Dramatic Transformations in Health Care and their Implications for Primary Care

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Making sense in a time when discovery science is rushing ahead of hypothesis driven science is not easy, especially when this new science is making mega "cents" - billions of dollars.

And a time when the nature of truth (from one to many), nature (seen as designable instead of God made or to live in peace with), reality (challenged by quantum and miniaturized by nanotechnology) and society (connected via new digital technologies) are all undergoing revolutions that promise to make all of us strangers in a strange land, reason is hard to come by.

The dot.com boom is certainly being followed by revolutions in nano-medicine, pharmco-genomics and artificial intelligence ...to mention a few of the forces changing health care.

The Claims are Grand.

Some of these claims are fueled by the promise of federal funding. In the USA, funding for nanotechnology has gone from 100 million in 1997 to 400 million in 2002 and around a billion outside the USA. Life science USA federal research funds have gone from 5 billion in 1970 to near and likely above 20 billion now.[2] In November 2003, the USA Senate approved funding of 3.7 billion dollars over four year to fund nanotechnology research.[3]

Underneath this is the reductionist worldview, searching for the one factor that will somehow solve our health predicaments, and, it seems deliver us from death, or least from living a live of misery and pain.

And way below, in the unconscious lies the true source - the search for the silver bullet, the fountain of youth, the final solution, and the hope that it is not Pandora's box that is being opened, as Professor Ken Donaldson of the University of Edinburgh warns: "Nanotechnology threatens to generate new hazards in the form of toxic molecules that can enter the lungs.[4]

But the promises are dramatic and utopian.

Writes Robert Frietas in his book *Nanomedicine.*

"Once nanomachines are available, the ultimate dream of every healer, medicine man, and physician throughout recorded history will, at last, become a reality. Programmable and controllable microscale robots comprised of nanoscale parts fabricated to nanometer precision will allow medical doctors to execute curative and reconstructive procedures in the human body at the cellular and molecular levels. Nanomedicine will employ molecular machine systems to address medical problems, and will use molecular knowledge to maintain and improve human health at the molecular scale ... "[5]

Nano surgery ... nanomachines flossing and brushing, identifying and destroying pathogenic bacteria while allowing the harmless flora of the mouth to flourish in a healthy eco-system... nano systems in your body,

proactively guarding against cancer and other diseases.

Continues Frietas:

> "Nanomedical physicians of the early 21st century will still make good use of the body's natural healing powers and homeostatic mechanisms, because, all else equal, those interventions are best that intervene least. But the ability to direct events in a controlled fashion at the cellular level is the key that will unlock the indefinite extension of human health and the expansion of human abilities."[6]

Ultimately the would lead to the pharmacy in your body, suggests Clem Bezold of the Institute for Alternative Futures.[7]

But it is not only nanomedicine that is spearheading a different future. The promise of health bots, once imaginary, are now at the proto-type stage at MIT.

Health bots are health coaches - always-on wearable computers. They will provide individualized and immediate feedback to our behavior, for example, letting us know caloric intake, the amount of exercise needed to burn off the pizza we just ate.

They will also let us know the make-up of each product we are considering purchasing, helping us to identify allergies, for example.

These intelligence computer systems would be reflexive knowledge systems, learning about us and our preferred and not so preferred external environment.

These will be powerful health coaches provided by health-care providers, which will not only aid diagnosis but also reinforce pursuit of your chosen health goals. These expert systems, or electronic personal guides, will tailor the information to your own knowledge level, interest level, and learning style, as well as those of your family members, each of whom would have a personal electronic 'health coach.' If you are genetically or otherwise inclined to heart disease, your coach will encourage specific preventive measures.

This is the health professional on a wrist.

What is crucial is these bots will be: customized, immediate and reflexive - that is connected and learning, and individualized.

But if this was not enough, along with nano and bot futures, there is emerging field of pharmacogenomics.

Pharmacogenomics[8] "is a science that examines the inherited variations in genes that dictate drug response and explores the ways these variations can be used to predict whether a patient will have a good response to a drug, a bad response to a drug, or no response at all."

Write proponents.

> "Right now, in doctors' offices all over the world, patients are given medications that either don't work or have bad side effects. Often, a patient must return to their doctor over and over again until the doctor can find a drug that is right for them. Pharmacogenomics offers a very appealing alternative. Imagine a day when you go into your doctor's office and, after a simple and rapid test of your DNA, your doctor changes her/his mind about a drug considered for you because your genetic test indicates that you could suffer a severe negative reaction to the medication. However, upon further examination of your test results, your doctor finds that you would benefit greatly from a new drug on the market, and that there would be little likelihood that you would react negatively to it. A day like this will be coming to your doctor's office soon, brought to you by pharmacogenomics." [9]

Those in the field do not see these new developments as minor historical events, rather a renaissance is here

Of course, we are not even discussing gene therapy or germ line intervention - the use of genetically altered eggs or sperm to correct or improve the genetic makeup of a resulting baby.[10] This is not just genetic surgery but germ line therapy or the modification of heritable characteristics.[11]

What Does It Mean?

Now what does this all mean? There are endless websites on the subject now, stunning documentaries. As well, technological and biological transformation are not the only game in town. Research consistently suggests that what

is needed is more walking, and better diets.[12] And we do not need to invoke Marx to remind us of the foundational imprinting of class in deciding our life chances. And in societies where patriarchy is dominant, gender certainly defines life chances.

But perhaps as important as the search for more than one factor, ie going beyond the silver bullet theory of the universe, is seeing genes (and the nano world as well) as far more fluid.

Writes Matt Ridley:

"In the new view, genes allow the human mind to learn, remember, imitate, imprint language, absorb culture and express instincts. Genes are not puppet masters or blueprints, nor are they just the carriers of heredity. They are active during life; they switch one another one and off; they respond to the environment. They may direct the construction of the body and brain in the womb, but then almost at once, in response to experience, they set about dismantling and rebuilding what they have made. They are both the cause and the consequence of our actions."[13]

The Future

Thinking about the future should be neither risky nor arrogant, but systematic and rigorous. There are a range of tools that can be used to make the future more sensible - among them is the Futures Triangle.[14]

That is

1. What are the pulls of the future - the images that define where we are going.
2. What are the pushes - the quantifiable drivers?
3. What are the weights - the structures or patterns that make change difficult.

In health care future, the images are

1. Long life, healthy life via human design and technological intervention.
2. A better, higher quality of life via social policy: access to health dollars, individual behavior change by following the evidence, in most case, this now means, more exercise, a better diet, and a more responsive and responsible health system.
3. The slower life, guided not by technological advancements but my communication - talking to friends, nature, the doctor, and even angels. Quality is first here, it is not doing more but enhancing the immune system by changing society's views of progress and quantity.

The drivers include economics, an aging society, funding for high-tech interventions and globalization.

Health Care Futures

TECHNONOLOGICAL INTERVENTION
SOCIAL POLICY INTEVENTION
WORLDVIEW TRANSFORMATION

PUSH OF THE FUTURE

WEIGHT