Thinking too much is bad for some brains

JOSEPH H. FRIEDMAN, MD
joseph_friedman@brown.edu

**Einstein purportedly** said that “insanity is doing the same thing over and over again and expecting different results.” This quote, although ascribed to the great physicist, is not actually his. However, the quote, which would certainly carry more weight if authored by Einstein, but possibly from Casey Stengel or Yogi Berra, is still relevant to a recent breakthrough in clinical brain research. Using new techniques, an explanation has been found to explain why people will, in fact, do the same thing over and over again, even though it doesn’t work. It also ties together recent functional magnetic resonance imaging (fMRI) evidence suggesting that thinking too much may damage white matter pathways. “It appears that thinking very hard about something may actually be bad for you,” reported the lead author of the fMRI study, Dr. Clouseau, in the New York Times. Using a new technique, Mass Electro-neurographic Connectome Analysis (MEnCA), one can follow bulk information processing pathways, when large enough and when provoked using certain techniques.

Advances in MRI have allowed scientists to image the brain in ways that markedly enhance our understanding of physiology in addition to structure. fMRI produces images based on metabolism, so that an image can be interpreted as representative of brain activity. When the language center is active, listening, talking, or thinking about words or language, it “lights up.” The speech areas increase in activity, producing an increase in oxygen utilization, resulting in increased blood flow, which is measurable. In addition to this physiological measure, brain connectivity has been imaged, via diffusion tensor imaging (DTI), allowing images to show pathways between one part of the brain and another. More recently, a technique has been developed that provides seemingly accurate, or at least reproducible, estimates for “traffic” flow between brain regions and the speed of information exchange. Using techniques that are too complex to be summarized here, we can track information flow, much as Doppler principles allow clinicians to measure blood flow, both speed and volume, in a non-invasive manner.

Imagine a song, playing over and over again, while probes pick up electrical activity and programs analyze it using the exact timing of the notes of the song, to isolate the “background noise” of the other brain activity, from those electrical responses to the song itself, presumably changing synchronously with the song (within milliseconds, time locked). With this as the simplified foundation, a subject who has been working on a problem is asked to think about the problem. In the experiment, a video graphic image of a Rubik’s cube is displayed and the subject must, using computer-based tools, attempt to rotate the blocks to solve the problem.

Most subjects attempt the puzzle in 3–5 different ways, then settle on 2, which they repeat many times, varying their turns later and later as each “path” is laid down. When asked to alter their third or later rotation, they generally find themselves unable, as if transfixed, thinking that they had been on the correct path, making their errors later on. Using the new technology, it was found that the speed of transmission of impulses along the circuit increased with each successive similar attempt at a solution, and, most interestingly, the volume of information, measured as gigandobytes of electrical impulses transmitted in the circuit, increased dramatically. In addition, electrical signals in nearby, but different circuits, not clearly related to the Rubik’s cube problem, were pulled in to the increasingly powerful circuit, causing a decline in information transfer in circuits not devoted to solving this problem. Why this happens is unclear. One theory is ephaptic transmission, a process in which adjacent axons, with breakdown in the myelin sheath, transmit impulses from adjacent neurons, which implies damage to the myelin. In support of this
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theory, 7 Tesla MRI revealed evidence of mild white matter changes and DTI revealed a loss of connectivity in the adjacent “subverted” pathways and increased connectivity in the pathway directly involved in this Rubik’s cube problem-solving circuit. In non-technical terms, these pilot studies are consistent with the idea that once the brain attempts to solve a discrete problem using the same approach repeatedly, it causes structural changes that increase the likelihood that it will continue to use the same unavailing approach. In addition, the repeated attempts interfere with adjacent pathways, causing them to slow or weaken. This creates a high flow/low flow competition, a Bernouli-type effect, and the possibility of increasing damage to brain circuits.

The question of what happens to structures in the brain that receive the “excess,” or at least increased, neural transmission remains even more speculative. One theory posits the possibility that increased activity leads to apoptosis, programmed cell death, induced by an inborn protective mechanism that keeps neurons from exploding. A competing hypothesis is that the nucleus ignavus, a minute structure only recently discovered, lying entirely within the vegan nucleus, containing the only neurons using gluten-amine as a neurotransmitter, may function as an electrical sink, a physiological safety valve, which draws off extra electrochemical energy before damage is caused. It had been long sought for by cognitive psychologists exploring the underpinnings of “cognitive sinks,” (see Medicine and Health, R.I. 84[4]:98-99) the so-called black holes of cognition. These are people who, without intent, reduce the intelligence of those around them without apparent benefit to themselves. The underlying notion is that by attempting to solve a problem in the same way, regardless of the futility, causes physiological changes that make it increasingly difficult for the brain to change its approach. This, in turn, reduces connectivity in other brain circuits attempting to solve other problems, thus making the person less able to solve other problems. The process may be related to the alterations that distinguish cognitive sinks from the rest of us.

This work also may explain why some people decline in intelligence, perhaps caused by thinking too much.

April fool! ☁

Author
Joseph H. Friedman, MD, is Editor-in-chief of the Rhode Island Medical Journal, Professor and the Chief of the Division of Movement Disorders, Department of Neurology at the Alpert Medical School of Brown University, chief of Butler Hospital’s Movement Disorders Program and first recipient of the Stanley Aronson Chair in Neurodegenerative Disorders.

Disclosures on website
On Mentoring
KENNETH S. KORR, MD

Medicine is increasingly referred to as a team sport, driven by evidence-based guidelines and goal-directed therapies. And clearly these approaches have improved patient outcomes and quality of care. When it comes to the education and training of physicians, however, there is also something to be said for the merits of experience-based training. This is particularly true in the surgical and interventional subspecialties where technical expertise and on-the-spot clinical decision-making are learned at the hands of more senior physicians. Even in the non-procedural areas, medicine has always been a mentoring profession. Most of us have benefited from one-on-one learning situations, from clinicians with years of experience in the diagnosis and management of diseases, some of which we have rarely seen or have only read about in textbooks. Diseases like rheumatic valvular heart disease or congenital cardiac abnormalities, the subtleties of physical diagnosis or even the appropriate use of digitalis are knowledge and skills which we have gleaned from observing and emulating others.

When I reflect back on my own career, several physicians stand out as role models. There was the young cardiologist during my residency training who exposed me to bedside right heart catheterization (Swan-Ganz) for the management of acute heart failure patients. That experience made me realize I could have a career that combined both procedural skills and intellectual decision making in patient care. During fellowship I worked closely with two outstanding clinicians who were also accomplished academics and who guided me through the process of writing my first publications. And much later, caring for an esteemed and revered physician colleague, showed me by example what it was to be a patient with dignity.

Working in a medical school environment is perhaps the optimal mentoring experience both for the student and the teacher. As a newly minted assistant professor I met every Thursday afternoon with two 3rd year medical students. They presented cases they were following and we discussed differential diagnoses, pathophysiology and what the next steps would be as the cases unfolded. There was a lively give and take and while I like to think that I taught them a lot, it was also an opportunity for me to review disease entities which I hadn’t thought much about since my Medicine Boards a few years earlier. In addition, they were each given small study assignments on some related topic (usually one where I also needed the review) which they would come back and present the next week. Of course, it wasn’t all case review or patient care. We also talked about career direction, the difficult balance of medicine and family life and even just good restaurants or places to go on vacation. In the small Rhode Island medical community, these relationships can come full circle as they did when many years later, my mother-in-law developed breast cancer and I sent her to the same 3rd year student who was now an accomplished surgeon specializing in breast cancer and partial mastectomy. And it was no small irony when 25 years later the student doing his office clerkship with me was the son of one of those two medical students.

Patients have for the most part been very receptive to the presence of students in the exam room. It is important to keep the focus on the patient, make them feel that they are the most important person in the room and not just there for the physician to make a “teaching” point. And increasingly as the clerkship progresses, the student/resident becomes more relaxed and confident and begins to interact more directly with the patient. That is perhaps as equally important as the case discussion which happens after the patient encounter.

Mentoring can be a rewarding experience for the mentor. We get as much as we give, or even more. In the rapidly expanding technologic environment of medicine, students and residents have
always been the ones to point out the quickest shortcuts to navigating the EMR or the best cellphone apps for drug compendiums and risk calculators. And then there is the obvious satisfaction of watching medical students progress clinically. Some stay on through the training programs as residents and fellows and develop their own teaching skills. Many go on to become well-respected physicians within the community and accomplished faculty colleagues. Each of them is the amalgam of countless clinical interactions with faculty, those little clinical pearls, the nuances of the physical exam or the individual approaches to difficult patient discussions and decisions.

This issue of the RIMJ includes an interesting Q&A with members of the Clinical Faculty Advisory Committee discussing the mentoring process and opportunities for clinical faculty at the Alpert Medical School. I would recommend this article and accompanying links to anyone curious about becoming a clinical faculty mentor. Other than direct patient care, it can be one of the most rewarding experiences of your career.

**Author**
Kenneth S. Korr, MD, FACC, Associate Professor Emeritus of Medicine, Alpert Medical School of Brown University; Associate Editor of the *Rhode Island Medical Journal*.

**Correspondence**
kkorr@lifespan.org

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**On the Practice of Medicine**

Thirty-nine years ago when I entered practice, the retiring doctor I had joined put his arm around my shoulders and told me he had seen the best days of medicine and he felt sorry for my generation of physicians. I remember thinking, what does he know? Now as I contemplate my own retirement and take stock of my career, I find myself echoing those exact sentiments! But then I realize that no matter what “they” do to the structural practice of medicine, no matter how many challenges we are forced to accept, no matter how our livelihood is impacted, there is one thing that can never be taken away from physicians, and this gets right to the core of what being a physician is about. That, of course, is the privilege and duty to touch the life of another human being, and to be touched in return. This, for me, is the essence of being a physician, and, at the end of the day, what helps me look forward to tomorrow. So the next generations will have the best days of medicine as well.

Barry Wepman, MD

*Dr. Wepman is an Ophthalmologist, practicing in South County, working under the aegis of Koch Eye Associates.*
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AMA Code of Ethics: Roots, Revisions and Relevance Today

HERBERT RAKATANSKY, MD

A Rhode Island doctor recently had his license reinstated after successful treatment for an illness. The consent order issued by the Rhode Island Board of Medical Licensure & Discipline (BMLD) includes the following statement: “Respondent shall conduct himself according to the Code of Ethics of the American Medical Association.” Most of us have never read the Code and likely do not understand its origins and current importance in the lives of US physicians.

Early codes: Origin and evolution

The Hippocratic Oath (460–370 BC) was a personal pledge to adhere to certain principles such as confidentiality and “do no harm.” (In those days there was little chance of doing much good.) There was no consistent organized compendium of “ethics principles” applicable to all physicians.

For many years, up to and including the Middle Ages, the church defined the standards of morality. As the influence of the church waned during the Renaissance, the concept of moral philosophy in which virtue in life and basic human rights assumed increasing importance, influenced many areas including politics and the medical profession.

University education included the teaching of moral philosophy (in contrast to religious dictates). In the late 18th century, collections of aphorisms about the moral basis of virtue as applied to medical practice were the first ethics’ codes.

Dr. Thomas Percival

The revolution in thinking about codes of medical ethics started in The Manchester (England) Fever Hospital, a source of care for the poor in the late 18th century. In 1792 a controversy over staffing and operational issues came to a head and disrupted hospital operations. Hoping to avoid any further such disruptions, the trustees hired Dr. Thomas Percival (1740–1804) to write a Code of Ethics. Published privately for the hospital in 1794, this treatise “codified duties to patients and other practitioners.” It was published widely in 1803.

Prior to Percival the ethical behavior of doctors was encouraged and supported by individual oaths or pledges to behave honorably toward patients. Percival’s revolutionary idea was that the profession of medicine as a collective had a primary duty to care for patients. This obligation of the whole profession as an entity was a duty above and beyond just the obligation that each doctor had to lead an honorable and virtuous life himself and therefore be honorable in his care of his patients.

It is hard to overstate the
Dr. Percival’s Code of Ethics

importance of Percival’s idea about the collective responsibility of the medical profession. He wrote that physicians, individually and collectively, hold the responsibility to advise the civilian trustees of hospitals about the necessary professional issues such as safety, proper ventilation and other issues that affect the care of the patients. Finances were addressed as well. Percival warned against saving money by using “cheaper drugs of inferior quality.” He warned doctors, individually and collectively, “not to suffer themselves to be restrained by parsimonious considerations from prescribing...drugs even of high price when required in diseases of extraordinary malignancy [sic] and danger.”

Percival’s ideas were incorporated into many codes of ethics. For example, in 1810 the Boston Medical Association published a booklet titled “The Medical Police,” which was based directly on Percival’s treatise.

One other consequence of Percival’s work is the concept that since medical ethics was a responsibility of medical organizations, those same organizations could and should enforce ethics principles. Only in 1889 did a Supreme Court decision (Dent v WV) definitively recognize that state governments had the right to regulate the practice of medicine. But the AMA Code is recognized by virtually every state licensing board as an adjunct to the state medical practice act, thus incorporating the Code into its regulations de facto if not de jure.

Rhode Island law defines 30 specific unprofessional behaviors. Additionally, the RI BMLD expects physicians to adhere to the AMA Code and so do most, if not all, medical institutions. The application for membership on the medical staff of our largest medical care system requires a signed statement that our behavior will conform to the AMA Code. Most courts and administrative bodies use the AMA Code as a reference standard.

The Rhode Island Medical Society (RIMS) was founded in 1812. In its charter, the state of RI gave RIMS the responsibility for licensing and discipline of doctors. RIMS, however, was not given specific criteria to do this and thus relied on the increasing recognition of “Percivalean” ethical standards.

That situation remained in place in RI until 1895 when a state Department of Health was established and assumed that responsibility. Currently the BMLD exercises those responsibilities. Louisiana had been the first state to establish a health department in 1855.

The AMA was formed in 1847 with the triple purpose of advancing science, medical education and ethics. The original AMA Code of Ethics was derived directly from Percival. We now regard that initial code as more of a guide to medical etiquette that omitted issues that today we consider basic. But it was revolutionary in establishing a national standard for ethical behavior for all doctors in the country. In 1855 the AMA decreed that the Code of Ethics applied to all constituent member associations. Dissidents in the AMA forced a revision of that restriction in 1903. By 1912, however, the “principles of medical ethics” were accepted and a Judicial Council was established to elaborate and enforce these standards. Since then we have had a nationally accepted set of defined ethical behaviors.

Interestingly, Percival’s ideas were not generally accepted in his own country. England established the government-operated General Medical Councils in 1858 to license and discipline doctors. But there was no independent code of medical ethics developed by the medical profession to provide an ethics framework.

The modern concept of autonomy and informed consent, though discussed in the early 1900s, took root only after World War II as the participation of many German doctors as well as the German Medical Association in the Holocaust was revealed. What those doctors did from 1933 to 1945 was
both legal and ethical according to the Nazi standards of that time in Germany. Consonant with the “never again” stance toward the Holocaust, the patient-centered ethics standards of autonomy and informed consent are designed to thwart unethical policies and/or medical behaviors that might be instituted or encouraged by governments or other organizations.

AMA Code of Ethics

The Code consists of:

1.) Nine broad “Principles of Medical Ethics” ratified by the AMA House of Delegates. Amending them is intentionally procedurally difficult. First established in 1903, they were modified in 1912 and shortened in 1957 and since then revised in 1980 and 2001. The Principles form the basis for complete reports on specific topics.

2.) Conclusions (Opinions) are formulated by the Council for Ethical and Judicial Affairs (CEJA) about many specific issues. These Opinions make up the body of the Code and generally are what most persons consult. Take a look at them – we should know what we agreed to and what is expected of us.

3.) The analytical, complete reports supporting the Opinions either are published in the medical literature or are available directly from the AMA.

CEJA is composed of seven doctors, one appointed by the president of the AMA each year for a single 7-year term, one resident for a 3-year term and one medical student for a 2-year term and is supported by a highly qualified professional staff.

The reports and Opinions are widely discussed by the membership and the House of Delegates during their formulation, but CEJA issues its Opinions and reports independently, without the need for approval by any other part of the AMA.

The Opinions have been recently revised to a more readable form. They are freely available on the AMA website, along with the Principles. The published reports are in the medical literature and the unpublished reports are available from the AMA.

An annotated version includes references to specific court and regulatory decisions based on the Code. It is available from the AMA in a print or e-book version that serves to document the actual, real-world effect of the Code. The physical weight of the print version (3 pounds, due to the numerous citations) suggests how extensive the Code’s influence over medical practice in the US has become!

The fact that courts and regulators accept these Opinions widely indicates societal acceptance of self-regulation by the medical profession. The doctor mentioned above, whose license was reinstated, benefited from the existence of ethics’ standards generated by the profession itself, as do we all.

A highly respected ethicist has stated: “Considered as a single body the...AMA Code constitute[s] the most comprehensive and influential statement of medical ethics extant.”

Thank you, Dr. Percival! ✤

Author

Herbert Rakatansky, MD, FACP, FACC, is Clinical Professor of Medicine Emeritus, The Warren Alpert Medical School of Brown University.

Disclosure

Dr. Rakatansky was a member of CEJA from 1994–2001.
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Like any self-respecting internist, I was raised to have the appropriate disdain for the ED and all who reside there. My complaints usually came down to one of two things: [a] “Why did they admit this patient?” or [b] “Why did they, or did they not, get a CT?” However, you should not judge a man until you walk a mile in his shoes. That way, when you do judge him, you’ll be a mile away and have his shoes.

During my second year of residency, when I walked what seemed like a mile from the teaching wards and became an ED doc for a month, I realized a few things. First, we internists can be quite snotty. Second, ED docs know a lot of things that we don’t. And third, it changes everything to be the one who saw the patient when she walked or rolled in the door.

Let’s start with the admitting physicians I had to deal with. I had a patient one night who came in for an ulcerative colitis flare. I gave her fluids and pain medication, called GI, and admitted her to the medicine service. For a second, I basked in the glory of getting my patient admitted. The next day, I checked the chart to see how I had done. When the patient presented, she had been tachycardic to about 110. Although her rates quickly normalized, the admitting physician cynically wrote in her H&P something along the lines of, “most likely sinus tach, which resolved, but ED did not get an EKG.” Who cares? Then, in the progress note from the physician who took over the patient the next day, down in the copy-pasted plan section, it said again, “but ED did not get an EKG.” Yeah, we get it already.

As for that impressively broad knowledge, the ED docs know so much about eyes. I know next to nothing about eyes. In the ED, they have ophthalmoscopes in every room, and they seem to have at least some idea how to use them. In morning report, we had a lecture on eyes, and these kids knew how to tell a blepharitis from a conjunctivitis from a chalazion from a cornea. They were also well-versed in something else I had revealed in forgetting: obstetrics and gynecology.

Lastly, in the ED I learned what it means to be the first physician to see the patient. While I managed my share of COPD exacerbations and cellulitis, I also encountered some ill-appearing patients whose labs and imaging all returned normal. Most likely, these patients could have gone home, but I realized that if a patient was in the fetal position when I met her, it is hard to discharge her in good conscience. Unless of course she subsequently displays the universal “texting sign.” However, I would also occasionally see the fetal position followed by the texting sign, followed again by the fetal position. Then I would just be confused. So I would reluctantly call my internal medicine friends, apologize for the weak admission, and tell them they have to take the patient because triage said so. Although back on the wards I still grumble about having to admit patients like her, I might quietly concede that I would have made the same decision that my colleagues in the ED did.

My experience in the ED helped me grow as a physician in subtle, but real ways. For one, the next time I opened my board review question bank, I took a deep breath and clicked on “ophthalmology.” In primary care clinic, I found myself considering what the ED would have done if the patient had gone there with the same complaint. Most importantly, though, the experience deepened my understanding of how a patient ends up under my care and why he brings with him what he does, whether it’s a CT scan, a couple of troponins, or a certain diagnosis. And somewhere in my differential, I now consider the possibility that the ED physician making the decisions is an internal medicine resident.

Author
Eric R. Gottlieb, MD, MS, Internal Medicine Resident, Department of Medicine, Alpert Medical School of Brown University, Rhode Island Hospital.

Correspondence
Eric R. Gottlieb, MD, MS
593 Eddy Street
Jane Brown Ground, Suite 0100
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