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TITLE Executive Director, FutureMed & Faculty
Chair, Medicine, at Singularity University
AGE 44 **HEADQUARTERS** Silicon Valley, US

An app a day keeps the doctor away

TEXT Nicholas Smith | PHOTOS Chris Maluszynski

Ericsson Business Review
meets the doctor who believes
that a smartphone could save your
life – and the US health-care system.
All he has to do now is convince
his colleagues. ►

“Doctors face a simple choice – adapt or die.”

YOU WOULDN'T SUSPECT a thing. All politeness and easy Californian charm, Daniel Kraft blends in effortlessly among the unsuspecting bureaucrats of downtown Washington, D.C. Yet this physician, entrepreneur and sometime fighter pilot is here on seriously subversive business. The marbled heart of the US political establishment is just the latest stop on Kraft's mission to change the face of modern medicine – and to challenge some of our most established ideas about doctors, technology, and the intersections between the two along the way.

“Medicine today is still practiced in the same way it was 100 years ago; if you get sick, you go to the hospital and often see a doctor specialized in one particular body part,” he says, with a shake of the head. “Big data and connectivity, on the other hand, give us a unique chance to reimagine health care for the better by taking it outside the hospital, and bringing it to the individual.”

Kraft pauses for a moment before adding: “Doctors face a simple choice – adapt or die.”

INTENSIVE CARES

This stunning dispatch comes straight from the front line. Kraft's 20 years of clinical experience span faculty positions at Stanford University's School of Medicine and the pediatric bone marrow transplantation service at the University of California, San Francisco. In Washington, D.C. to deliver a keynote address to the American Medical Group Association about the role of technology and data analytics in creating patient-centered health-care systems, the 44-year-old radiates enthusiasm and urgency in equal measure.

“When a physician can combine data such as a patient's genomic sequence with information on their family medical history, where they live and even how often they go to the gym into an integrated, actionable dashboard view, that creates an extremely powerful tool for both diagnosis

and prevention on a highly individual level,” he says.

NURSE, THE (SMARTPHONE) SCREENS

Following famed systems biologist Lee Hood, Kraft refers to this as “P4 medicine” – the ‘Ps’ in question being predictive, preventative, personalized and participatory – and believes that a radical reorientation of health care around these concepts is the key to better patient outcomes and more sustainable health-care systems.

He sees doctors leveraging huge volumes of data to make better predictive models about what diseases a specific person is more likely to develop, and taking action to prevent them before they occur. Treatment would be tailored to fit the patient, down to a remarkable level of granularity; imagine being prescribed a particular drug for hypertension because you're a smoker who carries a particular gene and lives near a nuclear power plant. Finally, patients themselves can see their own dashboards and monitor their health anywhere, anytime with guidance and support from their clinician.

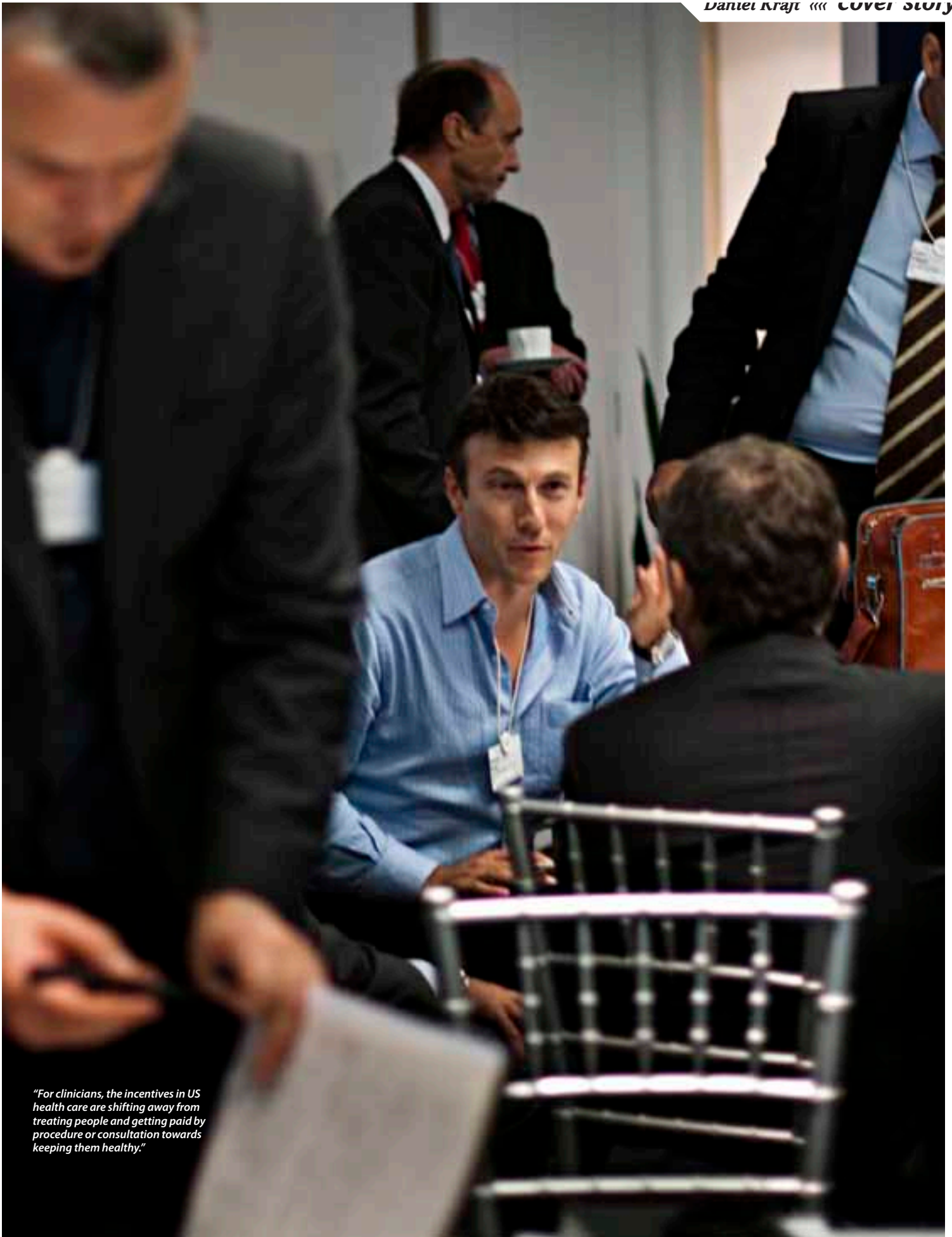
So don't be surprised to see a doctor near you reaching into their little black bag and pulling out a smartphone rather than a stethoscope. Because if there's one thread that ties Kraft's vision together, it's the five inches of aluminum and plastic to which we already seem to be surgically attached. Smartphones, he says, can be used to display dashboards, measure vital signs or perform tests that can then be shared with a clinician for interpretation. Kraft talks about doctors prescribing tablets in the Apple sense of the word, where – for example – prediabetics would be given apps that monitor their blood-sugar levels, suggest behavior patterns, and connect them to clinician and peer groups for follow-up and support.

THE DOCTOR WILL SEE YOU NOW

Meeting Kraft is like sitting down with half a dozen different people all at once. In the course of an hour's conversation, ►

Background check

- **2012-present:** Founder, Intelli-Medicine, US
- **2011-present:** Executive Director, FutureMed, Singularity University, US
- **2009-present:** Faculty Chair, Medicine, Singularity University, US
- **2008-2010:** Fellow, Society of Kauffman Fellows, US
- **2005-2011:** Faculty Member, Stanford University School of Medicine, US
- **2004-2010:** Clinical Faculty Member, Pediatric Bone Marrow Transplantation Service, University of California, San Francisco, US
- **2004:** Astronaut selection finalist, NASA
- **2003:** Founder, StemCor Systems (now RegenMed Systems), US
- **2000-2005:** Fellow, Hematology/Oncology & Bone Marrow Transplantation, Stanford University & Postdoctoral Fellow in laboratory of Irv Weissman
- **1999-present:** Flight Surgeon, California Air National Guard
- **1996-2000:** Harvard Combined Residency Program, Internal Medicine and Pediatrics, Massachusetts General Hospital and Boston Children's Hospital, US
- **1996-1999:** Founder & CEO, Online Medical Bookstore (acquired by Netivation), US
- **1992-1996:** Research Training Fellowship, Howard Hughes Medical Institute, US
- **1990-1996:** MD, Stanford University School of Medicine, US
- **1990:** BA in Biochemistry, Brown University, US



"For clinicians, the incentives in US health care are shifting away from treating people and getting paid by procedure or consultation towards keeping them healthy."



"Many emergency room visits aren't actually emergencies. Smartphones can guide your care and keep you away from the hospital at two in the morning."



“A screening skin test to **check a mole for the possibility of melanoma** can now be done instantly **by a smartphone.**”

► *Ericsson Business Review* is introduced to a healer, impresario and evangelist, with frequent asides from a philosopher, iconoclast and wide-eyed technophile. He thinks fast and talks faster, spinning off into digressions and constantly leaning across to demonstrate the latest medical apps on his iPhone.

Kraft’s resumé certainly reads like an amalgamation of multiple individuals. As if building a medical career in some of the US’s top institutions wasn’t enough, Kraft has founded two companies focused on connected medicine and stem-cell-based regenerative therapies, and invented Marrow-Miner, a device approved by the US Food and Drug Administration for harvesting bone marrow in a minimally invasive way. He advises a range of other health-care start-ups, and is core faculty at Singularity University in California where he chairs the medicine track and serves as Executive Director of FutureMed, a cross-disciplinary program designed to explore how rapidly developing technologies can be applied to global challenges.

He is also a self-confessed flying and space junkie, reaching the final rounds of astronaut selection in 2004 (“NASA basically invented telemedicine – they transmitted Buzz Aldrin’s EKG from the moon in real time,” he says). Kraft has served as a flight surgeon in the National Guard for the past 12 years, frequently taking to the skies in an F-16 jet. Little wonder, then, that he conveys a forceful, yet thoughtful, self-confidence.

SWALLOWING A BITTER PILL

He’s going to need it. Elements of Kraft’s brave new world lie on a direct collision course with a more cautious, conservative sphere. A *Wall Street Journal* article in April 2012 claimed that 62 percent of US doctors have yet to even start using e-mail with their patients, while according to a survey conducted by the American Medical Association, 90 percent are still uncomfortable using genomics in their clinical practice. And when Kraft explains that reimagining

health-care also means reimagining the role of the doctor, it’s perhaps easy to understand where some of this resistance comes from.

“Doctors need to get used to sharing the responsibility for their patients’ health with the patients themselves,” he says. “They have no choice but to adapt to this – even though the change may be painful. Some fields in health care are going to be dramatically disrupted, particularly those like radiology or dermatology that are largely based on pattern recognition. A screening skin test to check a mole for the possibility of melanoma can now be done instantly by a smartphone, and the average x-ray will be screened by an AI (artificial intelligence)-enabled algorithm.”

Kraft also notes that many of the people creating medical apps are not even doctors. However, he declines to be drawn as far as Vinod Khosla, the cofounder of Sun Microsystems and a frequent investor in early-stage health-care businesses, who at a conference in August 2012 stated that technology could eventually replace up to 80 percent of doctors. Instead, Kraft suggests that 80 percent of doctors will be using big data and AI systems to support their diagnostics and therapeutic interventions.

WARNING: MAY CAUSE SIDE EFFECTS

Whether this will be enough to mollify the jealous guardians of an insular, almost hieratic profession remains to be seen. And in any case, perhaps the doctors aren’t the only ones who should be asking questions about Kraft’s vision. Having your vital signs monitored by a smartphone 24/7 may help a clinician make earlier diagnostic decisions, but it also raises tricky issues of privacy – and that’s before Kraft raises the possibility of individuals signing up to become “data donors” who freely volunteer their medical information to clinicians online.

Kraft sees the objections and accepts that a satisfactory system for protecting and making patient data anonymous is still elusive. However, he argues that the benefits outweigh the risks. ►

“We no longer need to **spend 30 percent of every health-care dollar**, as we do today, on fragmented care, defensive medicine, paper forms and jumping through insurance-reimbursement hoops – in other words, **on waste.**”

Health care on life support

► **THE HEALTH-CARE SYSTEM** in the US proves that you don't always get what you pay for. The country currently spends more on health care than any other OECD country – an average of USD 7,290 per person and year, versus the OECD average of USD 2,964.

THIS CAN'T GO ON. The nation's health-care tab is on track to hit USD 4.6 trillion in 2020, accounting for about USD 1 of every USD 5 in the total economy and giving an average spend of USD 13,710 per person. The Congressional Budget Office estimates that in every year since 1975, spending on health-care has risen 2.3 percent faster than the growth of nominal GDP per capita. If this trend is allowed to continue, health-care costs will eventually consume 100 percent of US tax receipts.

TO TOP IT OFF, the returns from this huge outlay are decidedly anemic. The OECD has found that US citizens have access to fewer physicians and hospital beds than people in most other OECD countries. And life expectancy at birth in the US ranks 50th in the world, below the European Union average and some developing nations. ●

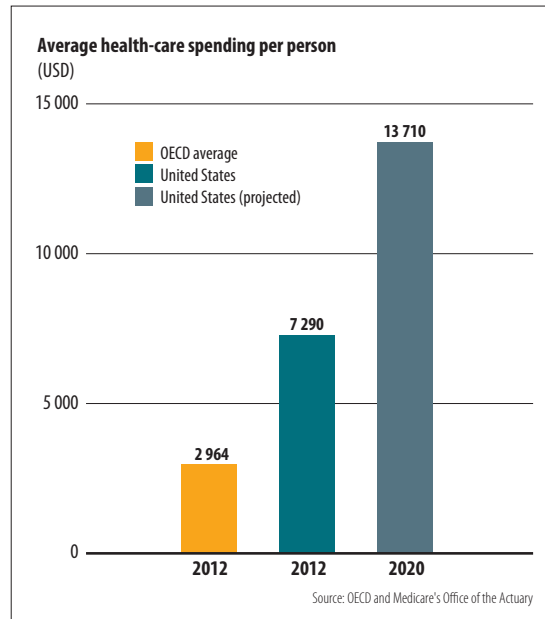
► “By sharing and, in effect, crowdsourcing information, data can be translated into practice right away,” he says. “Instead of waiting years before research becomes practically available, a clinician or a patient can mine data to make an informed decision.

“For example, if you have heart disease and you've just undergone a hip replacement and I need to find the right anticoagulant for your genetic makeup, there probably isn't a study that precisely fits you. But by mining data to find other patients of your age and genetic subtype, I can basically do a clinical trial on the fly.”

THE MELANCHOLY OF ANATOMY

But if the wisdom of sharing your genome sequence with a clinician like a particularly cringe-worthy Spotify playlist still sounds questionable, the impact of the permanently accessible dashboard may prove to be even more ambiguous. Checking your blood pressure as often as your e-mail could be a potent recipe for increased stress and worry – ultimately leading to poorer, not better health – and Kraft emphasizes that checks and balances are required here too.

“People need to find the right level of monitoring and be able to turn the dial up and down in the same way that they can adjust privacy settings on Facebook,” he says. “And as a doctor, I don't want to be automatically alerted every time my patients hiccup. But I am convinced that a dashboard on your smartphone that tells you and your physician when your blood sugar is out of control can be a very powerful le-



ver for you, your family and your health-care provider to help you get back on track.”

ENDGAME

Watching the small army of joggers that crisscross Washington, D.C.'s vast National Mall at all times of the day, just for a moment it seems hard to imagine that any-

body in the US would have much use for such technology. But away from the wholesome glow of one of America's healthiest cities, where even iconic Pennsylvania Avenue has a bike lane, a major public-health crisis is fast developing. A study released in September 2012 by the Trust for America's Health and the Robert Wood Johnson Foundation warned that without immediate action, half of the country's adult population will be obese by 2030.

So Kraft might be onto something after all. And in fact, his sights are set even higher. With health-care costs now posing an existential threat to America's economic well-being, he sees digital medicine as vital in creating a more sustainable system.

“Things have to change, and as we start to integrate more and more data, leverage connectivity, and practice medicine that is truly predictive, preventative, personalized and participatory, we can treat people earlier and more effectively,” he says.

“When we can do that, then we no longer need to spend 30 percent of every health-care dollar as we do today on fragmented care, defensive medicine, paper forms and jumping through insurance-reimbursement hoops – in other words, on waste.”

If that's possible, then reimagining medicine might be just what the doctor ordered after all. ●

"There is nothing better than being able to innovate at a time when so much is converging. And you don't need to be a doctor to impact health care. One app can change the game."

Where will you be ...

► **... IN FIVE YEARS?** Continuing to grow FutureMed to help catalyze the improvement of health care across the planet. Serving on faculty with Singularity University to help educate, inspire and enable leaders to understand and leverage fast-moving technologies in order to address major global challenges.

► **... IN 10 YEARS?** Will have developed IntelliMedicine into a major health-care company that impacts the lives of tens of millions by integrating intelligent, connected and personalized information with highly effective and individualized health care, including personalized prevention and therapy.