



Patient-centered healthcare

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The acceleration of technological innovation in the life sciences will be accompanied in the 21st century by profound changes in the landscape of the pharmaceutical, diagnostics, and the healthcare industries. For decades, the pharmaceutical industry has developed drugs that address only the symptoms of disease. Today, genomic information is revolutionizing the drug discovery process by providing an understanding of the fundamental causes of disease and a pathway toward a new generation of mechanism-based pharmaceuticals. It is expected to have a major impact on virtually every area of drug discovery and may enable the development of new therapeutic approaches that we cannot now envision.

Recent estimates suggest that, with investments amounting to \$2.2 billion by the year 2005, genomics will become the dominant technology in the next millennium, with probably the fastest growing sector being biological/pharmacological research. Genomics, particularly high-throughput sequencing and characterization of expressed human genes, has already created a wealth of opportunities for drug discovery. The challenge will be to turn the enormous amounts of genomic information into knowledge that can be used to discover innovative therapies.

Medium-term demographic and fiscal trends in the European Union provide a powerful incentive for governments to restructure the provision of healthcare. Somehow they need to contain ever-increasing costs, while ensuring equitable, beneficial, and appropriate care for the population. The cost drivers are numerous: enhanced technology, increasing life expectancy, huge variations in clinical practice, and increasing emphasis on patient choice. European governments are responding to these market pressures by restructuring care, focusing on a strengthening of primary care and gatekeeper roles, and furthering the integration of all segments within the healthcare system. How does genomics fit into this natural progression or evolutionary trend?

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Personal profiling

Several strategic implications in healthcare delivery systems for the next millennium stem from genomics. First, the information coming from genomics studies and human population genetics could have a tremendous impact on healthcare options and cost-effective therapies. Existing therapeutic approaches do not take into account individual responses to drugs resulting from genetic and genotyping factors. Pharmacogenomic profiling, for example, would enable the development of more adapted and personalized therapies based on individual genetic profiles and responses to medicines. Second, early diagnosis of disease is thought to be possible. In the future, it would not be unrealistic to perform an examination for a series of diseases on an increasing proportion of the population using a molecular chip-based diagnostic test. Third, genomics information will produce a shift to the patient in terms of empowerment, knowledge, self-care, responsibility, and choice of healthcare professionals and services. And finally, ethics and risk management will have a significant impact on the use of the genomics information and patients' data.

In the context of the market pressures for cost containment and a patient-centered healthcare system, the genomics age will empower the patient through access to a new world of information and knowledge. Each person might have his or her own genomic profile or personal genomic report in the form of a smart card. Healthcare policies would incorporate more social and individual responsibility toward wellness, early intervention, and healthy lifestyles. People would be held more accountable for unhealthy habits like smoking, drinking, or overeating.

Advances in technology and molecular medicine will transform the caterpillar into a butterfly. We will see much fewer late-stage invasive interventions, but many more tailored therapies and timely interventions and more self-care. Birth certificates in the next millennium might read more like a projection of a child's future health than the bare statistics of names and parentage that we have today.

We believe that all these factors will also require changes in the healthcare industry. Individual and corporate participants will

need new skills. They will need to adopt new perspectives and forge new linkages to other players. To accomplish the promises of genomics, those in the healthcare industry need to think outside the traditional models for healthcare delivery, infrastructure, information services, and management.

Provision and risk

The competencies and roles of physicians, payers, healthcare providers, and other participants in the healthcare industry will be dramatically different in the 21st century. Most hospitals, physicians, medical supply services, pharmaceutical firms, payers, and others serving the industry will be linked together in a fully integrated structure.

The role of a genomic profile counselor will be very important in applied genomics healthcare. The genomic profile counselor will need core scientific capabilities to analyze the clinical implications of patients' genomic data and to assess the risk associated to therapeutic options. The counselor will essentially provide support to patients and physicians. The physician will be entitled to monitor and guide the flow of patients across care entities (i.e., hospitals, specialized centers, clinics, ambulatory care centers and tertiary-care facilities). The physician will have information systems enabling him or her to maintain a single patient's medical records. Thus, the physician will have a broad-based orientation to managing patients throughout the full continuum of care and therapeutic options. Finally, treatment protocols and a methodology will be available for measuring outcomes.

The pace of progress in biomedical research poses, however, a serious threat to the future of healthcare development. The healthcare scene would need a regulatory framework in place with clear rules to ensure equitable and appropriate care for all, in particular for those individuals "at risk" through genetic predisposition. Gatekeepers, independent observers, and ethical oversight services will play a crucial role in controlling any genetic malpractice. Unless the public is reassured that the requisite protections are in place to avoid public concern and alarm will deflect progress and the full benefits of genomics. In the age of patient-centered healthcare, society's obligations to individuals must remain fundamental. //