ISSN 1543-4672

Medical Ethics

Fall 2010
Vol. 17, Issue 3

Quote to note

"Everything that can be counted does not necessarily count; everything that counts cannot necessarily be counted."

—Albert Einstein

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Virtue ethics and medicine

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What is virtue ethics?

Virtue ethics has its theoretical roots in ancient Greek and Chinese approaches to the question of how to live well as a human being—that is, how to live a good life. A "good life" in this sense is one that expresses excellences of human character. In both ancient and modern forms of virtue ethics, character traits—or virtues and vices—are the units of moral analysis and the specific forms of human excellence. If we want to know whether a given response to a dangerous situation is morally good or bad, we should ask whether it is courageous (or expressive of other relevant virtues) or rash or overly fearful (or expressive of other relevant vices). When we answer that question, we are, at the same time, answering whether the response is an excellent human response and, as a sort of yardstick, we may look to a comparison with ideal examples by asking, "What would virtuous person X do?"

Virtues (and vices, for their part) are familiar traits of character such as kindness, compassion, truthfulness and loyalty to promises on the side of virtue and, on the side of vice, meanness, cruelty, dishonesty and infidelity. These traits are specific forms of excellence (or, in the case of vice, excesses or deficiencies) relative to common human needs and problems such as how to share resources, maintain interpersonal commitments and so on. As traits of character, virtues are neither one-time-only actions nor merely intellectual conclusions. Instead, they are dispositions regarding actions, perceptions and emotions of the right sort, toward the right subjects, for the right end, at the right times and in the right way.[1]

Virtue ethics and medicine

An affinity between medicine and virtue ethics can be traced to ancient Greek philosophers: Plato, who praised Hippocrates' method for understanding the body as a model for efforts to understand the soul[2] and Aristotle, who compared the goal of medicine as health with the goal of virtue as human happiness or flourishing. Aristotle criticized the idea that the physician's aim was health as an abstract idea, but rather emphasized that the goal was *human* health, and more specifically the health of the physician's individual patients.[3]

This emphasis on the health and care of individual patients tracks important aspects of the affinity between virtue ethics and medicine, specifically the focus on context-based evaluation of decisions and the importance of appropriate practice and mentorship. In virtue ethics, the organizing moral virtue is practical wisdom, which is very different from a deductive exercise in applying particular principles or rules of action to a given context. Instead, it involves finely honed sensitivities for "seeing as" morally significant—that is, for recognizing moral salience—and for appropriate responsiveness that, while not "gut" reaction, is nonetheless an immediate response of applicable virtues of character. The virtuous response is, furthermore, the result of continued and extensive practice rather than "mere feeling."

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Virtue ethics—continued from page 1

As Kathryn Montgomery writes, "Medicine's success relies on the physicians' capacity for clinical judgment. It is neither a science nor a technical skill (although it puts both to use) but the ability to work out how general rules—scientific principles, clinical guidelines—apply to one particular patient. This is—to use Aristotle's word—phronesis, or practical reasoning."[4] Building the capacity for practical wisdom in both clinical and moral judgment requires appropriate education and habituation. Thus, under favorable circumstances, training in medicine through mentor-student relationships and the inculcation of good habits of clinical practice has the potential to instill practical wisdom in both professional clinical and moral judgment.

How can virtue ethics help decide difficult cases?

Virtue ethics has recently received renewed interest within medical ethics in part because of perceived limitations of both consequence-based and duty-based moral theories.[5] Tom Tomlinson, for example, critiques the idea that physicians have a "duty" to treat patients with deadly infectious diseases where there is substantial risk involved for the physician and his or her family.[6] Rather, he thinks that if we view treating in these circumstances as virtuous we will better understand the proper nature of the moral requirement (as an ideal of the virtuous person rather than a duty for all) as well as allowing us to admire, aspire to and positively reinforce this kind of behavior.

However, virtue ethics has also frequently been criticized for a lack of action-guidance in resolving concrete moral problems.[7] This critique has to do with two of the core features of virtue ethics discussed: the appeal to the virtuous agent in determinations of right action and the dependence of the virtues on appropriate responsiveness to specific moral contexts. Unlike a view of morality that relies on conformity of our actions to antecedently specified principles or rules of right action (such as following the 10 commandments), the determination of which actions, perceptions and emotions are of the right sort, toward the right subjects, for the right end, at the right times and in the right way is not readily specifiable absent a particular context. Further, the appeal to what the virtuous agent would do in the circumstances may seem unhelpful without a specification of actual particular persons on whose available judgment we may rely.

Yet this perceived limitation of virtue ethics can perhaps be ameliorated by three considerations. First, it is unclear whether other moral theories actually do better in helping to resolve difficult moral cases. After all, we must ask not only what a particular moral theory would actually recommend in the case at hand, but also which moral theory is the right one to appeal to. Both questions are so fraught with difficulties that many contemporary moral philosophers have abandoned the idea that medical ethics could be a matter of simply "applying" normative moral theories to particular cases.[8] Second, we might consider what kind of guidance we *should* want from a moral theory. While some might find appealing the idea that a moral theory give us something like a decision procedure for resolving difficult cases, good moral character is not something we should expect will be co-extensive with the technical ability to apply a moral decision procedure to a particular case. Further, if we rely on moral theories to "tell us what to do," we may in fact undermine the development of a robust sense of individual moral agency and responsibility.

Finally, and most important, is a consideration of what a virtue ethical perspective can do to help resolve difficult moral cases. Virtue ethical views offer (at least) three resources and reminders to help frame and approach difficult moral cases:

(1) Rich accounts of the contours of specific virtues relevant to different types of circumstances. In his account of the virtues particularly relevant to medicine, Pellegrino focuses on the virtues of fidelity to trust and promise, benevolence, effacement of self-interest, compassion and caring, intellectual honesty, justice and prudence (practical wisdom).[9] Other "virtues" mentioned in recent literature as important to medicine include: responsibility, humility, courage, temperance, unconditional positive regard, charity, vigilance, agility, faith, hope, love, respect for patients, integrity, self-sacrifice, competence and altruism. Such accounts can remind us, for example, that honesty in medicine is not simply "truth-telling" but is about *how* to relay news, such as that of a dire prognosis, in a manner that is both straightforward and compassionate. They can further remind us that moral honesty and intellectual honesty, such as the willingness to recognize and confront uncomfortable truths (including the "inexact" nature of medical science and gaps in one's own knowledge), are two sides of a coin—each required for the full virtue of honesty.

(2) A reminder of the importance of addressing not simply what is best to *do* in a particular context but also how we should *perceive* that context and what *emotions* are appropriate to the circumstance. Hence we are reminded that appropriately feeling empathy for a suffering patient and recognizing *that* a patient is suffering are both integral parts of the virtue of compassion.

(3) Appeal to the wisdom of those whom we recognize as exhibiting the virtues. In some cases that may be direct appeal by either practicing alongside and learning from these individuals or asking for advice in difficult circumstances. □

[1]Aristotle. *Nicomachean Ethics*. Irwin T, trans. Indianapolis: Hackett Publishing; 1985, at 1106b20.

[2]Plato. Phaedrus. In: *Plato: The Collected Dialogues*. Hamilton E, Cairns H, eds. Princeton, NJ: Princeton University Press 1989; 475–525.

[3]Aristotle, *supra*, at 1097a10.

[4]Montgomery K. *How Doctors Think: Clinical Judgment and the Practice of Medicine*. New York: Oxford University Press; 2006: 5.

[5]Larkin GL, Iserson K, Kasutto Z, et al. Virtue in emergency medicine. *Acad Emerg Med* 2009; 16(1): 51–55; Bryan CS, Call TJ, Elliot KC. The ethics of infection control: Philosophical frameworks. *Infect Control Hosp Epidemiol* 2007; 28(9): 1077–84.

[6]Tomlinson T. Caring for risky patients: Duty or virtue? *J Med Ethics* 2008; 34: 458–62.

[7]Louden L. On some vices of virtue ethics. In: Crisp R, Slote M, eds. *Virtue Ethics*. Oxford: Oxford University Press; 1997; Childress JF. Methods in bioethics. In: Steinbeck B, ed. *The Oxford Handbook of Bioethics*. New York: Oxford University Press; 2007; 15–45, at 35–8.

[8]Rachels J. Ethical theory and bioethics. In: Kuhse H, Singer P, eds. *A Companion to Bioethics*, 2nd ed. Oxford: Blackwell Publishing; 2009; Hursthouse R. *On Virtue Ethics*. Oxford: Oxford University Press; 1999.

[9]Pellegrino ED. Toward a virtue-based normative ethics for the health professions. *Kennedy Inst Ethics J* 1995; 5(3): 253–77; further virtue ethical views tailored to medicine are offered in Walker RL, Ivanhoe PJ, eds. *Working Virtue: Virtue Ethics and Contemporary Moral Problems*. New York: Oxford University Press; 2007. See in particular the chapters by Pellegrino, Baier, Radden, Blustein.

Ask the ethicist:

Clinical decision making for the unbefriended patient

A 72-year-old man was admitted after he collapsed unconscious on the street. He was found to have a large acute subdural hematoma that required neurosurgical removal. He remained cognitively incapacitated following the surgery and was going to require a tracheostomy and gastrostomy feeding tube. He was unmarried, had no family and no friends. He had rented an apartment in the area two years earlier but kept to himself. He had no advance directives. His physicians wished to obtain consent for treating him but were uncertain how to act in the absence of any available surrogate. What would you recommend?

Response: *An evidence-based approach*

Connecting this patient with his past—family, friends, life goals, etc.—is just as urgent as his physical medical needs, the gastrostomy and tracheostomy. Making this connection begins with an "investigative" social worker who has experience researching an individual's past. The social worker starts with finding evidence of identity, who he is: name, address, social security number, organizations to which he belonged, churches, etc. Calling neighbors, landlord, senior centers and stores is another step. At 72 the patient probably receives Social Security and Medicare benefits that might provide some basic data about his background. The investigation is important both for the sake of notifying family members—children, spouse and siblings—to let them know about the situation, as well as getting evidence about this man's life such as his occupation, hobbies and activities. This search may include gaining access to his apartment with appropriate legal authority and looking for papers that could be helpful. In the process of this search a will, advance directive or living will might even be uncovered. The plight of a homeless person in a similar situation is more difficult because of the lack of a physical place to look for such information.

In an emergency situation, the hospital and staff obviously do what is necessary to preserve this patient's life, such as surgery to evacuate the hematoma. That could include performing a tracheostomy and possibly even a gastrostomy if these were needed in the first few weeks. After the initial life-saving efforts, the ethical standard for decision making is to follow what is in his "best interest," which generally means further life-prolonging care. However, it has now become clear that not everyone, or perhaps even most people, want life-extending care in circumstances like this especially if this means continued existence in a vegetative state or if it means uncontrollable seizures, hemodialysis or permanent mechanical ventilation.[1]

After stabilizing the patient's physical condition, the next step is to establish a likely prognosis. Prognosis requires a careful, thorough review of the patient's neurological condition (exams, scans and EEG) and course as well as data concerning other systems. At 72, he may have underlying (subclinical) heart, pulmonary, kidney or liver disease that may become evident and affect his prognosis. Intensivists need to estimate what they see as the likelihood of recovery as well as what recovery is likely to entail, such as return to normal function versus long-term ventilator assistance.[2]

It may take weeks to sort out all the pertinent physical and social parameters. In the meantime, life-support measures should be used, including resuscitation if needed. While it seems likely that something about this man's past would be uncovered, it is possible that in a busy, crowded, understaffed medical facility no information would become available. In that case how should decisions be made? Asking for a court to appoint a guardian to make a substituted judgment would be one option. However, in the absence of information or details about this man's past, the guardian or judge would need to think about what "most people" would wish or what is "medically best" in this circumstance. These speculations seem unreliable as a way to make a patient-centered decision. The error implicit in this presumption would be especially likely in this circumstance because this man is already obviously unlike "most people" in his social disconnection. Indeed, homeless people, who might be similar to this patient, distrust the courts and legal system more than they do doctors in making critical life-extending decisions.[3]

Review by an ethics consultation or committee would be another approach once the medical and social data were obtained. There would be several actions an ethics committee could take. If a surrogate decision maker could be found, the surrogate could be counseled on the grounds for decision making—what he or she would consider the decision the patient would make about life-extending treatment. If no surrogate is found, the committee could gather evidence relevant to the patient's values, other decisions the patient made, such as any testimony as to what the patient may have said. Next, the committee could listen to caregivers and review the medical data as well as the social or "value-oriented" data, and assist the caregivers in reaching a consensus on what would be the best course of treatment. The emphasis here is on getting the best medical *and* person-oriented evidence and processing it in a consensus-oriented discussion to reach, what might be called, a "synthetic" decision. It is important to emphasize that the ethics committee does not make a decision but rather facilitates a process that enables a decision to be made based on the best available evidence.

Daniel Callahan, in his book *Setting Limits,* provides a helpful way of thinking about this approach.[4] He describes a person- or patient-centered approach for medical decision making as one that is biographical as opposed to biological. The biographical standard requires evidence of facts about the meaning, purpose and significance of the person's life. This narrative synthesizes the person's previous actions, alliances and relationships into a life story. The group decision-making process, convened by the ethics committee, reviews and discusses both the biological and biographical evidence and reaches a consensus on the basis of both categories. Although some committee members may vary in their perspectives of the relative weight of certain pieces of evidence, the process of hearing the life story and listening and sharing perceptions produces the best chance at arriving at a patient-centered medical decision.

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The legal column:

The health insurance exchange and competing visions of justice

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The health insurance exchange is the centerpiece of the Patient Protection and Affordable Care Act (ACA), the health reform legislation recently adopted by Congress. Beginning in 2014, every state will have two exchanges—one for individuals and one for small businesses (initially for employers with up to 100 employees but possibly for larger employers after 2016). States may combine the two exchanges. The states will run the exchanges, but the federal government will run the exchange in a state that chooses not to.

An exchange is a marketplace for insurance plans, much like a travel Web site. An individual who is not insured through her job will purchase insurance through the exchange Web site. There she will find clear, standardized, comprehensive and comparable information about available health plans. All plans must be certified by the exchange as meeting basic requirements. All must cover "essential benefits." Plans will be arrayed in "tiers" based on their cost-sharing requirements, so individuals will be able to pick high-deductible plans or high-coverage plans. Multistate plans, like those that serve the Federal Employee Health Benefits Program, will be offered and new nonprofit cooperative plans may be available in some states. The exchanges will rate the plans and include consumer satisfaction survey information.

An employee of a small business will be able to pick the plan that best suits his situation, with the employer and employee each paying part of the premium. Most insured small-business employees today have only one plan available, but the exchange will offer a range of options. An enrollee who qualifies for Medicaid or whose children qualify for CHIP (Children's Health Insurance Program) will be enrolled in those programs through the exchange. An individual or family whose income is less than 400% of the poverty level[1] will receive premium assistance tax credits and cost-sharing reduction payments to make both premiums and cost-sharing affordable. These tax credits will be keyed to the proportion of household income spent on premiums and will phase out as income reaches the 400% level.

The exchange is based on the theory of managed competition originated by economist Alain Enthoven in the 1970s.[2] The idea is that if health insurers can be made to compete with one another in an organized market where the consumer's attention is focused on price and value, competition will bring down premiums and increase health plan value. Health plans will, in turn, try to control health care costs so that they can hold down their premiums. Exchanges will reduce administrative costs for insurers and employers, further lowering the cost of health insurance. The best current examples of the exchange are the Federal Employee Health Benefits Program and the Massachusetts Connector, although successful small-business exchanges operate in Connecticut and elsewhere, and a number of states offer their state employee or retiree programs through exchanges.

Although some exchanges have succeeded, attempts by a number of states to establish exchanges have failed. For example, the Health Insurance Plan of California, which was founded in 1993 and privatized and renamed PacAdvantage, grew to 150,000 members, but ultimately failed, closing in 2006.[3] The key problem has been adverse selection. Ten percent of Americans account for 70% of health care costs in any given year. Thus, insurers can do much better competing for healthy enrollees than by competing on prices. Exchanges attempted to offer their enrollees high-value health plans and to insure individuals regardless of their medical conditions. But insurance was still available outside of the exchange. Healthy individuals and groups purchased cheaper insurance outside of the exchange. Exchanges ended up with sicker enrollees and the premiums of plans purchased through the exchange became more expensive. Insurers avoided the exchange and its sicker enrollees, and the choices available in the exchange diminished. Eventually, the exchanges folded.

The ACA outlaws underwriting based on health status and bans the exclusion of preexisting conditions. Insurance will continue to be available outside of the exchange, but insurers outside the exchange will have to serve the unhealthy as well as the healthy. A risk pooling system will also be put in place in 2014, so that insurers that attract healthier individuals and groups will be assessed fees that will be paid to insurers that end up with less healthy enrollees. Benefit packages will be standardized so that insurers will have less ability to manipulate benefits or cost-sharing to attract healthier enrollees. Adverse selection against the exchange should be much less of an issue.

In 1993, Deborah Stone published an article entitled "The Struggle for the Soul of Health Insurance."[4] She argued that two visions of justice or fairness—two ethical norms—were competing as we as a nation tried to decide how health care should be financed. On the one hand, the principle of mutual aid or solidarity, on which the health care financing systems of other developed nations are based, views sickness as a condition that should automatically generate mutual assistance from the community. The willingness to help one another in the face of medical need is "the glue that holds people together as a society." On the other hand, the principle of actuarial fairness claims that each person should pay his own way, bear her own risk. Individuals should no more be obligated to pay for another's health care than they should have to provide others with cars or computers. Endorsing the actuarial fairness principle, 21 states have sued the federal government, claiming that Congress lacks authority under the Constitution to require individuals to

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Ethics and the humanities:

Gender trouble

A film review of ***Ma Vie en Rose*** *directed by Alain Berliner, 1997*

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> "One is not born a woman,
> but rather becomes one."
> —Simone de Beauvoir, *The Second Sex*

According to legend, the first white child born in Colorado, a girl, occurred in the northwestern corner of the state in what came to be known as Greeley. Named for Horace Greeley ("Go west, young man"), its settlers were seeking a utopia where churches, schools and farms could flourish, and the city has largely been a quiet and conservative place to rear a family. Even temperance did not end until 1969 and only then by a margin of 477 votes. However, in the summer of 2008, Greeley found itself in the national spotlight when Allen Ray Andrade was charged with the murder of 18-year-old Angie Zapata—the first time in the United States that the homicide of a transgender victim was prosecuted as a hate crime. Her family worried constantly about Angie, who had endured years of taunting, and tragically, their fears proved valid when Andrade beat her to death upon discovering that she was male. He allegedly told friends: "It's not like I killed a straight, law-abiding citizen."

The suburbs of Paris are about as far from Greeley, Colorado, as any place on earth, and while the kind of horrific brutality inflicted upon Angie Zapata never actually erupts in Alain Berliner's groundbreaking film, *Ma Vie en Rose (My Life in Pink)*, we do witness a seemingly inexorable escalation of cultural anxiety, social ostracism, peer hostility and physical abuse directed toward a transgendered child and his family. However, *Ma Vie en Rose* is neither sensationalist nor simplistic; it is a complex and artful exploration of the power of imagination, the mystery of gender identity as distinct from sexual orientation, and the fear of difference.

Meet the Fabres: father, Pierre (Jean-Philippe Écoffey); mother, Hanna (Michèle Laroque); and four seemingly "normal" children—with the exception of seven-year-old Ludovic or Ludo (Georges Du Fresne) who is convinced that when he grows up, he will be a girl. His idol is Pam, a Barbie-like television character, who floats like a butterfly in gorgeous clothes and lives in a glittering house with a handsome boyfriend. However, Ludo struggles to make sense of his feelings. "Am I a boy or a girl?" he asks his teenaged sister, Zoe, who tries to explain with high school biology. Blending basic genetics with Sunday school, Ludo envisions God on a fluffy cloud showering X and Y chromosomes on houses awaiting babies. Of course, his other X chromosome simply bounced off the chimney and fell in the trash! At last, Ludo understands: He is a girlboy, a "scientific error" that will be resolved once he gets his X back and becomes the girl God had designed him to be.

Pierre and Hanna love their son—they just don't know how to cope with his obsession, and in frustration, they bring in a child psychologist for "reconditioning." After several episodes of public exposure, Ludo is beaten up; the family house is vandalized; parents petition for his removal from school; and Pierre is fired. In the midst of scandal, the family moves, but the stress is intense, and everyone teeters on the brink of emotional volatility and physical violence.

The opening images of the film are close-up shots of a dollhouse rendered in bright pastels and vivid fluorescents, immediately establishing color as a significant cinematic element. The camera slowly pans back to reveal a prototypical landscape of middle-class suburbia: neat homes, green lawns, running children. When Pierre toasts the beginning of their "new life," the message is that this world is actually no more authentic than the magical realm of Pam-land. Moreover, the consistent movement between the real and the imaginary underscores the instability or fluidity of gender identity as well.

The first major crisis in the film occurs when Ludo and his best friend, Jerome, act out a wedding in Jerome's bedroom. He plays a boy and Ludo a bride, arrayed appropriately in a lacy pink dress. As they admire themselves in a mirror, Jerome's mother sees them through the doorway. Horrified, she faints, and her husband angrily banishes Ludo from their home. This moment—from the sublime innocence of childhood play-acting to the slapstick comedy of adult panic—captures another major theme of the film. Adults are simply incapable of dealing with their children's imaginations, especially the wondrous and powerful forces that allow kids to transcend real-world limitations such as gravity and biology.

After each display of societal intolerance, the bright and extravagant colors of the opening images fade. With Ludo's expulsion from school, Berliner's palette becomes predominantly cool blues and flat grays. Being different in a black-and-white society affects not only the child but also his entire family, and the stigma of transgender makes outcasts of them all. Innocence and Eden are now lost, but the reversal of fortune will ultimately lead the family to a more diverse, more accepting community.

Since gender identity disorder (GID) entered the nomenclature in the DSM-III in 1980, critics have consistently contested its legitimacy, arguing that if children with GID show distress and impairment, it is not inherent to the condition but a reaction to social disapproval. Berliner's film not only foregrounds the comic arbitrariness of gender roles but also the shameful persecution of a child who does not conform to them. In Greeley in the spring of 2009, the jury found Andrade guilty after only two hours of deliberation, a hopeful sign that our society is slowly becoming more educated about if not more accepting of gender differences—perhaps because of films like *Ma Vie en Rose.* □

Dialogue:

The ethics of geoengineering: What is humanity's backup plan if climate change mitigation fails?

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Mitigation: the challenge of climate change

The challenge of mitigating man-made climate change involves profound ethical questions, as were raised by Andrew Jameton ("Climate Change Ethics," *Lahey Clinic Journal of Medical Ethics*, Spring 2010). What should be the rights and responsibilities of developed versus developing countries? What does our generation owe to future generations? Thus, the climate change challenge directly confronts our world with difficult issues of fairness and equality. These issues are not purely academic. Experience teaches us that nation-states will voluntarily enter into agreements only when they perceive that they are being treated justly.

There is another aspect of climate change that deserves consideration from an ethical perspective. What will happen if mitigation fails? Suppose that the world is unable to slash its emissions of greenhouse gases deeply enough and quickly enough. There are limits to our ability to adapt to climate change, especially to rapid and extreme change. If mitigation by mankind fails, what else can we do? What is humanity's backup plan?

This prospect is not a remote fantasy. There are many good reasons to think that adequate global climate change mitigation is beyond the capabilities of humankind. A grim recent assessment of results from climate change science, carried out by an international team of well-regarded climate scientists, provides ample grounds for pessimism. This assessment, *The Copenhagen Diagnosis*, shows that global emissions of greenhouse gases must peak within the next decade, and then rapidly decline, if global warming is to be limited to amounts often judged to be the upper limit of what is tolerable or safe.[1]

Global carbon dioxide emissions from fossil fuels in 2008 were nearly 40% higher than those in 1990.[1] This is not progress. Every year of continued inaction increases the likelihood that global climate change will exceed safe levels, and that tipping points in the climate system will be triggered, amplifying climate change and producing effects that may be irreversible on human time scales.

Meanwhile, the observational record shows that in many respects, climate change is already accelerating beyond the rates projected earlier. While global temperatures continue to increase at roughly the projected rate of about a third of a degree Fahrenheit per decade, other climate measures are changing at rates that are more worrisome. Arctic sea ice extent has declined more rapidly than predicted, and global sea level rise has accelerated to rates near the maximum of the predicted range. Thus, scientific projections of climate change have generally not been exaggerations, and in some cases may turn out to have been underestimates.[1]

Rapidly developing countries with large populations are now playing an increasingly dominant role. In recent years, China passed the United States as the country emitting the largest amount of greenhouse gases. China is experiencing explosive economic growth. In 2009, sales in China of trucks, cars and other vehicles were 13.6 million. This number represents a 46% increase from 2008. The corresponding 2009 number in the United States was 10.4 million vehicles.

A rising standard of living, fueled mainly by coal, oil and natural gas, obviously has many positive consequences for China's population, now above 1.3 billion and representing nearly 20% of world population. However, it does not bode well for the Earth's climate. Other large developing countries are not far behind. India, the second largest in population, with well over 1.1 billion, has seen its greenhouse gas emissions increase by nearly 60% between 1994 and 2007.

In 2009, carbon dioxide emissions from fossil fuel use and industrial sources in China were 6.1 metric tons per person, a dramatic increase since 1990, when they were 2.2 metric tons per person.[2] In fact, the per capita emissions in China are now almost exactly the same as those in France. The population of China, and thus its emissions total, is about 20 times that of France.

Recent major global recessions, such as in 1974–1975 and 1980–1982, produced decreases in global carbon dioxide emissions.[2] However, global emissions of carbon dioxide from fossil fuel use and industrial processes were essentially unchanged from 2008 to 2009, despite the recession occurring then. This was the first time since the 1992 recession that global emissions have failed to increase every year. The main reason why global emissions did not change from 2008 to 2009 is that the global recession caused a drop of about 7% in emissions from the OECD (Organization for Economic Co-operation and Development) countries and Russia, which was almost exactly compensated by increases of 9% in China and 6% in India.[2] This fact dramatically illustrates that rapid economic growth in developing countries with large populations is now a major cause of increasing greenhouse gas emissions, and is expected to remain so for many years, unless binding international agreements on emissions reductions can be forged and then successfully enforced.

Geoengineering

One can easily imagine a future day when a tipping point is reached, and an unmistakable and unpleasant climate transition occurs. For example, a large portion of an ice sheet on Greenland or Antarctica might destabilize, fall into the ocean and suddenly increase global sea level. Alternatively, a hurricane of unprecedented magnitude might gather strength over an unusually warm tropical ocean, and then make landfall and cause massive damage.

On that day, if it occurs, decades of climate disinformation will be exposed as a collection of ugly lies. Much of humanity will suddenly understand that mainstream climate science had always

been correct, and that human-caused climate change is real and serious. Governments, which until now have dithered, procrastinated and failed to produce any significant global decrease in greenhouse gas emissions, may then quickly demand "action." Geoengineering, a term denoting intentionally intervening in the climate system, on that day may seem to many people to be an attractive option as a quick technological solution to an otherwise frightening and intractable problem.

Such intentional interventions in the climate system might be capable of reducing some aspects of climate change. For example, it is easy to propose ways to make the planet more reflective. Reflective particles, or their chemical precursors, can be added to the atmosphere, reducing the amount of sunlight that the Earth absorbs, and there are many ways to do this. Paul Crutzen, a Nobel laureate in chemistry and an exceptionally thoughtful scientist, has analyzed the possibility of releasing a sulfur-containing gas from balloons in the tropical stratosphere, while stressing that this ought to be thought of as an emergency strategy to be considered for deployment only in the event of a massive failure of efforts to mitigate climate change. The sulfur gas would become converted to sulfate particles in the atmosphere, which would add to the reflectivity of the planet and lead to some reduction in the absorption of sunlight, much as happens naturally when major volcanoes erupt.[3]

However, reflective particles are not negative greenhouse gas molecules. The hope that they will more or less exactly compensate for the human-caused strengthening of the greenhouse effect is just that: a hope. In fact, this approach is founded on the idea that tinkering with the Earth's solar radiation budget can somehow negate the inadvertent tampering that humanity has already done, and continues to do, to the Earth's terrestrial radiation budget. Carried out on the entire planet, it is an extreme act of desperation and of hubris. Modeling this sort of global intervention with theories and computer codes is a staggeringly difficult scientific task. It requires treating complex cloud feedbacks and aerosol physics and chemistry accurately, and being able to provide trustworthy quantitative error estimates and confidence limits. Today, this is beyond the state of the art in climate modeling.

Ocean acidification is also occurring now, because some of the carbon dioxide added to the atmosphere by mankind becomes dissolved in the sea. This problem is not reduced at all by geoengineering approaches such as making the Earth more reflective. The biological consequences of acidification may be abrupt and discontinuous. The pH of the sea is now significantly decreasing (so acidity is increasing) as the concentration of carbonic acid in the ocean increases. Animals forming calcium carbonate shells, such as mollusks and crabs, are less able to do so. Is there a point at which the base of the marine food chain becomes seriously affected? For example, whales and juvenile salmon feed on pteropods, which are marine snails with calcium carbonate shells. We do not yet know the answers to many of these fundamental questions. Ocean acidification can also directly and adversely affect the physiology of fish, and there too, much remains to be learned. This is also an urgent research issue.

The climate and other environmental implications of deploying geoengineering technology are potentially very serious. So are its ethical and geopolitical implications.[4] It is probable that unforeseen consequences will occur. Geoengineering is very likely to produce winners and losers, for example, by altering patterns of precipitation, increasing it in some regions and decreasing it in others, and it is almost certain to be perceived as producing severe damages, which will inevitably be blamed on those who decided to deploy it.

At best, geoengineering leaves important problems unsolved and may well force our descendants to continue deployment of flawed technologies. These technologies may forestall certain aspects of damaging climate change but at enormous costs in the form of harmful side effects. Some may be more harmful than others, and opinions will vary. Ocean acidification, a result of adding carbon dioxide to the atmosphere, has already been recognized as an extremely dangerous threat that is not reduced at all by geoengineering schemes that rely on reducing the amount of sunlight absorbed. Geoengineering also will generally be unable to undo many kinds of climate damage that are effectively irreversible on human time scales, such as rebuilding glaciers that have already disappeared. Some foreseeable geoengineering side effects are even aesthetic in nature, but many people will consider them very important. Future generations may never again see blue skies, for example, because a milky grey-white sky may be one quasi-permanent consequence of continually adding reflective particles to the atmosphere to reduce the amount of sunlight absorbed.

There are very serious legal as well as ethical problems with all geoengineering schemes. Who has the right to decide on behalf of all humanity to

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***Legal**—continued from page 4*

participate in the risk pool who choose not to.

The ACA strikes a compromise between these principles. It does not set up a national health insurance program financed by tax revenues. Public health programs will continue to be limited to the poor, elderly and disabled. Each individual will still purchase health insurance (or get it through employment). Premiums will still vary based on age, geography and other factors. Undocumented aliens are totally excluded from any assistance, even from participating in the exchanges. But premiums will be subsidized for lower- and middle-income Americans, large employers will be penalized if their employees have to seek public assistance, and all individuals will be required to purchase insurance. The struggle for the soul of health insurance goes on, but the ethical principle of mutual aid has the upper hand.[5]

Acknowledgment: This research was supported by a grant from the Commonwealth Fund. □

[1]400% of poverty is $43,320 for an individual, $88,200 for a family of four.

[2]Enthoven AC. The history and principles of managed competition. *Health Aff* 1993; 12(Supp. 1): 24–48.

[3]Wicks EW. Building a national health insurance exchange: Lessons from California 2009. Available at: http://www.chcf.org/~/media/Files/PDF/B/BuildingANationalInsuranceExchange.pdf.

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[5]For further reading on health insurance exchanges, see Jost TS. Health insurance exchanges and the Affordable Care Act: Key policy differences. Washington, DC: Commonwealth Fund, 2010. Available at http://www.commonwealthfund.org/Content/Publications/Fund-Reports/2010/Jul/Health-Insurance-Exchanges-and-the-Affordable-Care-Act.aspx.

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Outcome: The physicians approached the hospital bioethics committee to advise in decision making. No friend or family member could be identified to serve as a surrogate.

The bioethics committee advised the neurosurgeons to proceed with tracheostomy and gastrostomy because that treatment represented the standard of medical care in this situation and it was one for which most surrogates provide consent. The patient was transferred to a nursing home a week later. □

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[1]California HealthCare Foundation. Attitudes towards end-of-life care in California. http://www.chcf.org/publications/2007/03/racial-cultural-and-ethnic-factors-affecting-the-quality-of-end-of-life-care-in-california.

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[4]Callahan D. *Setting Limits: Medical Goals in an Aging Society.* New York: Simon and Schuster; 1987.

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tinker with the global environment? Who pays for the inadvertent damages done? We must hope that humanity develops the wisdom to mitigate climate change, to adapt to what cannot be avoided, and to confine geoengineering to research labs, rather than deploying it in a vulnerable world.[5] □

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Generous funding for *Lahey Clinic Journal of Medical Ethics* is made in memory of Harold Karp, by the Karp Family Foundation.

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