4) the uncertainty principle; and the economic laws of (5) diminishing returns, (6) unintended consequences, (7) distribution, and (8) economizing (Tables 1 and 2). These laws represent observable features of daily life in a physically limited world. The four physical laws acknowledge the finitude, resistance to improvement, constant deterioration, and uncertainty inherent in all creation. The four economic laws demonstrate the frustrated perfection, perverse outcomes, variable potency, and opaque motivation of human behavior. Each of these laws has corollaries, some of which are famous in their own right, such as Prochaska's Readiness to Change,[9] Tar Baby Syndrome,[10] Murphy's Law,[11] network theory,[12] and moral hazard.[13]

The idealized realm of medicine sustains rules or maxims that are contradictory (here designated as *antinomes* or antilaws) to the physical and economic laws. According to Montgomery, each maxim of medicine indeed has its contradictory opposite, and the phronesis of the clinician is to enact the right choice for the situation. A typical example would be the need to consider unforeseen side effects or even prolongation of suffering (law 6) when new and presumably "better" therapies become available for disease (antinome 6), such as percutaneous feeding tubes. Usually, many of the eight laws must be considered simultaneously. A physician attempting to achieve "quality of care" hemoglobin A1C standards (antinome 7) in a poorly controlled diabetic must consider why the patient is an outlier (law 7) as well as his or her compliance to (law 8), the likelihood of benefit of (law 5), potential side effects of (law 6), and affordability of (law 1) an additional prescribed medication. Irrespective of the physician performing the dialectic, the eight physical and economic laws manifest themselves in the absence of health, the pathogenesis of disease, prognosis, and the behaviors of participants in the health care enterprise. In essence, the physical and economic laws describe observable reality—while their antinomes, the commonly espoused rules of medicine, represent idealistic goals.

To the extent that physicians apply the idealistic rules without regard for these physical and economic laws, there will be not only incongruity and dissonance but also tangible peril. We believe that such disregard is near universal, and, as a result, the peril is seriously pervasive and ominous.

The Perils of Disregarding the Laws

We have attempted to outline plausible perils that may result from ignorance or

Table 1
Physical Laws Pertinent to Health Care and Medical Education[55]

Law and definition	Synonym of the law	Medical antinome to the law	Corollaries to the law	Manifestations of the law in health care	Perils of disregarding the law
Finitude: Resources such as time, energy, finances, and attentiveness are finite.	Conservation of Energy and Mass	The patient comes first; "do everything"; Rule of Rescue	Economic scarcity; Malthusian prophecy	Soaring costs; shortened clinic visits; understaffing; triage; hospital financial crises; unfunded mandates	Patient noncompliance; bankruptcy; poor outcome[56]; overcommitted schedules; futile care; medical errors; denial of death, bureaucratic bleeding; hubris; exhaustion
Inertia: A body in motion continues in motion; a body at rest remains at rest.	Newton's First Law of Motion; Conservation of Momentum	Education and/or therapy can change the outcome if only the patient is dosed adequately	Prochaska's Readiness to Change[9]; Medical Cascade[10]	Repeat admissions; progressive downhill course; cascading iatrogenesis; failure to implement new guidelines	False hope; unrealistic prognosis; practice mediocrity
Entropy: The tendency of systems is toward disorder and decay.	Second Law of Thermodynamics	Humans are resilient and persist through time	Murphy's Law[11]; chaos	Degenerative diseases; multiorgan failure; caregiver burnout	Overestimation of resilience; unrealistic prognosis; disappointment; anguish
The Uncertainty Principle: The accuracy of measurement and prediction is limited.	Heisenberg Uncertainty Principle	"Establish the diagnosis"; "consider everything"; cause and effect determinism	Philosophic and quantum indeterminacy; complexity theory; classical and Bayesian probability[47]	Random disasters; incidentalomas; multiple diagnostic tests; empiric and duplicate therapy; reluctance to prognosticate	Overextensive evaluation; misinformation; polypharmacy; information overload; arrogance

Table 2
Economic Laws Pertinent to Health Care and Medical Education[57]

Laws and definition	Synonyms of the law	Medical antinomes of the law	Corollaries to the law	Manifestations of the law in health care	Perils of disregarding the law
Diminishing Returns: Each additional unit of input results in smaller marginal product.	Law of Increasing Opportunity Cost	"Where there's life, there's hope"; "new best therapy"	Cost inflation; diminishing marginal utility; Peter Principle	High end-of-life costs; technology cost increase; sequential tests and therapy; ICU care; transplantation	Unnecessary tests; marginally useful and futile therapy; cost escalation; unjust distribution of resources
Unintended Consequences: Actions have consequences unintended or unanticipated by the actors.	Law of Unforeseen Consequences	"The benefits outweigh risks"; "medical progress"	Perverse economic incentives; paradox	Surviving to get degenerative disease[58]; Hygiene Theory; increasing chronic disease and disability; less time at bedside, more at computer[59]; drug reactions	Increased iatrogenesis; cumulative disability; prolonged suffering; dissatisfaction; regret; claims
Pareto's Law of Distribution: 80% of the consequences result from 20% of the causes.	Pareto Principle; 80/20 rule; Power Law Probability Distribution	All patients are similar and should be treated the same and achieve the same standards of outcome	Network nodes and network analysis[12]; wealth condensation	High-cost patients; "problem" patients; case management; epidemic "spreaders"; "problem" personnel	Failure attributable to unfocused effort; unjust resource allocation; prejudice; cynicism; professional burnout
Economizing: Rational persons attempt to maximize gain and minimize cost; gains, costs, and overall utility are specific to the person and unknown to others.	Behavioral economics; neuroeconomics[44–46]	Patient goals and autonomy are paramount. Medical personnel should never have self-interest	Laws of self-interest and time preference; moral hazard[13]	Irresponsible health behavior; seeking disability; noncompliance; somatoform and factitious diseases; "lifestyle enhancement"; funding "fearful" diseases	Conflicts of interest; unjust or misdirected effort; political influence; unfunded mandates; frustration

disregard of these four physical and four economic laws (Tables 1 and 2). We categorized these perils as misdiagnosis, distraction, false expectations, unanticipated and undesirable outcomes, inequitable distribution of scarce resources, distrust, and cynicism. We believe that medicine and its offspring, health care, in their disregard of the physical and economic for the ideal, are increasingly frustrating themselves as well as society, and thereby multiplying pain and suffering.

Why Health Care Disregards Physical-Economic Laws: Don Quixote

Medicine evolved from a religious context and still retains many religious forms, costumes, and rituals, such as mystery, special knowledge, oaths, the white coat, stethoscope, rounds, and now scrub suits. Medicine is a moral and ethical endeavor that touches people at their most vulnerable times: sickness and death. Persons who are anxious and ill have always sought help from especially "called" persons who had *gnosis*, or special knowledge, to assist them to recover or to pronounce prognoses. Shamans, witch doctors, and Asclepius all were thought to have a touch of the divine to be able to heal and prognosticate. Patients may, in fact, *need* to feel that their physicians are special to be healed. Whether because of this "divinity" or through contract, society has always set physicians apart and given them special regard, which unfortunately at times physicians have come to expect and covet. This relationship is reciprocal[1] and comprises the doctor–patient relationship.

Not belittling the humanitarian ethos of non-Christian religions or the Hippocratic Oath, we believe that medicine's current idealisms flow with greatest turbulence from the teachings and life of Jesus of Nazareth. Called by some the "Great Physician," he shaped the metanarrative of medicine most strongly by both the Golden Rule[14] and his compassionate healings of the most desperate, even raising the dead. For example, the stories of the good Samaritan[15] and the prodigal son[16] led to the expectation of rescue and lavish acceptance without judgment. Federal law codified these values for emergency care in 1986.[17]

These divine ideals compose the antinomes of these eight physical and economic laws. Medicine, and specifically physicians, should ideally be infinite in their resources, omnipotent to change outcome, capable of preventing or restoring decay, and omniscient in diagnosis, therapy, and prognosis. The ideal physician should ceaselessly deploy these godly powers even in the most desperate of cases because of the expectation of complete healing, to all equally, without judgment but, rather, with *agape* love. Of course, no one seriously considered this possible—that is, until our time.

As science advanced in the 19th and 20th centuries, society literally beheld "medical miracles," such as vaccination, antibiotics, and major advances in surgery. The image of physicians changed in literature, and new demigods like Osler and the Alpha Omega Alpha Leaders in Medicine[18] set the standards for the priesthood. By midcentury, many patients thought of their physicians as godlike in their powers and actions, with images of Marcus Welby, MD, Ben Casey, Dr. Kildare, and Camus's stoic Dr. Rieux fighting *The Plague.* The public

sought and paid to make these miracles and miracle makers available for everyone; Medicare, Medicaid, and National Institutes of Health research funding were their prayers and oblations. They breathlessly anticipated the weekly Thursday oracle from Parnassus of disease conquered and life enhanced. Even today, government leaders promise no less than the elimination of suffering and death from cancer and, presumably, any other disease.[19]

Like Don Quixote, 20th-century medicine grasped its glorious calling with high anticipation. It did so at a time of decline of other metanarratives (e.g., Biblical/Eternal Worldview, Enlightenment Progress, Social Darwinism, Marxism, Libertarianism) and their attendant actors. Society experienced the "Death of God"; decadence of liberty, community, and family; and loss of both purpose in life and hope of eternity.[20,21] Medicine became the one and only god for this one and only existence. All life was "medicalized." That is, characteristics of everyday life became medical issues and thus came within the purview of doctors and other health professionals to engage and treat, to the spiritual detriment of man.[22] Medicine enchanted the public with visions of perfect health, defining health as the absence of anything unwanted along with the certainty of everything desired. Omniscient and omnipotent, it became the only noble means for bright and earnest people to conquer all worldly ills, galloping on a quest to slay every fierce and monstrous evil, imagined, inconvenient, or pathologic. Their heads filled with too much reading of glories won, physicians picked up the magic sword of medicine and rode into battle on the Rocinante of health care accompanied by the Sancho of the pharmaceutical industry.

Calls for Pragmatism at the Macro Level

There has been no shortage of criticism of medicine's and the public's quixotic and deleterious disregard of the physical and economic laws enumerated herein. As early as 1959, Rene Dubos[23] showed that the goal of health is a mirage not to be grasped. Ivan Illich declared medicine to be a nemesis to man's character and spirit in 1977,[22,24] and Daniel Callahan[25] and Richard Lamm[26] have consistently called for prognostic realism, to the point of suggesting a moratorium on both new technology and research for life-prolonging therapy. Theodore Dalrymple[27,28] persuasively argues from his long experience as a prison psychiatrist that the transmuting of social deviancy, drug abuse, and crime into purely biomedical diseases is illogical, manipulatively used, naively self-serving, and ruinous to all because resources of society are squandered to perpetuate and promote irresponsible behavior that undermines the culture. Rheumatologist Nortin Hadler[29,30] decries both the faddish medicalization of misery and also the sucking of the last well person into the "therapeutic envelope." Criticism by medical anthropologist Sharon Kaufman[31] centers on how patients lose control of their own destiny when entering hospitals because of the all-pervasive evasion of death by doing something. What links these various critiques is a call to pragmatism and realism. However, the combination of inarguable goals, existential fears, and strong financial and political incentives make the public and the health care industry deaf to such arguments. No matter that there is ultimately little—if any—relationship between the quantity of health by any measure and the amount of health care dispensed.[32]

As with all utopian schemes, the quest of health care will ultimately be catastrophic. Now, before the collapse, there are hopeful signs of pragmatism, with the growth of geriatrics, palliative care, hospice care, hospitalists, new models of chronic care, standardization and guidelines, church- and community-based health centers, and even concierge medicine[33] all buffering the idealistic goals of medicine with physical and economic reality. Most notably, the American College of Physicians recently advocated an independent national research organization to establish and promulgate the value of health care interventions.[34] Similarly, the strengthening of public health as a sociological, political, and legal discipline separate from medicine seems to us to be a more promising approach to improving health disparities[35] than making transplants available for all.

Developing a Pragmatic Phronesis in Medical Education

Our medical school, undoubtedly like most others, selects medical students for their intelligence, industry, personality, and humanitarian motivation. As a profession, medicine continues to be blessed with the best and the brightest, with almost all potential students expected to have worked selflessly in some voluntary capacity for the sick, the poor, and the unfortunate. In their preadmission essays, they describe their calling to the priesthood of medicine. They know the rules of medicine before they come to school. They know the rule of rescue, the need for nonjudgment, and the expectation of agape. The problem in medical education has been to prevent students from becoming totally cynical by the end of the third-year ward rotations. There, the Knights of the Mirrors show the aspiring young knights-errant the realities of sickness, death, and health care in all of their repulsiveness.

The response of academic medicine has been to emphasize ever more the ideals, to elevate professionalism, to promote better role models, and to reward paragons who labor tirelessly. The teachers press the quest ever onward and make sure students and residents do the same, even so in less time with more "evidence" than ever. No wonder that the brightest students increasingly abandon primary care. They see their own and medicine's ideals increasingly unattainable in the face of physical and economic constraints. Yet, in the admission essays they write, they feel compelled to justify career choices such as dermatology or ophthalmology in terms of alleviating the great suffering of patients with skin or eye disease. They do not think they have a chance of acceptance into these residency programs if they simply admit that they want to pay off educational debt and balance family life with career.

We do not intend our recommendations to minimize the lofty altruistic and humanitarian goals of medicine, which we feel are absolutely necessary for the profession to continue. Rather, we suggest specific ways that students, residents, and medical professionals could learn and incorporate the eight physical and economic laws into their practice under any circumstances of

health care delivery and avoid—or at least recognize—the peril of disregard.

Premedical education should return to a broader liberal arts exposure. Today, students disproportionately obtain degrees in biology and even molecular biology, genetics, or microbiology, and they spend hours doing undergraduate bench research on single genes, proteins, or epitopes—to the detriment of their broader understanding of the world.

Although biological concepts are important, we propose that medical students be proficient in the humanities as well. The psychological and sociological aspects of illness are the impact points of the eight laws, and medical students should know human life in a rigorous sense beyond mere biology. Specifically, we suggest familiarity with the Bible and other scripture, classic works of literature, history, cultural anthropology, and sociology. There should be at least a semester each of physics and macro- and microeconomics where the eight laws are explicitly reviewed. They should peruse developmental and behavioral psychology, principles of management and leadership, and introductory courses in ethics and logic, both to think more rigorously and to educate others. Also useful might be courses in industrial engineering, education, marketing, and statistics. Such courses stress a holistic perspective, critical analysis, and practical approaches to real-world problems that have affected mankind throughout history. These areas of study repeatedly exhibit the impact of the eight physical and economic laws on individuals, cultures, and societies. They point future physicians to a realistic view of the world of today. A typical medical school class should include many persons who have majored in these various fields instead of only the hyperreductionist subdisciplines of biology or chemistry. Finally, more applicants should have experienced the crucible of complexity that is life in business, the military, teaching, or the Peace Corps before indulging in the reveries of medical idealism in medical school.

In medical school, the following topics should be included in the first years of the curriculum:

- the physician and illness in literature,[36]
- history of medicine,[37,38]
- medical ethics,
- social epidemiology,[39,40]
- value-based medicine,[41]
- logic and critical thinking in medicine,[42]
- complexity and failure,[43]
- neuroeconomics,[44–46]
- Bayesian statistics,[47]
- network theory,[12,48]
- decision analysis,[8,49]
- patient-centered medicine,[50]
- medical persuasion,[51]
- working with the poor,[52] and
- principles of quality improvement.[53]

Each of these topics demonstrates the physical and economic constraints of health care and the means that have been attempted to deal with them.

Residency training programs and faculty development courses should also incorporate and further these topics. In the clinics and on the wards, faculty should coach their students and residents in the application of these topics and the eight laws, demonstrating appropriate balance with the idealistic rules of medicine. Such understanding and application would serve as the basis for demonstrating competency in systems-based practice.

Paradoxically, the most useful clinical experiences to learn the necessary phronesis are those in the poorest environments. Many medical students participate in medical outreach to homeless shelters, free clinics, and foreign populations. There, they learn the power of medicine—that they can give of their minds, hands, and hearts without the usual diagnostic and therapeutic armamentarium—and how the idealist aspect of medicine must be balanced with the bald-faced realities of the eight laws. Many clinicians find that a mission trip rejuvenates their calling and career. They return with renewed appreciation of both the ideals and the realities of implementation.

Most exciting is the development of the new field of neuroeconomics.[44–46] Its domain is at the overlapping frontiers of neuroscience, economics, and psychology. It promises to provide new insight into causes of unhealthy behaviors of patients, as well as decisions made by clinicians. Research into how to motivate patients and the public to make better health decisions and overcome genetic and environmental handicaps might offer new and more economical ways to achieve better health. Students, residents, and faculty should explore this field, as well as other fields that enable clinicians to be more effective leaders of health care teams operating under physical and economic constraints.

Seeing the Darkness, Bringing the Light

Everyone should admire the passion of Don Quixote; however, quixotic behavior, even in the context of medical practice, is ultimately doomed to fail disastrously. Idealistic medicalization of life is detrimental to the spirit of man and frustrating to both the moral and economic development of society and the health care enterprise. Don Quixote didn't succumb from heartbreak because he saw the reality of the world but, rather, because he saw the folly of his behavior. The great and lofty goals of medicine will never disappear; they will radiate even brighter when doctors and medical educators recognize the oppressively dark economic and physical realities onto which their light must shine. Only then will there be wisdom in health care.[54]

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