Web-based genetics services

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Institute of Medicine:
Innovations in Service Delivery
in the Age of Genomics

July 28, 2008

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The Current Landscape |

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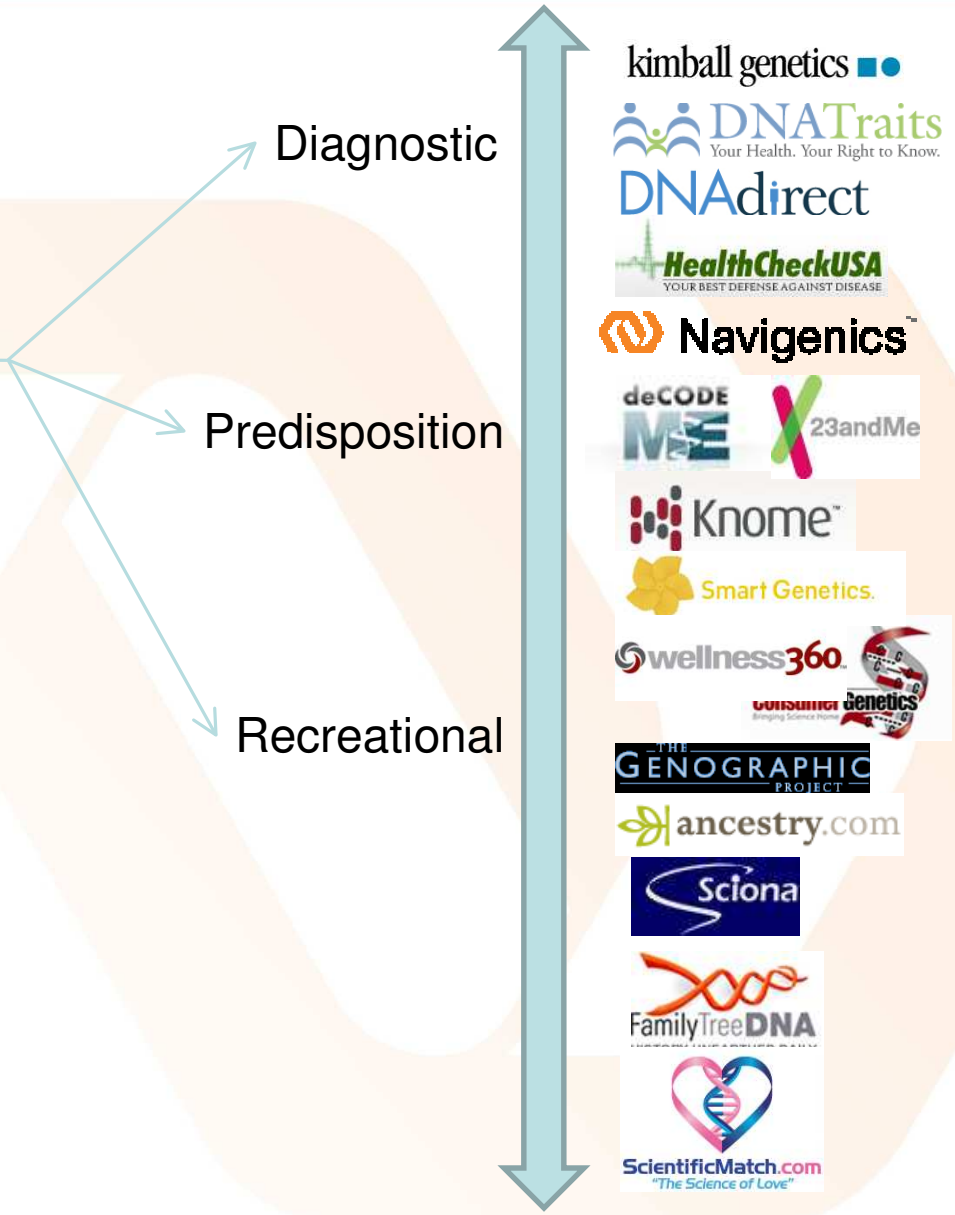
Why People Seek Online Genetic Testing

- Getting genetic testing can be difficult
  - No genetics service in region
  - Convenience: location, time preferences, time-off, childcare…
- Provider awareness is not optimal
  - Lack of perceived value in genetic testing
- More cost-effective
- Privacy and confidentiality concerns
- Proactive interest in genetic contribution to disease
  - Time to adoption for new types of testing in clinical setting
  - Media attention… increasing awareness about genetics

The Current Landscape

- A growing genetic testing market, but with major differences
  1. **Types of testing offered**



The Current Landscape

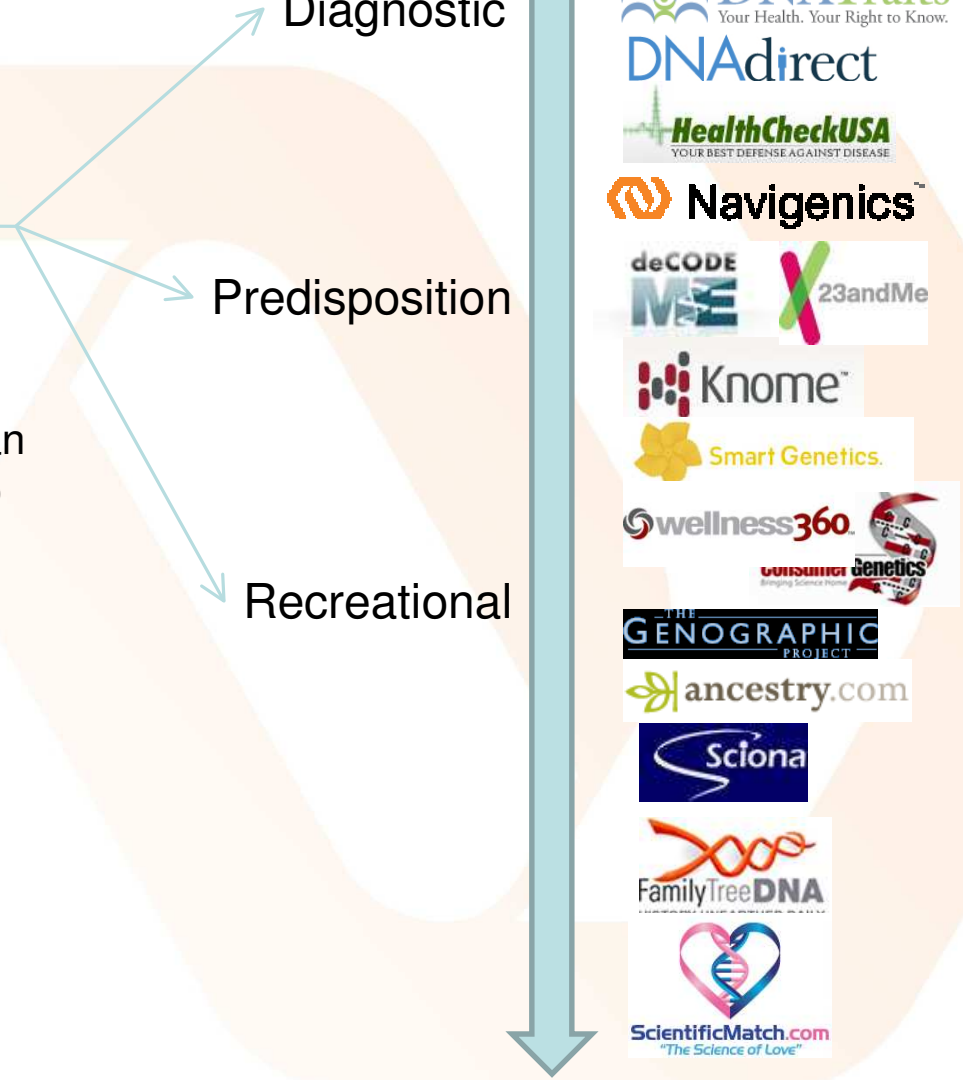
- A growing genetic testing market, but with major differences

1. **Types of testing offered**

2. **Model of services offered**

   Direct access testing: no physician ordering, no results in context, no professional support

   “Virtual clinic”: mirrored after traditional clinical practice



Quick Checklist

Patients *and* professionals need to be able to scrutinize these services

- What **types of genetic testing** is offered?
- Is the **laboratory** utilized appropriately certified?
- Is **educational information** provided?
- What **level of services** are provided?
- Who provides those services – **genetics professionals**?
- Are **results interpretation** provided?
- Will they **speak with your doctor**?
- Are **costs** are clearly stated?
- Are company **privacy policy** and standards available?

Examples of New Models |

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New Models: Kimball Genetics

kimball genetics

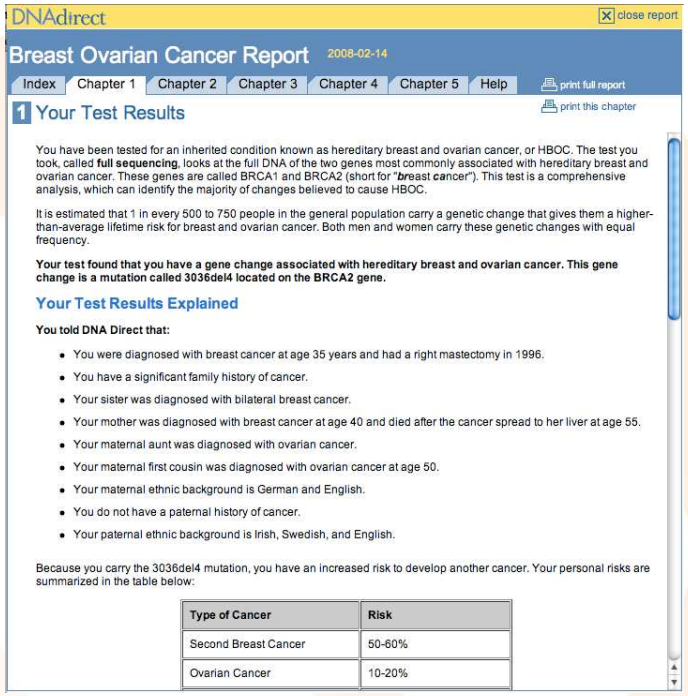
- A CLIA lab that provides access to testing and GC services
- Testing for genetic conditions that are “preventable or treatable”
- How it works:
  - Test ordered directly by patient, required to provide physician contact info
  - Results released directly to patient’s physician
  - Company provides interpretation reports, recommendations, and education
- GCs available by phone
  - For patients, their families, and physicians

New Models: DNA Direct

- Web-based testing modeled after clinical genetics services
- Pre-test education, questionnaires
  - What is the condition / disease?
  - How is it inherited?
  - What testing can or can't tell you?
  - Who is appropriate for testing?
  - What is the testing process?
  - What can you do with results?
  - Insurance coverage
  - Family history assessment
- Genetic counseling services
  - Condition-specific protocols (i.e. – BRCA)

New Models: DNA Direct

- Post-test interpretation of results
  - Comprehensive web-based report
  - Customized to family & medical history
  - Includes lab report, physician & family letter
  - Helps build an action plan for next step



- 34% have tested positive

- *People are testing appropriately!*

New Models: Navigenics

- **Vision:**

  To **improve individuals' health** across the population by educating, empowering and motivating people to take action to prevent the onset of disease or lessen its impact.

- **Product Description:**

  The Navigenics™ Health Compass is an innovative service which informs individuals of their **genetic predisposition** for a variety of **common diseases** and provides **guidance** and **information** on how to delay or prevent the onset of those diseases and focus healthcare strategies.

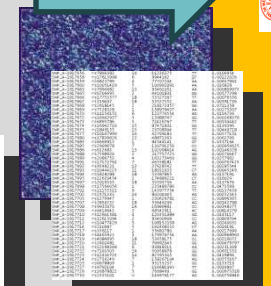
- **Key Company Standards:**
  - Quality science with a clinical basis
  - CLIA lab, guarantee 100% call rates
  - Health and wellness partnerships
  - Genetic counseling support
  - Security and privacy
  - External advisory boards

New Models: Navigenics

CLIA-Certified Lab

Receive & process biological samples

Data



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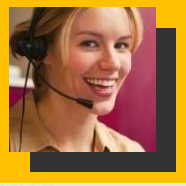
Scientific and clinical curation of literature

Genetic Counselors

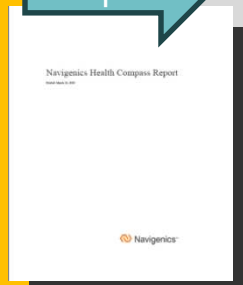


Personalized, secure web portal

Data analysis & risk estimation algorithms

$$\frac{p(D)}{p(D \mid NN)} = f_{RR}\lambda_{RR} + f_{RN}\lambda_{RN} + f_{NN}$$

Report



Physicians

Order tests

Release results

Provide follow-up

Collaborators:

AFFYMETRIX

Collaborators:

MayoClinic.com Medscape from WebMD

Collaborators:

MAYO CLINIC

Scripps

Cleveland Clinic

PARTNERS HEALTHCARE

DukeMedicine

Scientific Criteria

- The association is replicated and published in top-tier journals
  - >60% of independent studies
- Reasonable sample size to detect weak effects
  - OR < 1.5 needs at least 250 cases/250 controls (most studies have 1000's)
- Statistically significant result after correction for multiple testing
- Adjustment for population stratification
- Supporting evidence:
  - Adjustment for confounders
  - Functional data
- Well designed study and sound lab practice

Clinical Criteria

- The condition affects > one in 1,000 Americans
- The disease/condition must be clinically relevant and "actionable"
  - Preventable
  - Early screening makes a difference
  - Lifestyle makes a difference
  - Diet makes a difference
  - Medication/surgery makes a difference
  - Affects multiple organ systems
  - Impacts other diseases
- The risk information must be clinically/socially responsible
  - No IQ, athletic propensity, sticky earwax,

>95% of studies fail to meet our criteria

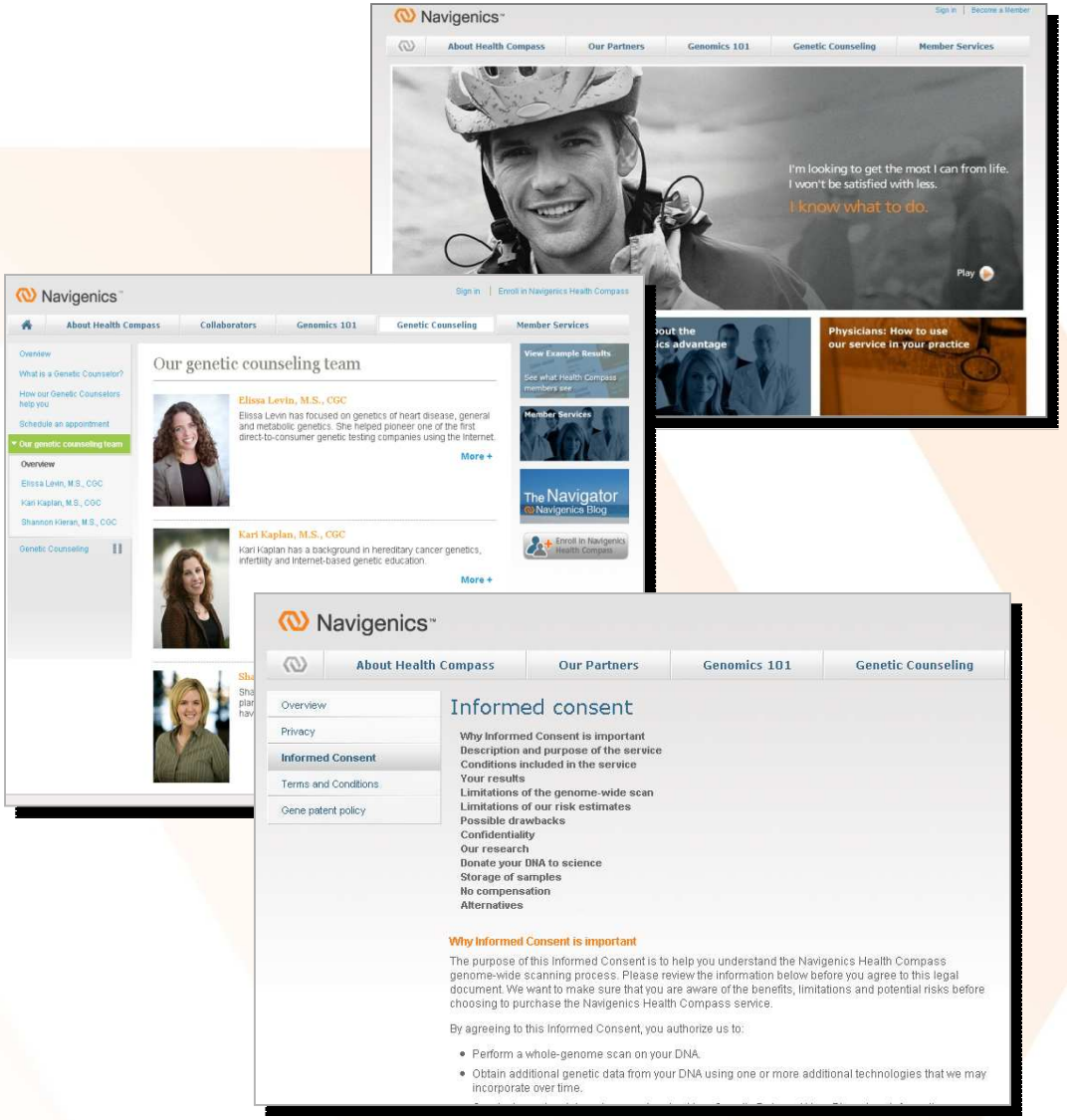
Online Education

- Transparent
- Set expectations

- Information/audiovisual tools
  - Genetics 101
  - How the process works
  - Behind the science
  - How GCs can help
  - Working with your doctor
  - About Navigenics
  - Genetic discrimination
  - Privacy

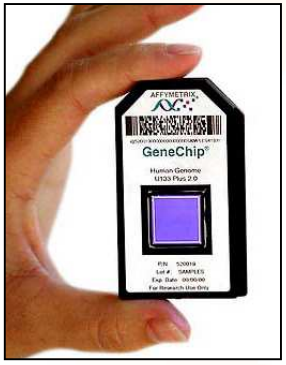
- Informed Consent

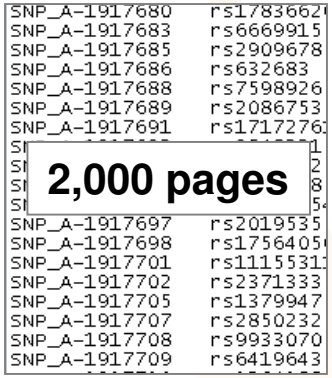
- Access to genetic counselors

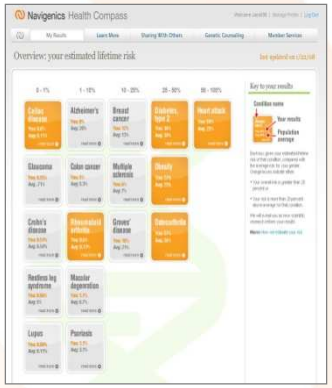


Genetic Risk Assessment and Communication

1	2	3	4	5
Sample Acquisition	CLIA Laboratory	Bioinformatics	Private Web Portal	Ongoing Updates



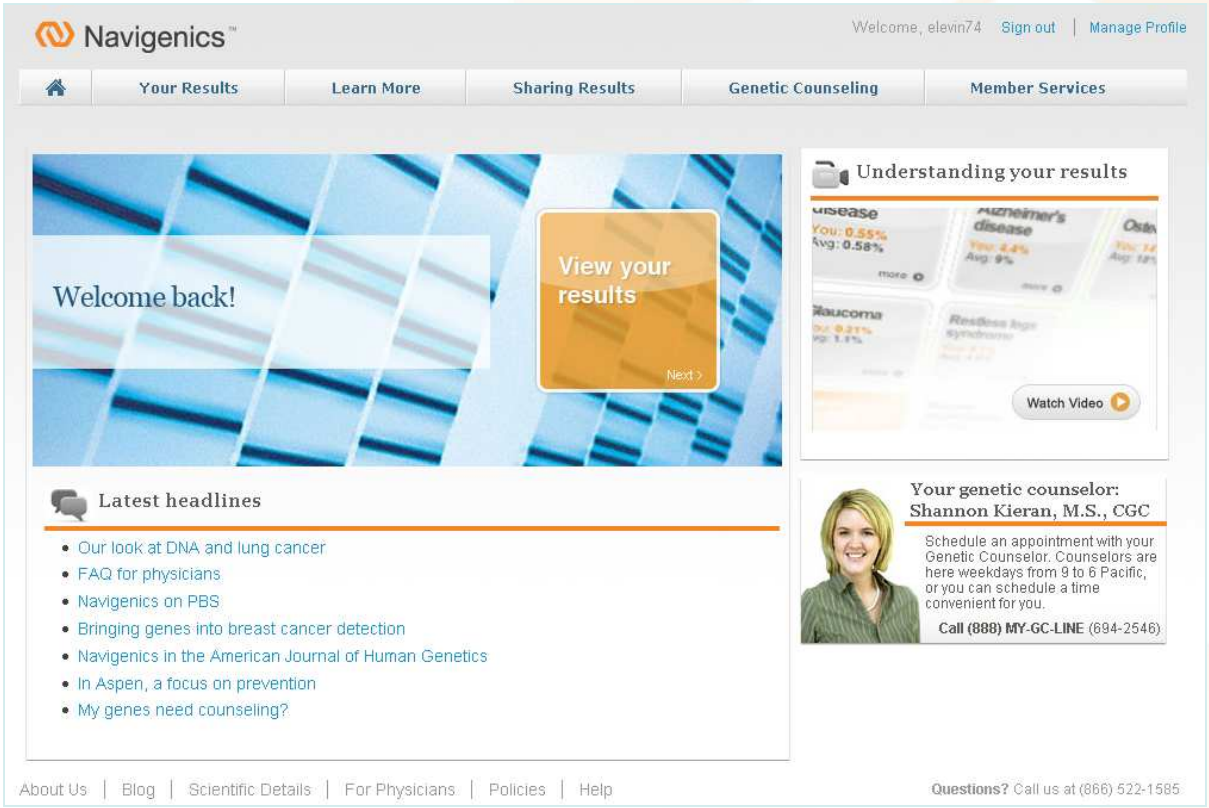




GC Services

Receiving Results

1. Secure login to personal web portal
2. Introduction tutorial
3. Select conditions (active opt-in)



Current list of conditions:

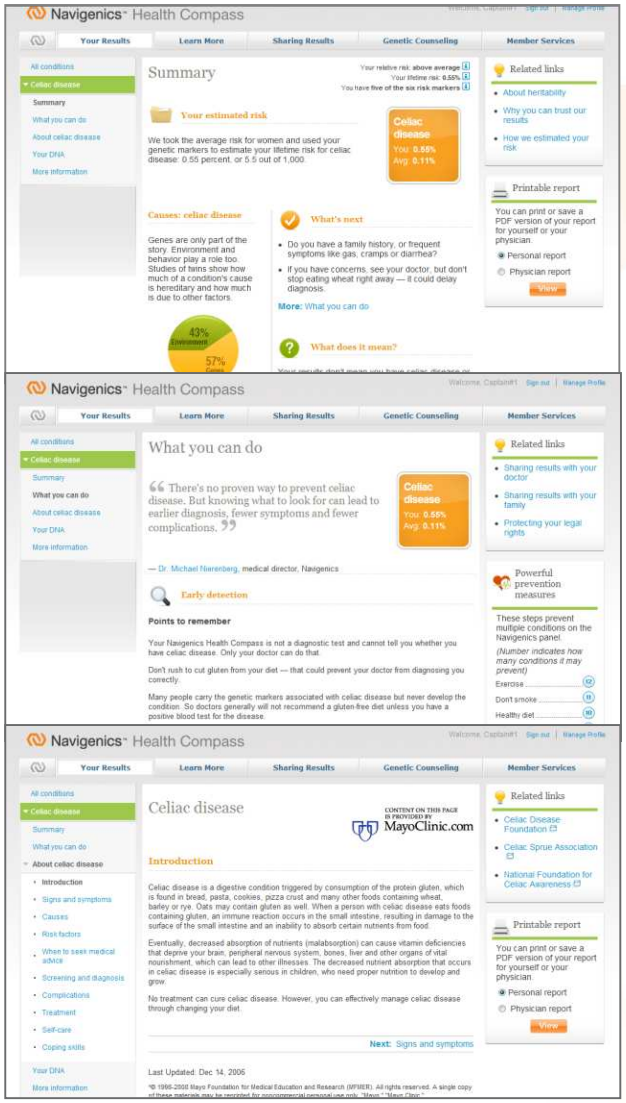
- Abdominal Aneurysm
- Alzheimer's Disease
- Atrial Fibrillation
- Breast Cancer
- Celiac Disease
- Colon Cancer
- Crohn's Disease
- Diabetes Type 2
- Glaucoma
- Grave's Disease
- Heart Attack
- Lung Cancer
- Lupus
- Macular Degeneration
- Multiple Sclerosis
- Obesity
- Osteoarthritis
- Psoriasis
- Prostate Cancer
- Restless Leg Syndrome
- Rheumatoid Arthritis

In-Depth Condition Reports

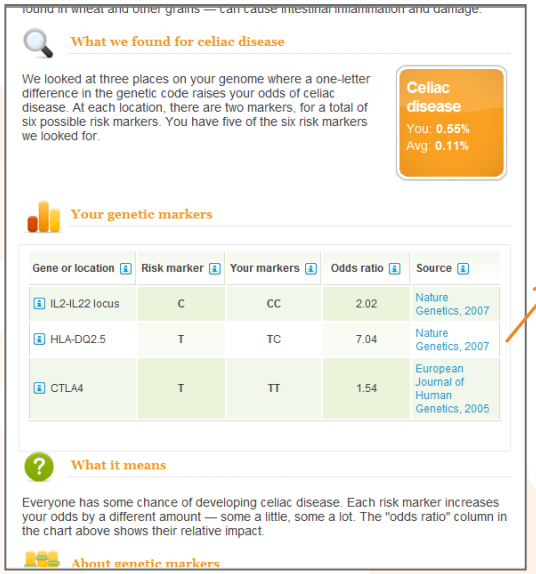
Condition summary

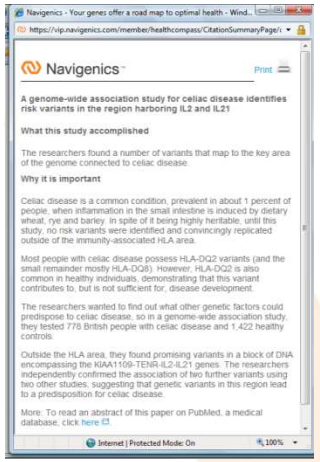
Action steps

In-depth condition information

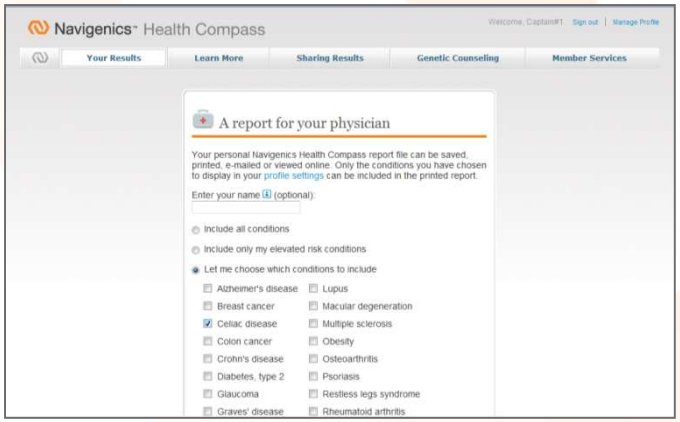


Marker details

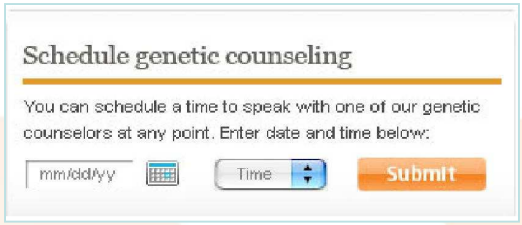




Sharing with physician



Genetic Counseling Service

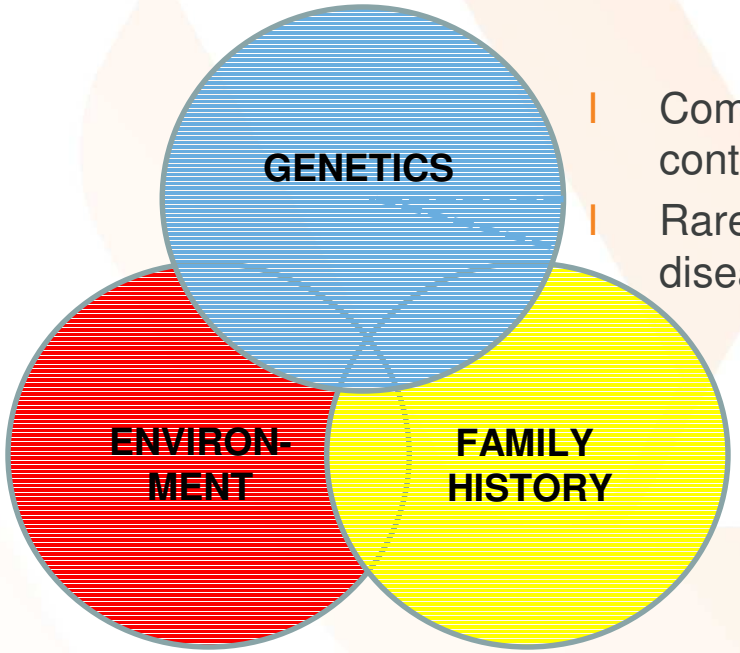


- Access to certified GCs:
  - Core component, cost included with testing
  - Pre-test, post-test, additional access as new data emerges
- GCs have specific training in genome-wide screening and risk assessment for common, multifactorial conditions
- Continuity of care: GC assigned to each tester
- Convenient scheduling, low barriers to engagement
- Identify in-person services and additional testing, as appropriate

Putting Results In Context

- Phone-based genetic counseling:
  - Conditions of most concern – based on results and patient interest
  - Multi-generation family history collection and assessment
  - Understanding results and review next step options

- Need to consider many components of risk and disease contribution



- Common genetic contributions
- Rare, monogenic disease

How Are People Handling It?

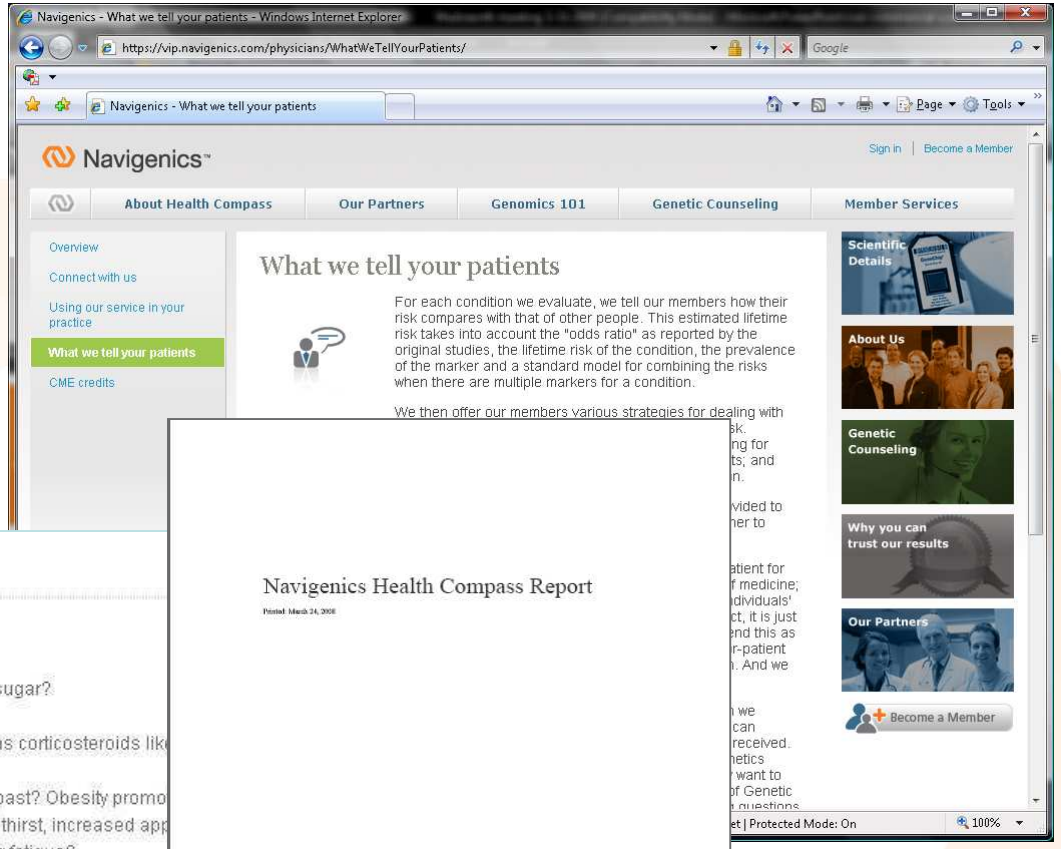
- Early reports = no extreme reactions to date
  - People can understand concept of risk factors
  - Those who are initially anxious report returning to baseline
  - Many further report feeling empowered and informed

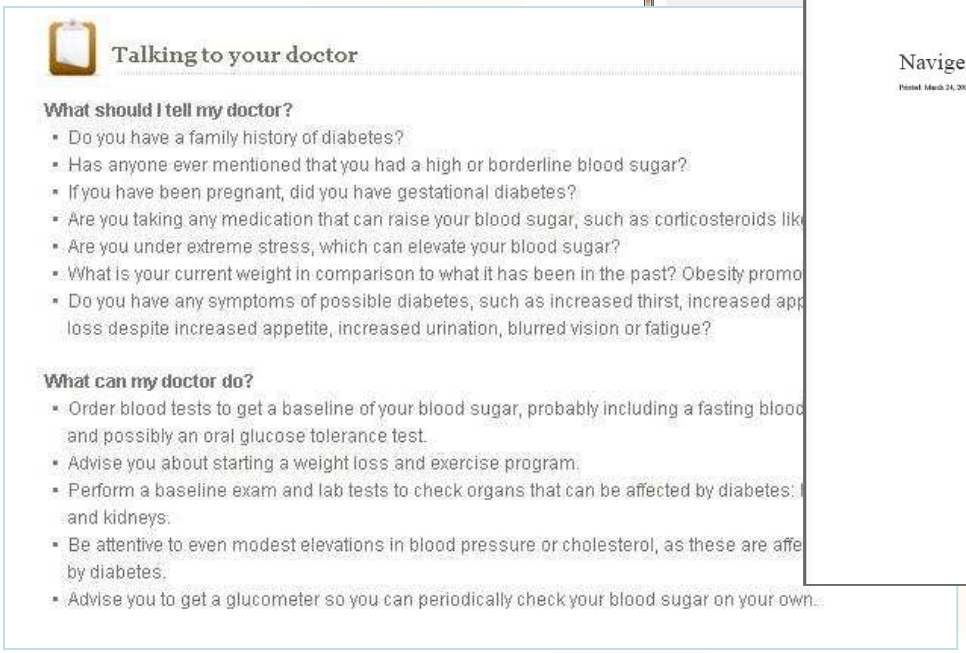
- 46% of early testers took action after testing
  - Lifestyle/behavior modification
  - Screening or interventions in conjunction with healthcare provider

- *Additional research is needed to further understand the long-term impact of genomic risk information on health behaviors*

Engaging Providers

- How to talk to your doctor
- Physician Report
- Provider access to GCs
- Web portal for providers (education, ordering…)

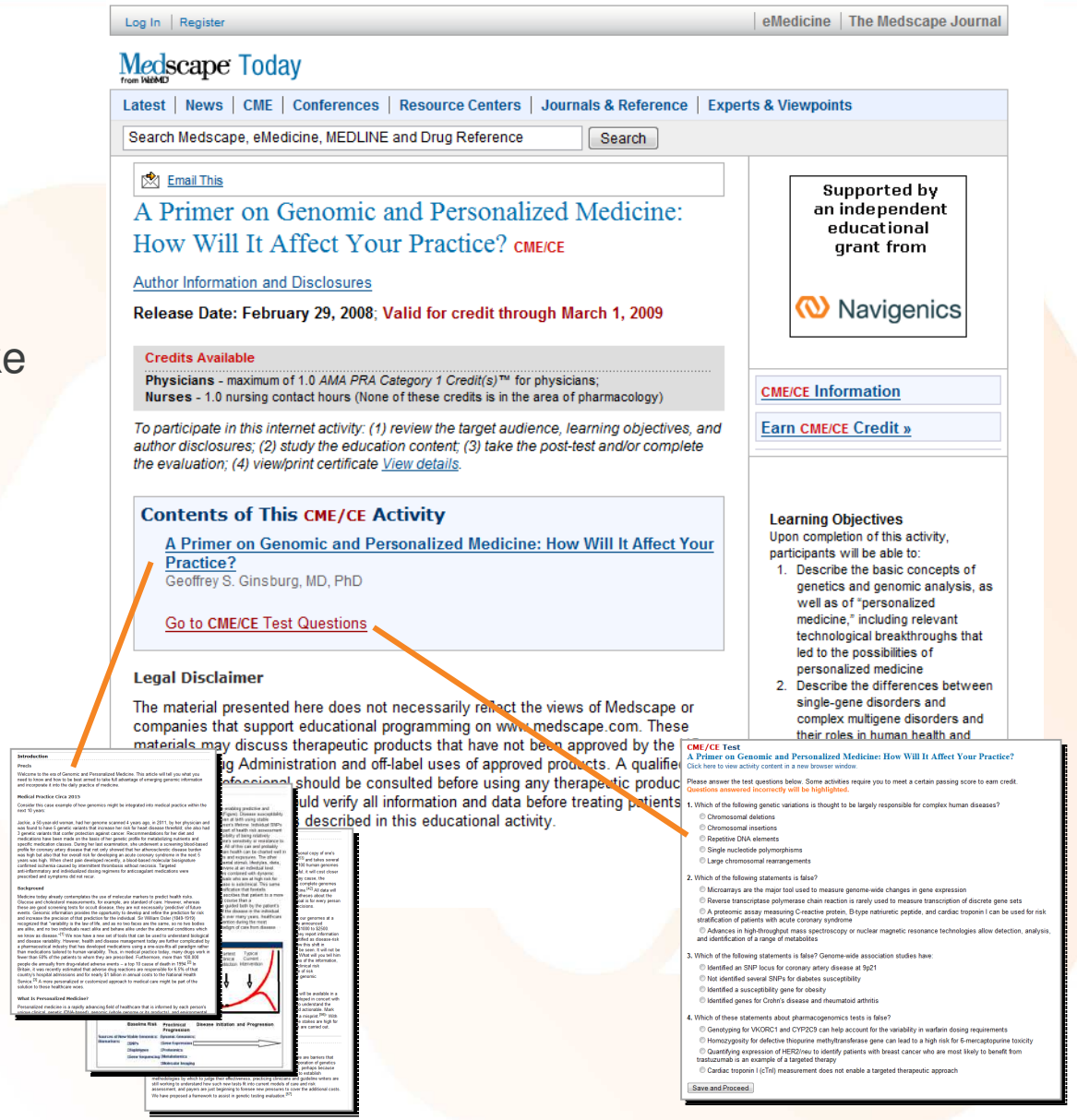




Physician Education

Medscape from WebMD

- CME article authored by Dr. Geoff Ginsburg of Duke
- Sponsored by Navigenics (no role in creation)
- Currently has generated about **6000** Medscape member readers, **2500** applied for credit (MDs, nurses, other HCPs)



Setting Industry Standards |

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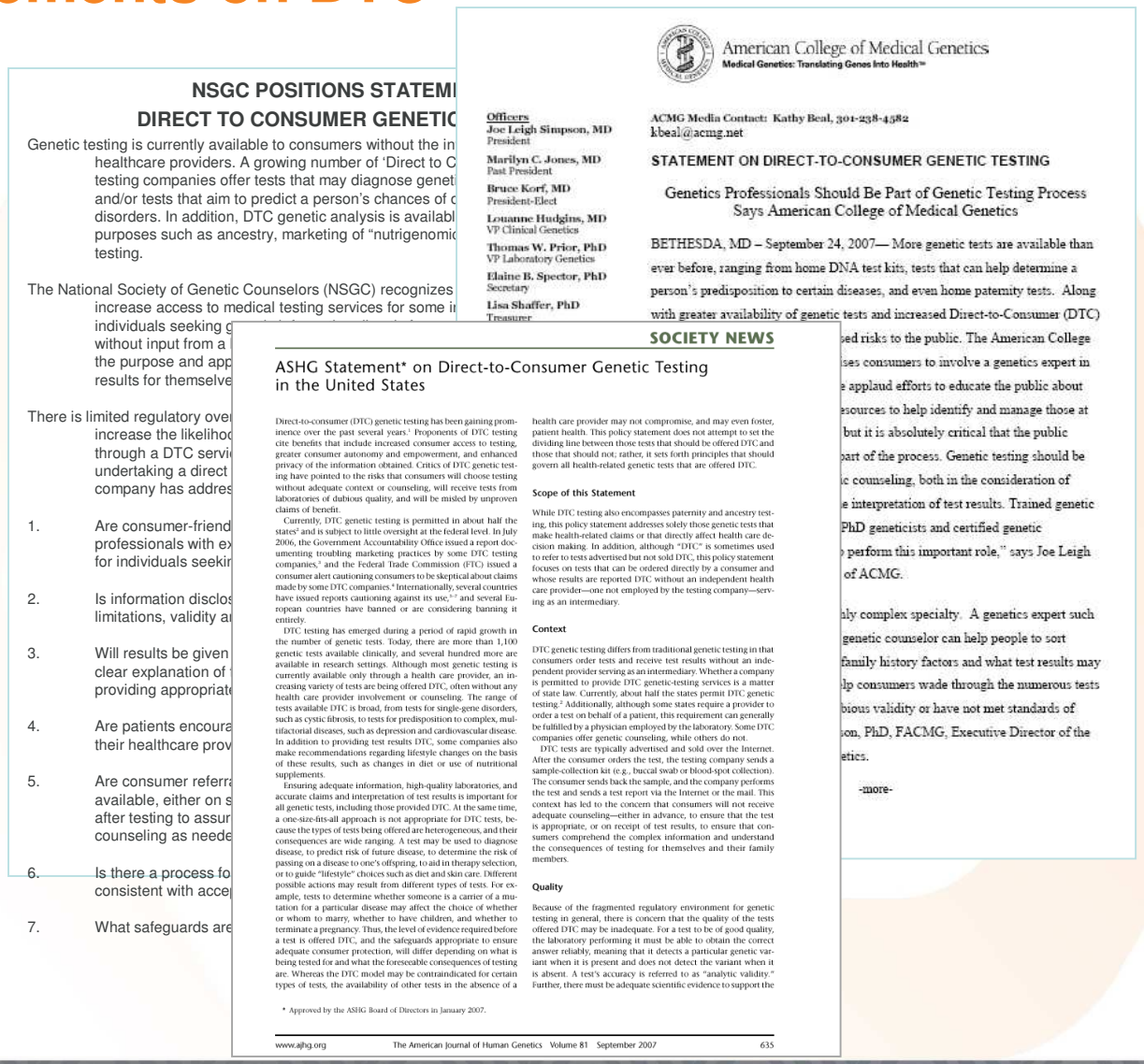
Professional Statements on DTC

- ACMG
- ASHG
- NSGC



NSGC POSITIONS STATEMI

DIRECT TO CONSUMER GENETIC

Genetic testing is currently available to consumers without the in
healthcare providers. A growing number of 'Direct to C
testing companies offer tests that may diagnose genet
and/or tests that aim to predict a person's chances of d
disorders. In addition, DTC genetic analysis is availabl
purposes such as ancestry, marketing of "nutrigenomic
testing.

The National Society of Genetic Counselors (NSGC) recognizes
increase access to medical testing services for some i
individuals seeking g
without input from a
the purpose and app
results for themselve

There is limited regulatory ove
increase the likelihoo
through a DTC servi
undertaking a direct
company has addres

1. Are consumer-friend
professionals with ex
for individuals seekir

2. Is information disclos
limitations, validity a

3. Will results be given
clear explanation of
providing appropriat

4. Are patients encoura
their healthcare prov

5. Are consumer referra
available, either on s
after testing to assur
counseling as neede

6. Is there a process fo
consistent with acce

7. What safeguards are

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STATEMENT ON DIRECT-TO-CONSUMER GENETIC TESTING

Genetics Professionals Should Be Part of Genetic Testing Process
Says American College of Medical Genetics

BETHESDA, MD – September 24, 2007— More genetic tests are available than ever before, ranging from home DNA test kits, tests that can help determine a person's predisposition to certain diseases, and even home paternity tests. Along with greater availability of genetic tests and increased Direct-to-Consumer (DTC)
sed risks to the public. The American College
ises consumers to involve a genetics expert in
e applaud efforts to educate the public about
esources to help identify and manage those at
but it is absolutely critical that the public
part of the process. Genetic testing should be
ic counseling, both in the consideration of
e interpretation of test results. Trained genetic
PhD geneticists and certified genetic
perform this important role," says Joe Leigh
of ACMG.

aly complex specialty. A genetics expert such
genetic counselor can help people to sort
family history factors and what test results may
lp consumers wade through the numerous tests
bious validity or have not met standards of
on, PhD, FACMG, Executive Director of the
etics.

-more-

SOCIETY NEWS

ASHG Statement* on Direct-to-Consumer Genetic Testing in the United States

Direct-to-consumer (DTC) genetic testing has been gaining prominence over the past several years.[1] Proponents of DTC testing cite benefits that include increased consumer access to testing, greater consumer autonomy and empowerment, and enhanced privacy of the information obtained. Critics of DTC genetic testing have pointed to the risks that consumers will choose testing without adequate context or counseling, will receive tests from laboratories of dubious quality, and will be misled by unproven claims of benefit.

Currently, DTC genetic testing is permitted in about half the states[2] and is subject to little oversight at the federal level. In July 2006, the Government Accountability Office issued a report documenting troubling marketing practices by some DTC testing companies,[3] and the Federal Trade Commission (FTC) issued a consumer alert cautioning consumers to be skeptical about claims made by some DTC companies.[4] Internationally, several countries have issued reports cautioning against its use,[5–7] and several European countries have banned or are considering banning it entirely.

DTC testing has emerged during a period of rapid growth in the number of genetic tests. Today, there are more than 1,100 genetic tests available clinically, and several hundred more are available in research settings. Although most genetic testing is currently available only through a health care provider, an increasing variety of tests are being offered DTC, often without any health care provider involvement or counseling. The range of tests available DTC is broad, from tests for single-gene disorders, such as cystic fibrosis, to tests for predisposition to complex, multifactorial diseases, such as depression and cardiovascular disease. In addition to providing test results DTC, some companies also make recommendations regarding lifestyle changes on the basis of these results, such as changes in diet or use of nutritional supplements.

Ensuring adequate information, high-quality laboratories, and accurate claims and interpretation of test results is important for all genetic tests, including those provided DTC. At the same time, a one-size-fits-all approach is not appropriate for DTC tests, because the types of tests being offered are heterogeneous, and their consequences are wide ranging. A test may be used to diagnose disease, to predict risk of future disease, to determine the risk of passing on a disease to one's offspring, to aid in therapy selection, or to guide "lifestyle" choices such as diet and skin care. Different possible actions may result from different types of tests. For example, tests to determine whether someone is a carrier of a mutation for a particular disease may affect the choice of whether or whom to marry, whether to have children, and whether to terminate a pregnancy. Thus, the level of evidence required before a test is offered DTC, and the safeguards appropriate to ensure adequate consumer protection, will differ depending on what is being tested for and what the foreseeable consequences of testing are. Whereas the DTC model may be contraindicated for certain types of tests, the availability of other tests in the absence of a health care provider may not compromise, and may even foster, patient health. This policy statement does not attempt to set the dividing line between those tests that should be offered DTC and those that should not; rather, it sets forth principles that should govern all health-related genetic tests that are offered DTC.

Scope of this Statement

While DTC testing also encompasses paternity and ancestry testing, this policy statement addresses solely those genetic tests that make health-related claims or that directly affect health care decision making. In addition, although "DTC" is sometimes used to refer to tests advertised but not sold DTC, this policy statement focuses on tests that can be ordered directly by a consumer and whose results are reported DTC without an independent health care provider—one not employed by the testing company—serving as an intermediary.

Context

DTC genetic testing differs from traditional genetic testing in that consumers order tests and receive test results without an independent provider serving as an intermediary. Whether a company is permitted to provide DTC genetic-testing services is a matter of state law. Currently, about half the states permit DTC genetic testing.[2] Additionally, although some states require a provider to order a test on behalf of a patient, this requirement can generally be fulfilled by a physician employed by the laboratory. Some DTC companies offer genetic counseling, while others do not.

DTC tests are typically advertised and sold over the Internet. After the consumer orders the test, the testing company sends a sample-collection kit (e.g., buccal swab or blood-spot collection). The consumer sends back the sample, and the company performs the test and sends a test report via the Internet or the mail. This context has led to the concern that consumers will not receive adequate counseling—either in advance, to ensure that the test is appropriate, or on receipt of test results, to ensure that consumers comprehend the complex information and understand the consequences of testing for themselves and their family members.

Quality

Because of the fragmented regulatory environment for genetic testing in general, there is concern that the quality of the tests offered DTC may be inadequate. For a test to be of good quality, the laboratory performing it must be able to obtain the correct answer reliably, meaning that it detects a particular genetic variant when it is present and does not detect the variant when it is absent. A test's accuracy is referred to as "analytic validity." Further, there must be adequate scientific evidence to support the

* Approved by the ASHG Board of Directors in January 2007.

www.ajhg.org The American Journal of Human Genetics Volume 81 September 2007 635

Setting Industry Standards

- **Validity** of scientific and clinical information provided
- **Accuracy and quality** of testing in a CLIA-certified lab
- **Clinical relevance** of information provided
- **Actionable** next steps for health conditions assessed
- **Access to genetic counseling** by qualified professionals
- **Security and privacy** including consistence with HIPAA regulations
- **Ownership of genetic information** belongs to the individual
- **Physician education and engagement**
- **Transparency** at all levels of the service
- **Measurement** to assess impact on health outcomes

The Personalized Medicine Coalition is leading an industry standards setting event with Navigenics and other industry leaders and stakeholders (Dec. 2008)

Questions?

Please contact me at any point with questions!

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