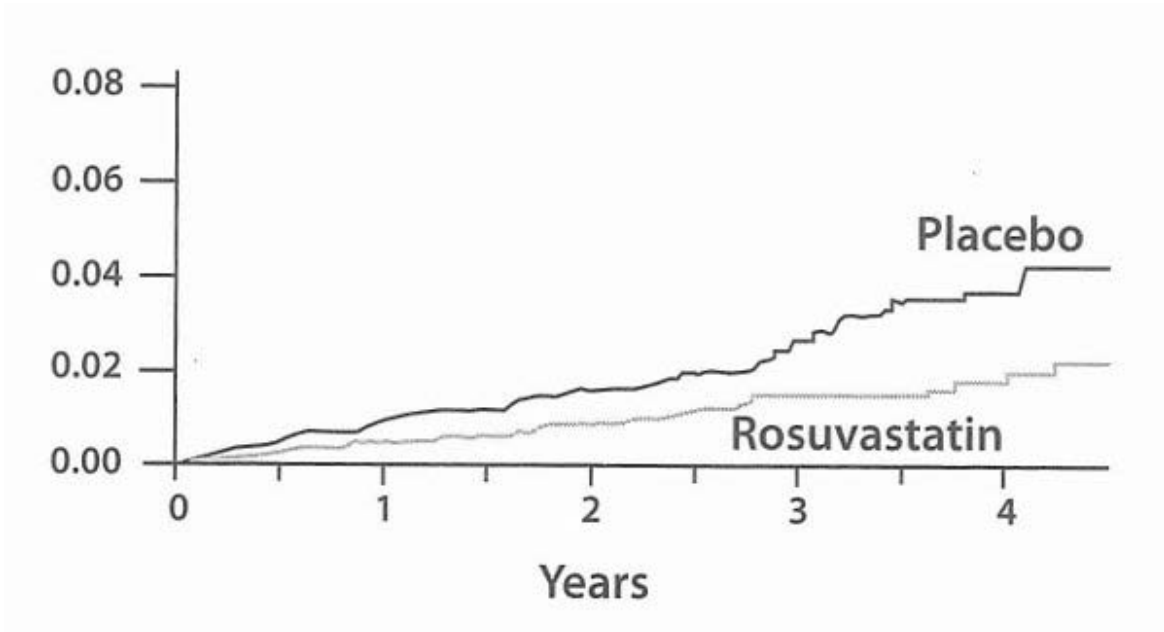


# **THE CREATIVE DESTRUCTION OF MEDICINE**

**HOW THE DIGITAL REVOLUTION  
WILL CREATE BETTER HEALTH CARE**

**BY ERIC TOPOL, M.D.**

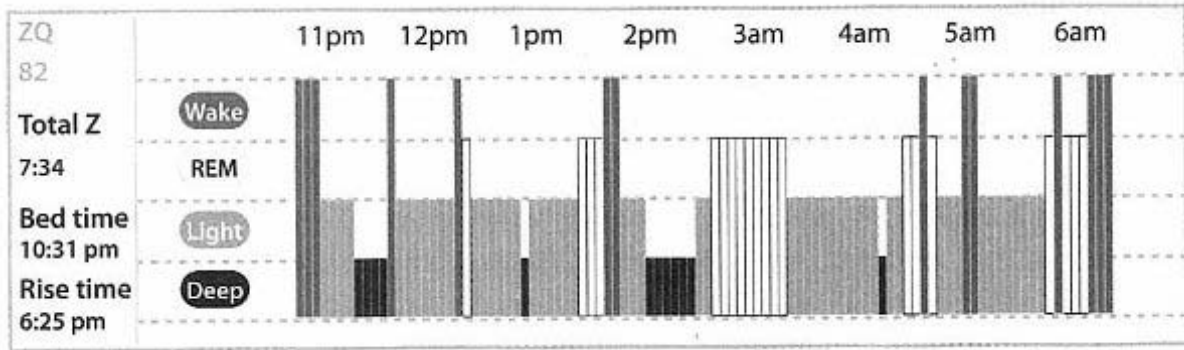
**Figure 1**



The risk of death, heart attack, and stroke among 17,800 patients randomly assigned to receive either Rosuvastatin or placebo for over four years.

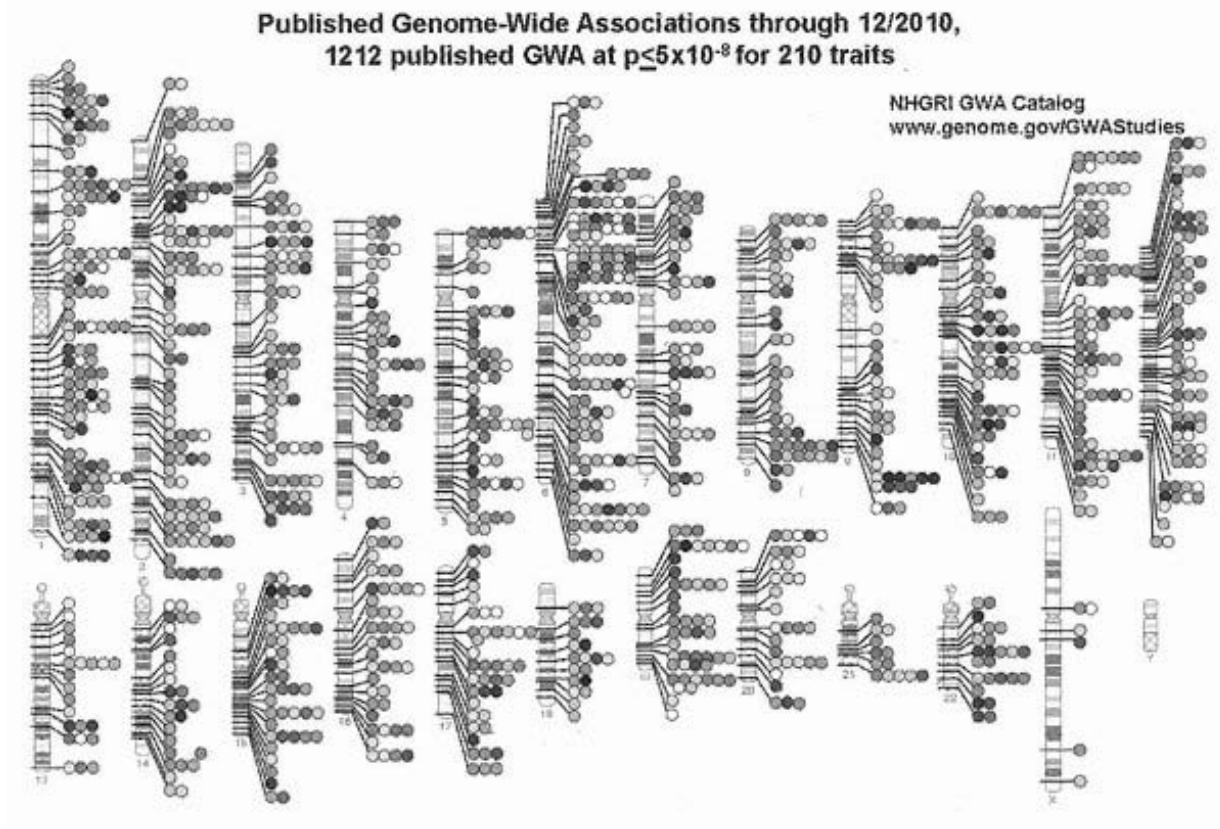
Source: P. M. Ridker, "Rosuvastatin to Prevent Vascular Events in Men and Women with Elevated C-Reactive Protein," *New England Journal of Medicine* 359 (2008): 2195–207.

Figure 2



A night of my sleep, with the phases of sleep and duration of time in each shown, along with a ZQ score that integrates all this information, including time to get to sleep and time awake during the night.

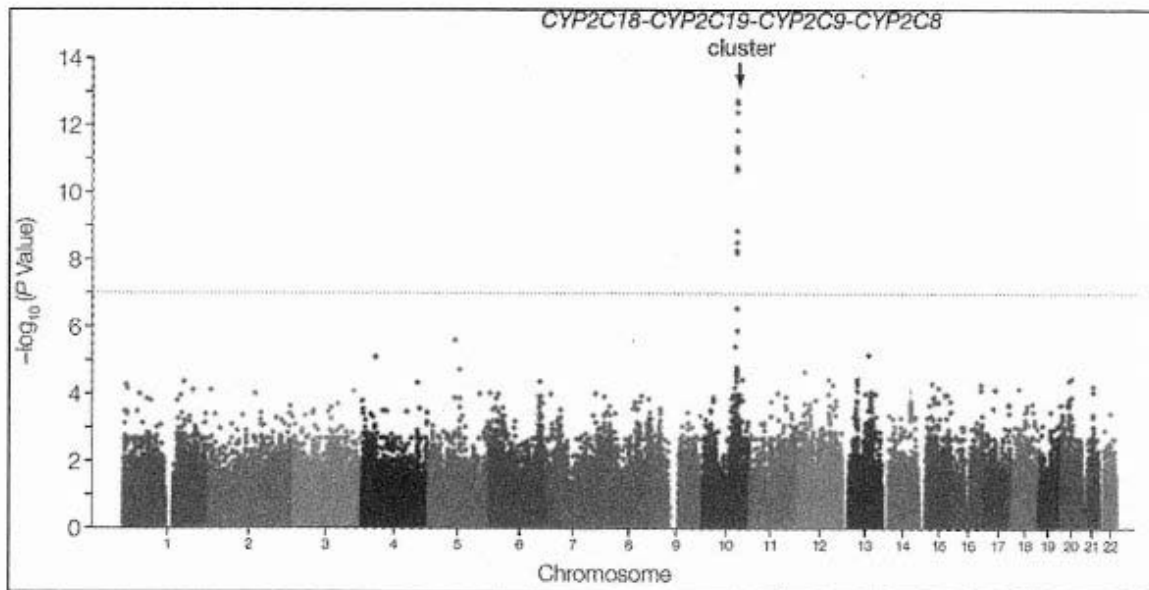
Figure 3



Output of the genome-wide association studies (GWAS) from 2005 to 2010. The complex traits' "zip codes" are shown schematically by chromosome and location on each chromosome.

Source: L. A. Hindorff et al., "A Catalog of Published Genome-Wide Association Studies,"  
Office of Population Genomics, National Human Genome Research Institute,  
National Institutes of Health, n.d., [www.genome.gov/gwastudies](http://www.genome.gov/gwastudies).

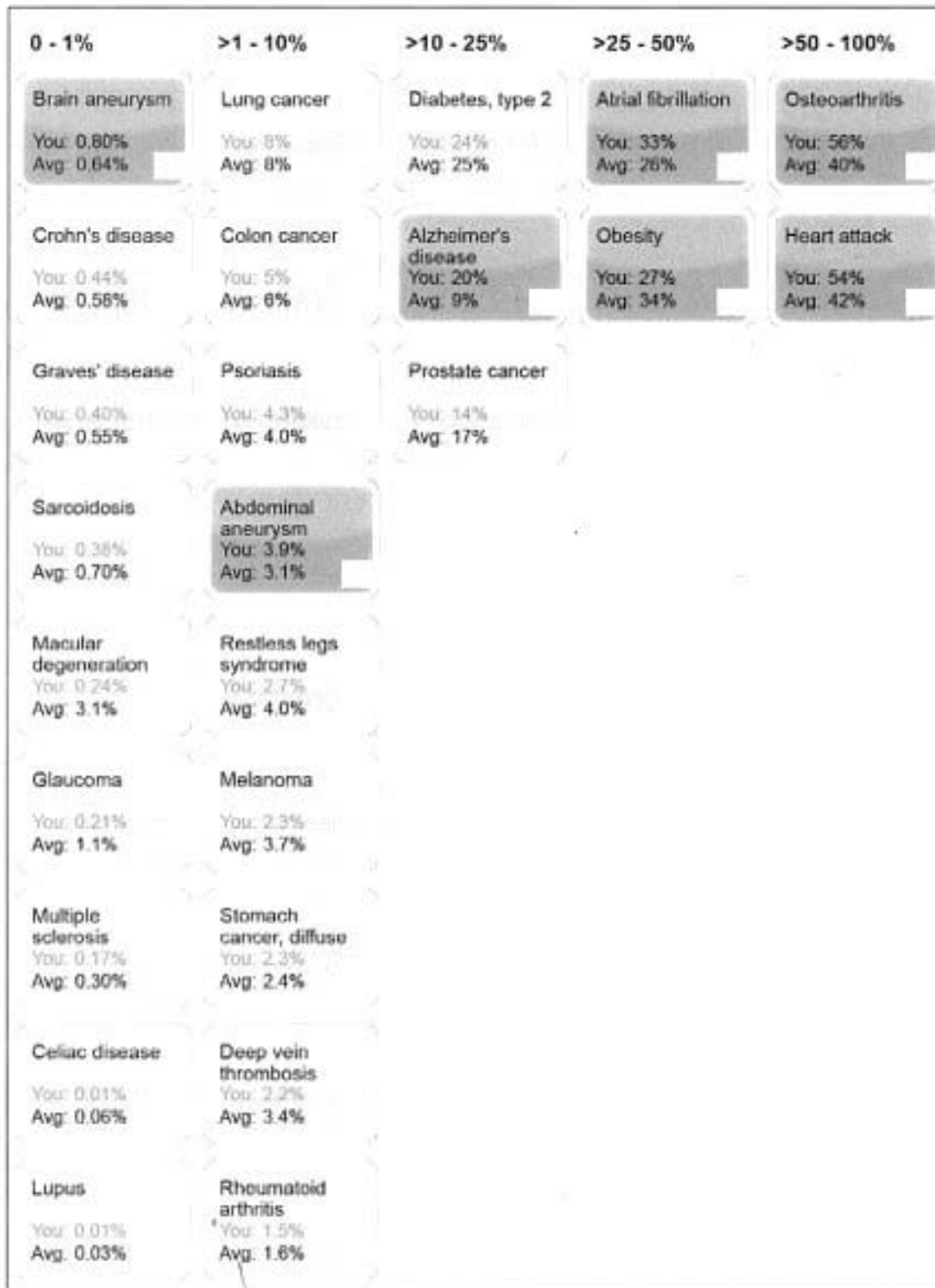
**Figure 4**



Genome-Wide Association Study of Plavix is shown schematically via a “Manhattan Plot,” which looks for skyscrapers, and in this case the cytochrome cluster, responsible for metabolizing Plavix, was the only common variant found.

Source: A. Shuldiner, “Association of Cytochrome P450 2C19 Genotype with the Antiplatelet Effect and Clinical Efficacy of Clopidogrel Therapy,” *Journal of the American Medical Association* 302 (2009): 849–58.

Figure 5



My Navigenics genome-wide scan results. Each column pertains to the risk level of the disease in the population, ranging from less than 1 percent to greater than 50 percent. My risk for each of the twenty-five conditions is compared to the general population.

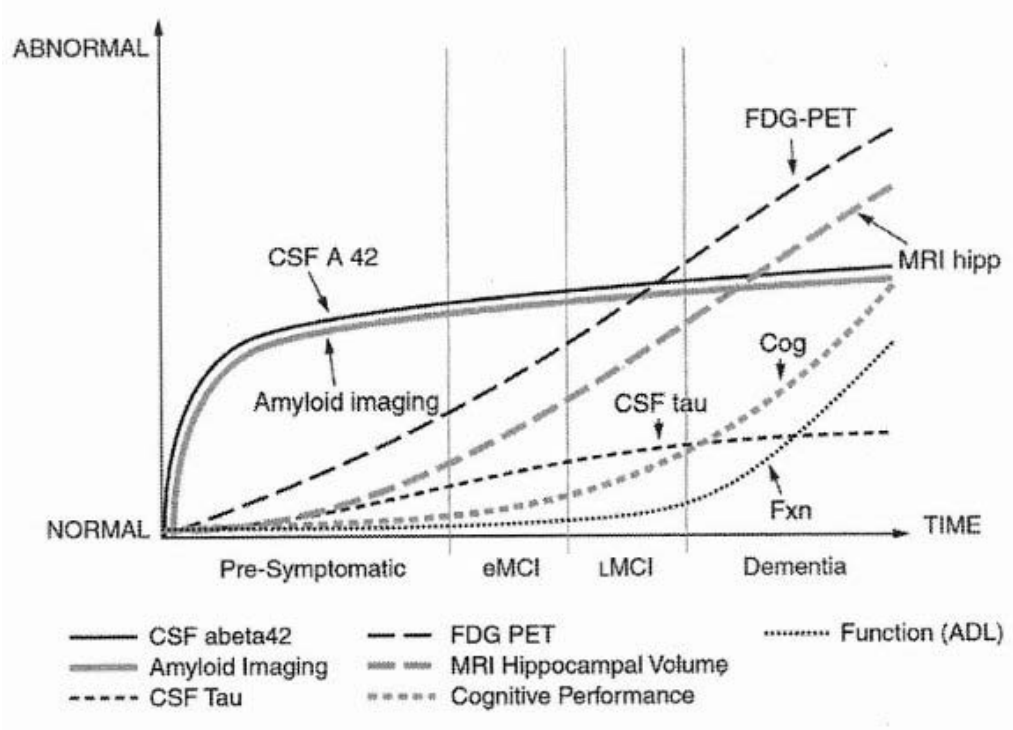
**Figure 6**

<b>Procedure</b>	<b>mSv Adult Dose</b>	<b>Equivalent No. of Chest X-rays</b>
<b>Airport whole body backscatter scan</b>	<b>0.002</b>	<b>0.1–0.2</b>
<b>Dental X-rays</b>	<b>0.005–0.01</b>	<b>0.25–0.5</b>
<b>Chest X-ray</b>	<b>0.02–0.1</b>	<b>1</b>
<b>Mammography</b>	<b>0.4</b>	<b>20</b>
<b>CT scan of head</b>	<b>2</b>	<b>100</b>
<b>CT angiogram of heart</b>	<b>16</b>	<b>800</b>
<b>Nuclear lung scan</b>	<b>0.2</b>	<b>10</b>
<b>Nuclear heart scan</b>	<b>41</b>	<b>2000</b>
<b>Angiogram of brain</b>	<b>5</b>	<b>250</b>
<b>Angiogram of heart</b>	<b>6</b>	<b>400</b>
<b>Coronary stent procedure</b>	<b>15</b>	<b>750</b>

The amount of ionizing radiation exposure in millisievert (mSv) units for various medical imaging procedures, with comparison to airport screening and dental X-rays.

Adapted from *White Paper: Initiative to Reduce Unnecessary Radiation Exposure from Medical Imaging*, Center for Devices and Radiological Health, U.S. Food and Drug Administration, February 1, 2010, and R. Fazel, “Exposure to Low-Dose Ionizing Radiation from Medical Imaging Procedures,” *New England Journal of Medicine* 361 (2009): 849–57.

Figure 7

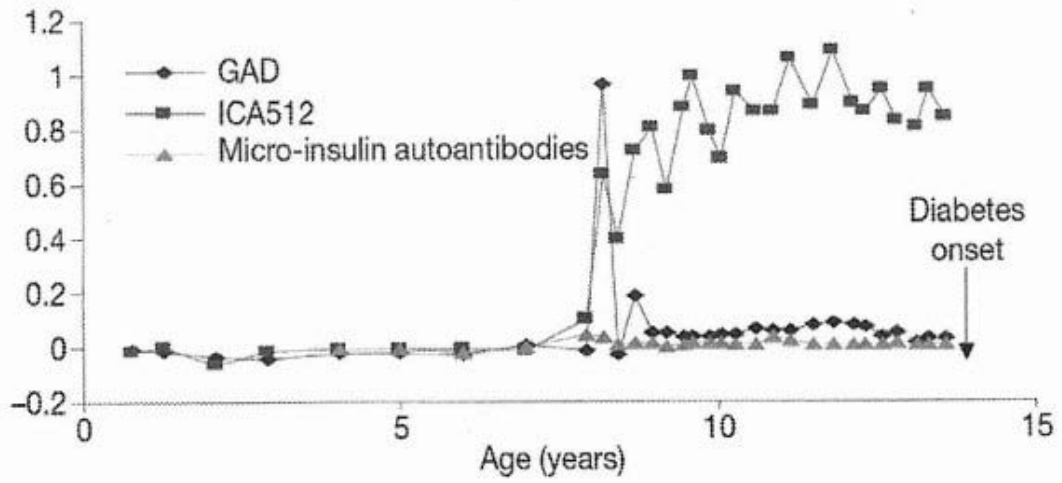


The pattern of various biomarkers over time in the stages of Alzheimer's disease from presymptomatic to early and late mild cognitive impairment (eMCI and LMCI), displaying the trends in imaging, cerebrospinal fluid, activities of daily life (ADL), and cognitive performance (Cog).

Source: *Future Opportunities to Leverage the Alzheimer's Disease Neuroimaging Initiative* (Washington, DC: National Academies Press, 2010).



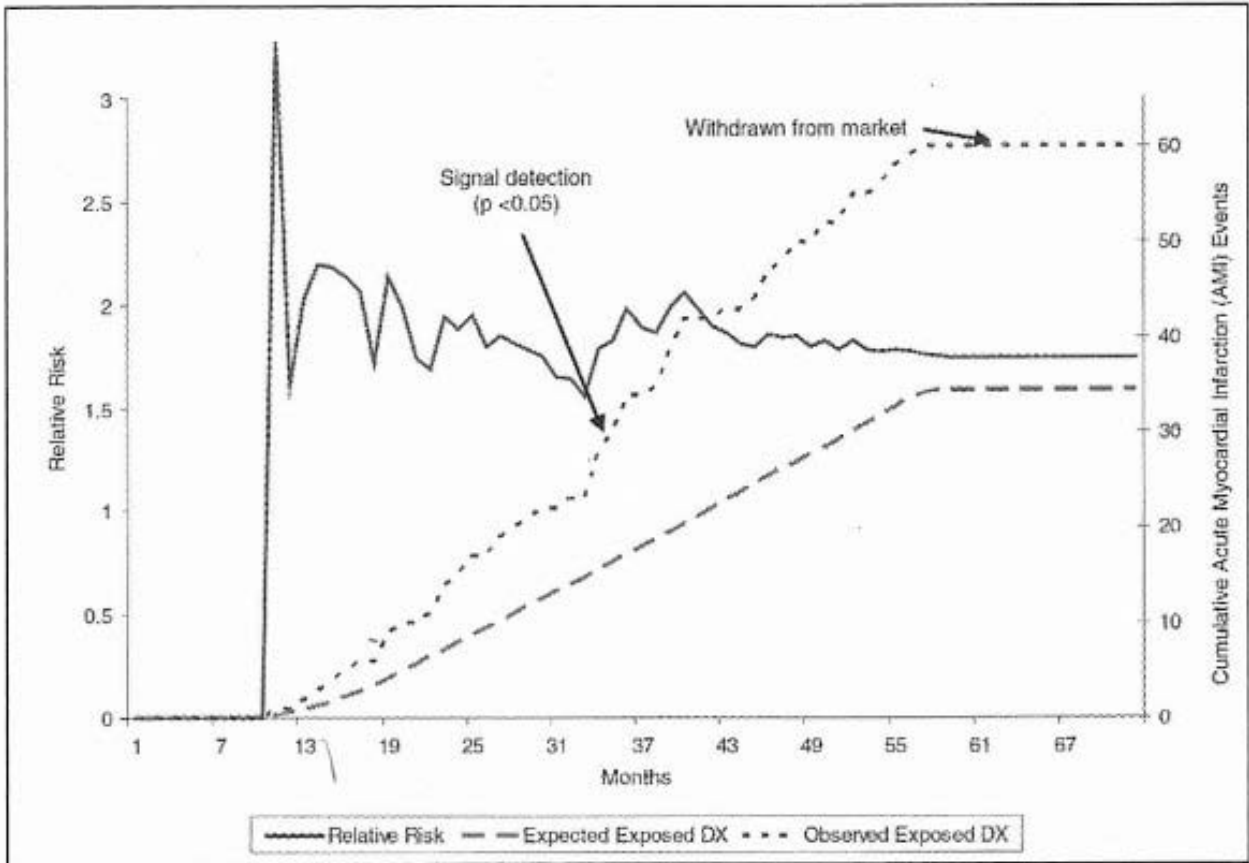
**Figure 8**



Development of different antibodies to the pancreas beta-islet cells detectable in the blood years before the diagnosis of diabetes as a child.

Source: J. Bluestone, "Genetics, Pathogenesis and Clinical Interventions in Type 1 Diabetes," *Nature* 464 (2010): 1293–300.

Figure 9



Detection of the signal of heart attack risk for Vioxx via the Kaiser Permanente health information system compared with the withdrawal of the drug by the manufacturer.

Source: Institute of Medicine, *Challenges for the FDA: The Future of Drug Safety, Workshop Summary* (Washington, DC: National Academies Press, 2007).