



SCRIPPS GENOMIC MEDICINE  
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# Consumer Genome-Wide Disease Risk Profiling: *The Scripps Genomic Health Initiative*

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*Presentation to:*

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# Personal Consumer Genomics

- GWAS findings leveraged by companies to offer genomic risk assessments based on common variants
- Much debate regarding this practice
- ***Proponents argue such testing can empower individuals***
  - Be more proactive in own healthcare
  - Make more healthful lifestyle and medical choices
  - Have a “right” to information about their own bodies
- ***Opponents argue this is premature translation***
  - Expense & direct-to-consumer nature
  - Lack of consensus as to how to present the information
  - Lack of demonstrated clinical validity
  - Lack of demonstrated clinical utility
  - Lack of data on consumer response



# The Scripps Genomic Health Initiative



- **Longitudinal cohort study of behavioral response to genome-wide risk testing for common disease**
- Participants purchased a commercially available consumer genome-wide scan
- Aim to assess impact of consumer genome-wide risk assessment
  - **Psychological**
  - **Behavioral**
  - **Clinical**
- Design based on studies looking at response to testing for single genes/conditions

for study procedures see Bloss et al., *Genetics in Medicine*, 2010

# Methods



- **Recruitment**
  - Scripps Health employees, family members, and patients
  - Other employers of health and technology companies
- **Inclusion criteria**
  - 18 years or older
  - Valid email address
  - Provision of co-payment (\$150 - \$470, fully subsidized)
    - At the time of the study, retail price was ~\$2,000

# Procedures



\*All assessments web-based

# Behavioral Measures

Domain	Sub-domains	Assessment Tool
<b>Psychological</b>	<i>State Anxiety</i>	•Spielberger State-Trait Anxiety Inventory (Spielberger, 1983)
	<i>Test-Related Distress</i>	•Impact of Events Scale-Revised (Weiss & Marmar, 1997)
<b>Behavioral</b>	<i>Diet</i>	•The Food Screener (Block et al., 2000)
	<i>Exercise</i>	•Godin Leisure-Time Exercise Questionnaire (Godin & Shephard, 1985)
<b>Health Screening</b>	<i>Surveillance/Health Screening Behaviors</i>	•Original items to gauge: (a) actual screening post-testing, as well as (b) intention to increase frequency of completing 13 specific tests

- Sharing of results with genetic counselor or personal physician

**Re-administered at 12-Month Follow-up**

# Health Compass

## 23 Conditions

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

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Home Your Results Genetic Counseling Help

### Health Conditions

## Your estimated lifetime

Click anywhere on the colored boxes below to condition, your genetic predispositions, what y much more.

**Condition name**

**Diabetes type 2**

**Your results**  
You: 45%

**Population Average**  
Avg: 30%

0 - 1%	>1 - 10%	>10 - 25%	>25 - 50%	>50 - 100%
<b>Crohn's disease</b> You: 0.97% Avg: 0.54%	<b>Alzheimer's disease</b> You: 9% Avg: 17%	<b>Atrial fibrillation</b> You: 25% Avg: 23%	<b>Obesity</b> You: 42% Avg: 32%	You have no results in this range
<b>Brain aneurysm</b> You: 0.91% Avg: 0.90%	<b>Breast cancer</b> You: 9% Avg: 13%	<b>Heart attack</b> You: 22% Avg: 25%	<b>Diabetes, type 2</b> You: 28% Avg: 30%	
<b>Lupus</b> You: 0.51% Avg: 0.26%	<b>Lung cancer</b> You: 6% Avg: 6%	<b>Osteoarthritis</b> You: 21% Avg: 26%		
<b>Multiple sclerosis</b> You: 0.45% Avg: 0.77%	<b>Psoriasis</b> You: 5% Avg: 4.0%			
<b>Celiac disease</b> You: 0.07% Avg: 0.11%	<b>Colon cancer</b> You: 5% Avg: 5%			
	<b>Rheumatoid arthritis</b> You: 4.2% Avg: 3.3%			
	<b>Restless legs syndrome</b> You: 4.0% Avg: 4.0%			

### Key to your results

Condition name

**Diabetes type 2**

**Your results**  
You: 45%

**Population Average**  
Avg: 30%

Why orange & gray boxes?

**Video:** Understanding your results

**Tutorial:** Review the tutorial

**More:** How we estimate your risk

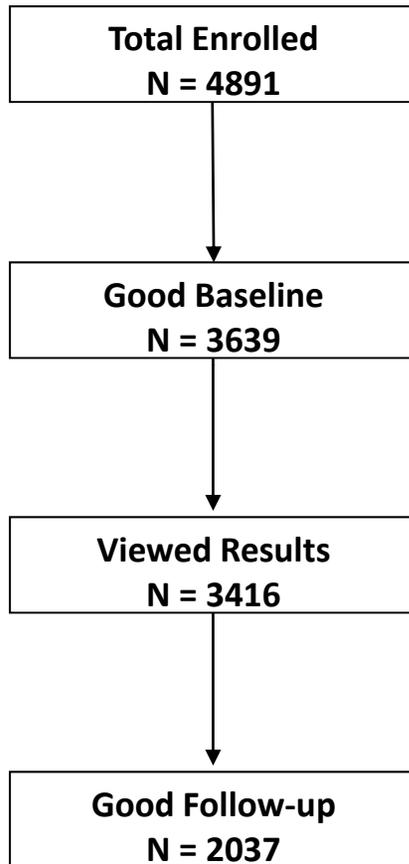
**Note different ways of presenting "risk"**

### Sharing results with your doctor

Here are some suggestions for making the most of a conversation with your doctor — including a doctor-friendly printed report.

Share with Doctor

# Enrollment, Study Cohort & Demographics



**56% response rate**

**Average Follow-up Interval = 5.6 Months (SD=2.4)**

Baseline Variable	Completed Follow-up
N	2,037
% Female	55.3
Age	46.7 (12.0), 19-85
Income	100k-149k
Education	Some Post-College Education
% Self-reported Caucasian	84.2
% Health Occupation	23.6

# Overall Impact of Genome-Wide Testing

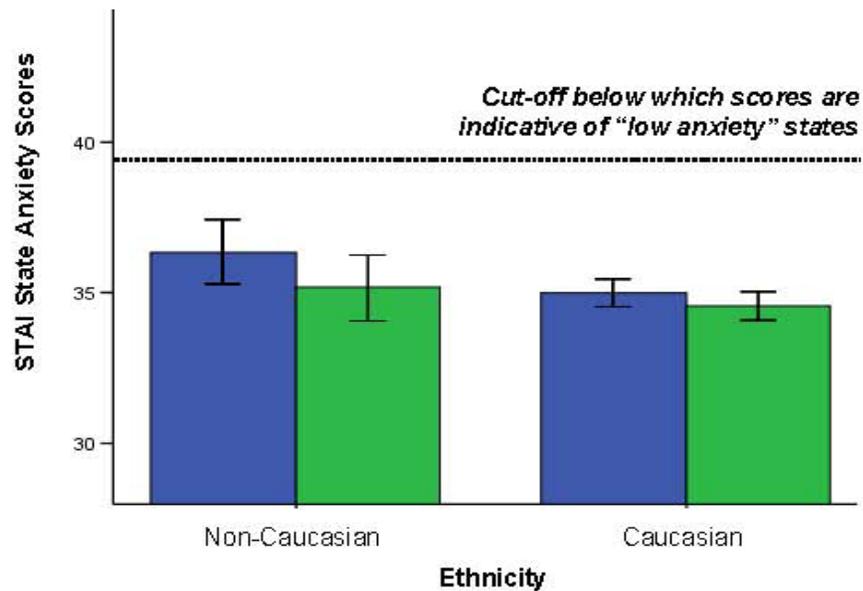
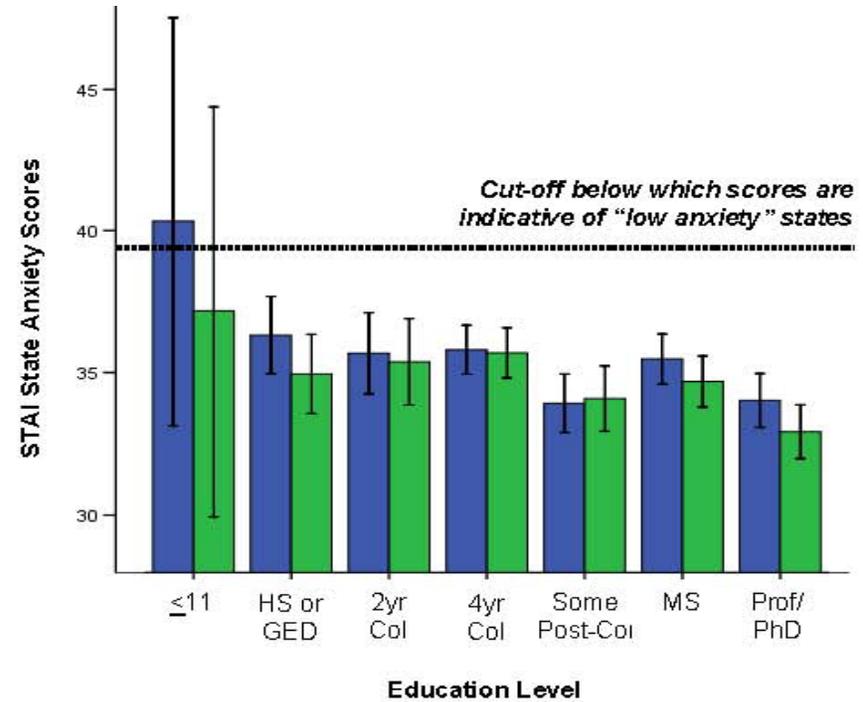
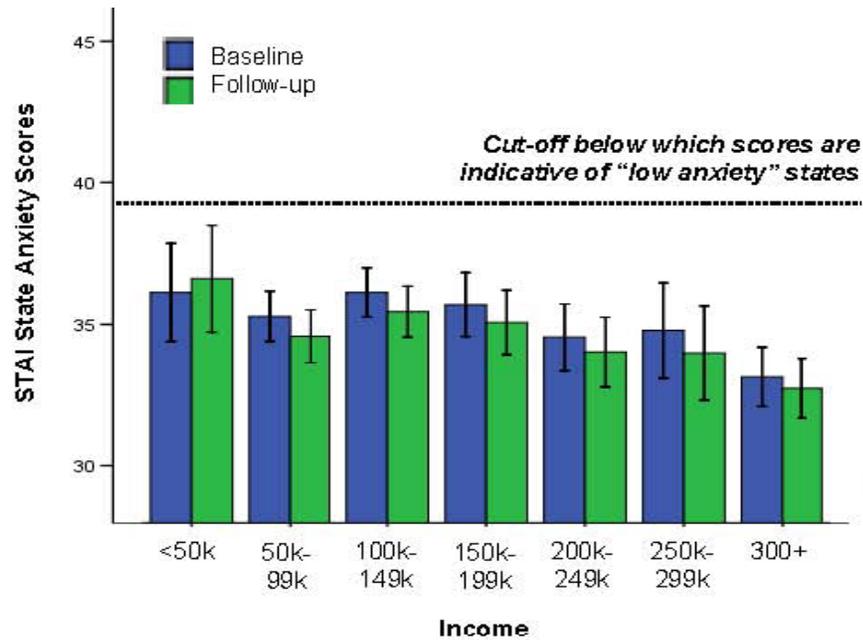
Bloss, Schork & Topol, *New England Journal of Medicine*, 2011

Outcome Measure	Baseline	Follow-up	p-value/ summary
State Anxiety	35.2 (9.6)	34.6 (10.0)	.801
Test-Related Distress	NA	3.2 (7.1)	90% no distress
Diet	16.0 (7.9)	15.2 (7.5)	.887
Exercise	28.6 (23.0)	28.6 (22.9)	.608
Screening Behaviors Intended	NA	1.8 (2.6)	<b>&lt; .001</b>

**Does not account for genetic risk estimates, just the effect of undergoing testing**

# Anxiety Level & Demographics

Bloss, Schork & Topol, *NEJM*, 2011



*Results for subgroups generally consistent with that of cohort as a whole.*

# Genetic Risk & Intended Health Screening

Screening Test	Screening Benefit for Asymptomatic Individuals	Condition	Actual Completion		Intended Completion	
			ELTR		ELTR	
			OR (95% CI)	p	OR (95% CI)	p
Thyroid Test	No Benefit	Graves' Disease	1.04 (0.93-1.16)	.47	1.01 (0.86-1.18)	.92
Skin Exam	No Benefit	Psoriasis	0.99 (0.92-1.09)	.97	1.05 (0.96-1.15)	.30
Ophthalmic Exam	<b>Possible</b>	Glaucoma	1.02 (0.98-1.07)	.32	<b>1.12 (1.06-1.18)</b>	<b>&lt;.001</b>
	<b>Possible</b>	Macular Degeneration	<b>1.01 (1.00-1.03)</b>	<b>.04</b>	<b>1.05 (1.04-1.06)</b>	<b>&lt;.001</b>
Glucose Exam	<b>Established</b>	Type 2 Diabetes	1.01 (0.99-1.02)	.18	<b>1.03 (1.02-1.04)</b>	<b>&lt;.001</b>
Electro-cardiogram	No Benefit	Atrial Fibrillation	0.99 (0.96-1.01)	.24	<b>1.03 (1.01-1.05)</b>	<b>.009</b>
	No Benefit	Heart Attack	0.99 (0.97-1.01)	.36	1.01 (0.98-1.04)	.42
Colonoscopy	<b>Established</b>	Colon Cancer	1.08 (0.98-1.19)	.14	<b>1.21 (1.13-1.30)</b>	<b>&lt;.001</b>
	No Benefit	Crohn's Disease	0.98 (0.78-1.22)	.84	<b>1.17 (1.01-1.36)</b>	<b>.04</b>
Cholesterol Level	<b>Established</b>	Heart Attack	0.99 (0.98-1.02)	.92	<b>1.02 (1.00-1.04)</b>	<b>.04</b>
	No Benefit	Type 2 Diabetes	1.01 (0.99-1.02)	.13	1.00 (0.99-1.01)	.68
Chest X-ray	No Benefit	Lung Cancer	1.01 (0.88-1.16)	.87	1.02 (0.89-1.16)	.82
Cardiac Stress Test	No Benefit	Atrial Fibrillation	0.99 (0.96-1.02)	.44	<b>1.02 (1.00-1.05)</b>	<b>.02</b>
	<b>Possible</b>	Heart Attack	0.99 (0.96-1.02)	.41	<b>1.03 (1.01-1.06)</b>	<b>.007</b>
Blood Test	No Benefit	Celiac Disease	0.96 (0.64-1.44)	.84	0.99 (0.62-1.60)	.99
	No Benefit	Colon Cancer	0.99 (0.94-1.06)	.97	<b>1.07 (1.00-1.14)</b>	<b>.04</b>
	No Benefit	Crohn's Disease	0.89 (0.77-1.02)	.08	1.03 (0.89-1.20)	.67
	No Benefit	Lupus	1.13 (0.83-1.52)	.44	1.19 (0.89-1.60)	.24
	No Benefit	Rheumatoid Arthritis	1.06 (0.99-1.13)	.09	1.04 (0.97-1.12)	.30
Self Breast Exam	<b>Possible</b>	Breast Cancer	1.02 (0.98-1.06)	.40	<b>1.05 (1.01-1.09)</b>	<b>.02</b>
Mammogram	<b>Established</b>	Breast Cancer	0.99 (0.96-1.03)	.73	<b>1.06 (1.01-1.11)</b>	<b>.02</b>
Prostate PSA	<b>Possible</b>	Prostate Cancer	1.02 (0.99-1.04)	.15	<b>1.06 (1.04-1.09)</b>	<b>&lt;.001</b>

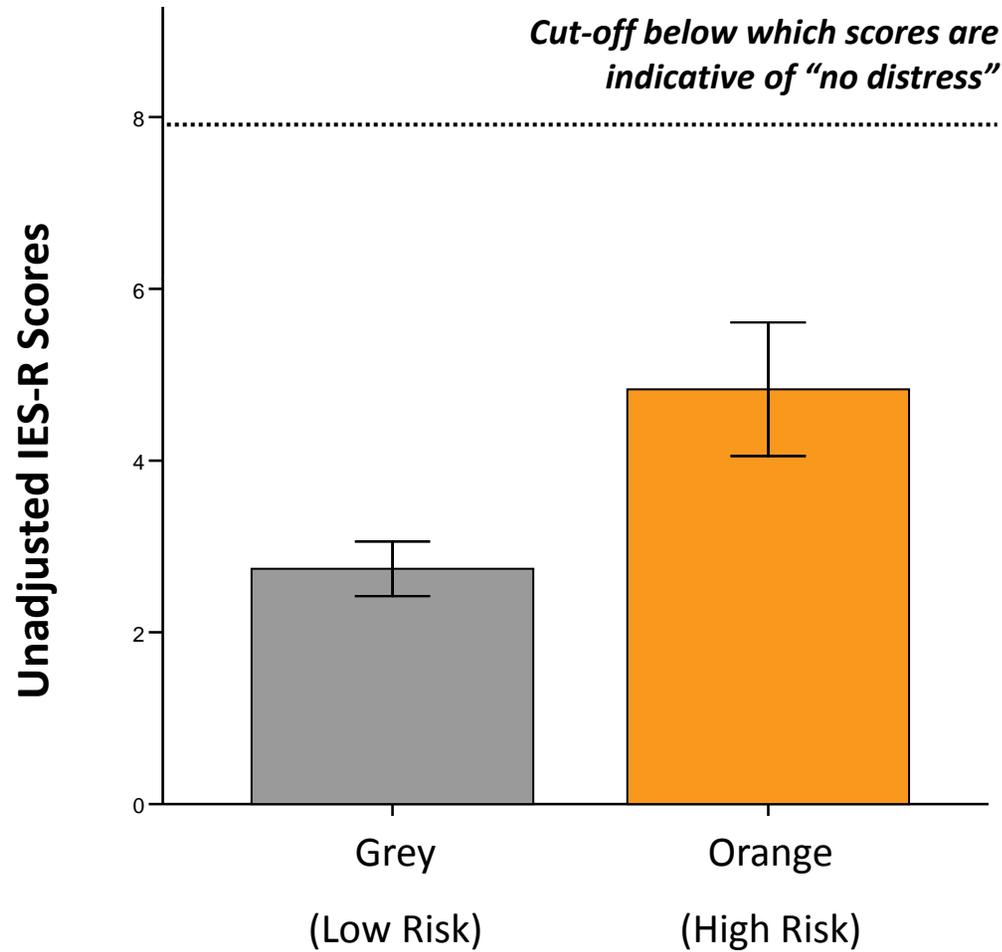
# Genetic Risk & Psychological Impact

Bloss, Schork & Topol, *NEJM*, 2011

Risk Estimate	Anxiety Scores		Test-Related Distress Scores	
	<i>ELTR</i>		<i>ELTR</i>	
	$\beta$	<i>p</i>	$\beta$	<i>p</i>
Abdominal Aneurysm	-.020	.50	.031	.50
Alzheimer's Disease	-.016	.26	<b>.186</b>	<b>&lt;.001</b>
Atrial Fibrillation	<.001	.98	.015	.53
Macular Degeneration	.016	.26	.032	.15
Obesity	.013	.35	.024	.30
Crohn's Disease	-.013	.34	-.035	.12
Celiac Disease	<.001	.97	.002	.92
Colon Cancer	.002	.91	-.025	.27
Diffuse Stomach Cancer	.002	.89	.032	.18
Graves' Disease	-.028	.15	-.024	.44
Brain Aneurysm	-.030	.10	.025	.38
Lung Cancer	.013	.42	.004	.89
Heart Attack	.003	.89	.051	.20
Multiple Sclerosis	.007	.68	.015	.57
Osteoarthritis	.005	.74	.031	.18
Psoriasis	<.001	.99	-.010	.66
Rheumatoid Arthritis	<b>-.039</b>	<b>.01</b>	-.033	.19
Restless Leg Syndrome	.019	.19	.006	.80
Lupus	-.006	.71	<.001	.99
Type 2 Diabetes	.013	.36	.018	.42
Glaucoma	<.001	.98	.016	.50
Breast Cancer	.020	.30	.022	.46
Prostate Cancer	<b>.042</b>	<b>.04</b>	.022	.51

# Genetic Risk & Test-Related Distress

Bloss, Schork & Topol, *NEJM*, 2011



*Individuals at high risk for AD have higher scores, but still in the "no impact" range*

*IES has limitations*

**Color-Coded Genetic Risk for Alzheimer's Disease**

# Genetic Risk & Behavioral Impact

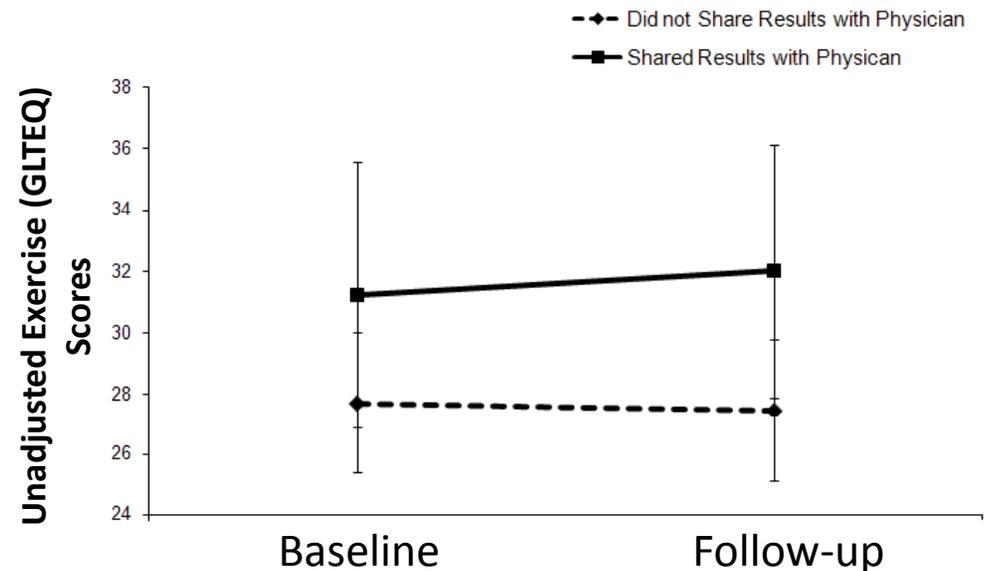
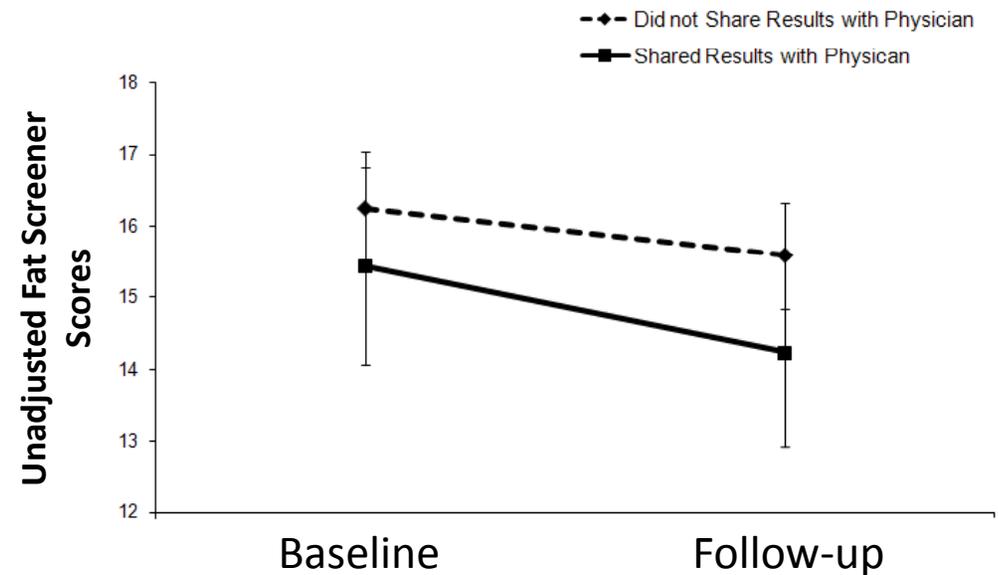
Bloss, Schork & Topol, *NEJM*, 2011

Risk Estimate	Fat Intake Scores		Exercise Scores	
	<i>ELTR</i>		<i>ELTR</i>	
	$\beta$	<i>p</i>	$\beta$	<i>p</i>
Abdominal Aneurysm	-.011	.73	-.001	.98
Alzheimer's Disease	.001	.95	-.019	.29
Atrial Fibrillation	-.015	.35	.008	.64
Macular Degeneration	<b>-.031</b>	<b>.04</b>	-.010	.56
Obesity	<b>.043</b>	<b>.005</b>	-.001	.95
Crohn's Disease	-.007	.62	.011	.49
Celiac Disease	.006	.71	.006	.74
Colon Cancer	<b>.034</b>	<b>.03</b>	.005	.75
Diffuse Stomach Cancer	-.006	.72	.016	.38
Graves' Disease	.030	.16	-.020	.40
Brain Aneurysm	.002	.94	-.008	.70
Lung Cancer	.034	.06	-.009	.66
Heart Attack	.027	.33	.010	.74
Multiple Sclerosis	-.022	.20	-.015	.42
Osteoarthritis	.010	.52	-.013	.47
Psoriasis	-.009	.56	.019	.26
Rheumatoid Arthritis	-.005	.76	.034	.07
Restless Leg Syndrome	-.002	.92	.002	.91
Lupus	-.027	.09	.006	.74
Type 2 Diabetes	.006	.68	.006	.73
Glaucoma	<.001	.99	-.002	.89
Breast Cancer	-.038	.08	-.012	.58
Prostate Cancer	-.028	.20	-.002	.94

# Involvement of Healthcare Provider

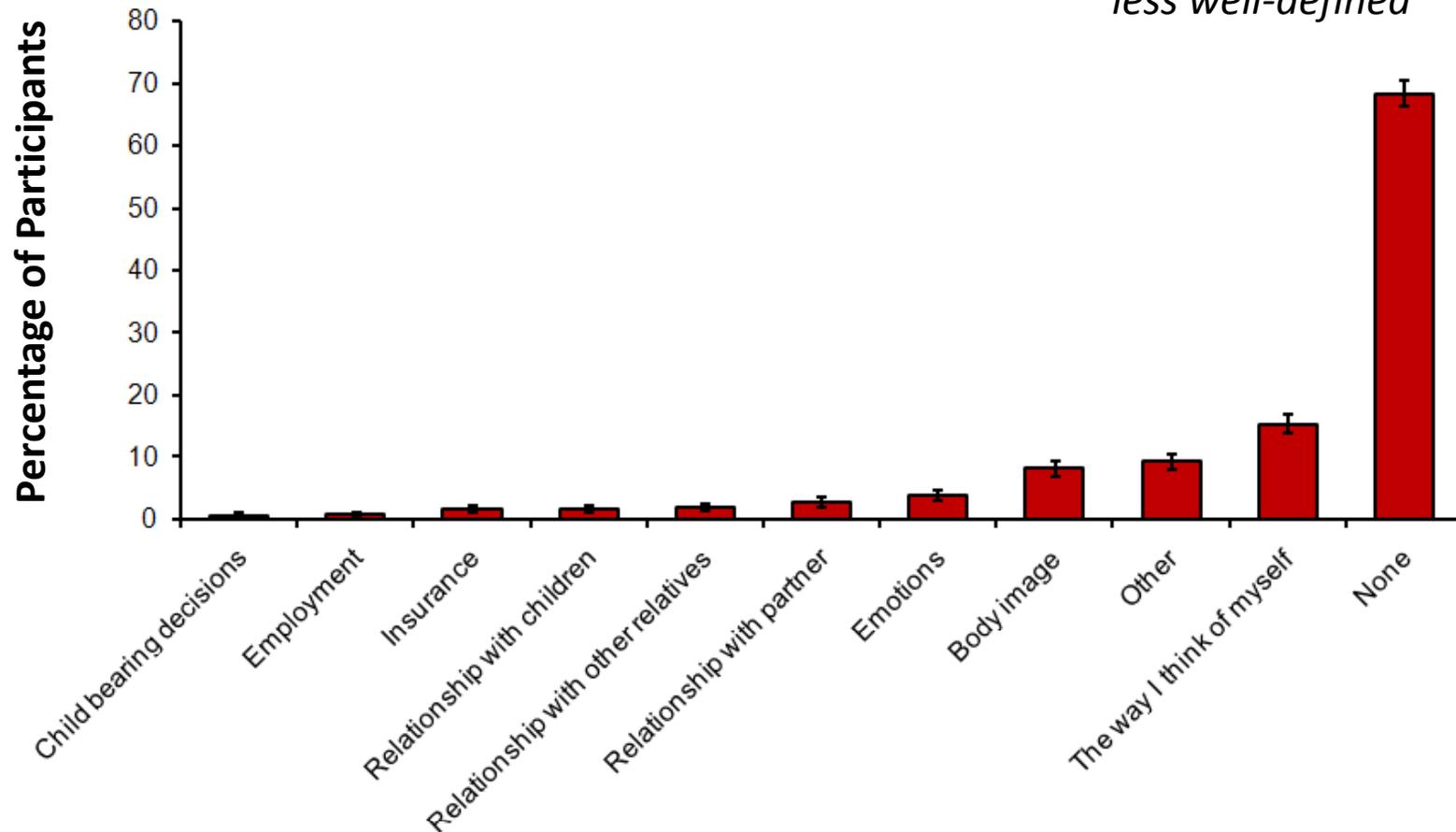
Bloss, Schork & Topol, *NEJM*, 2011

- **Genetic Counselor**
  - 10.4% of participants
  - Not associated with outcomes
- **Personal Physician**
  - 26.5% of participants
  - Associated with follow-up:
    - Lower fat intake
    - Higher exercise



# Self-Image & Other Changes

*Most say “none”, but some report other changes that may be more far-reaching and less well-defined*

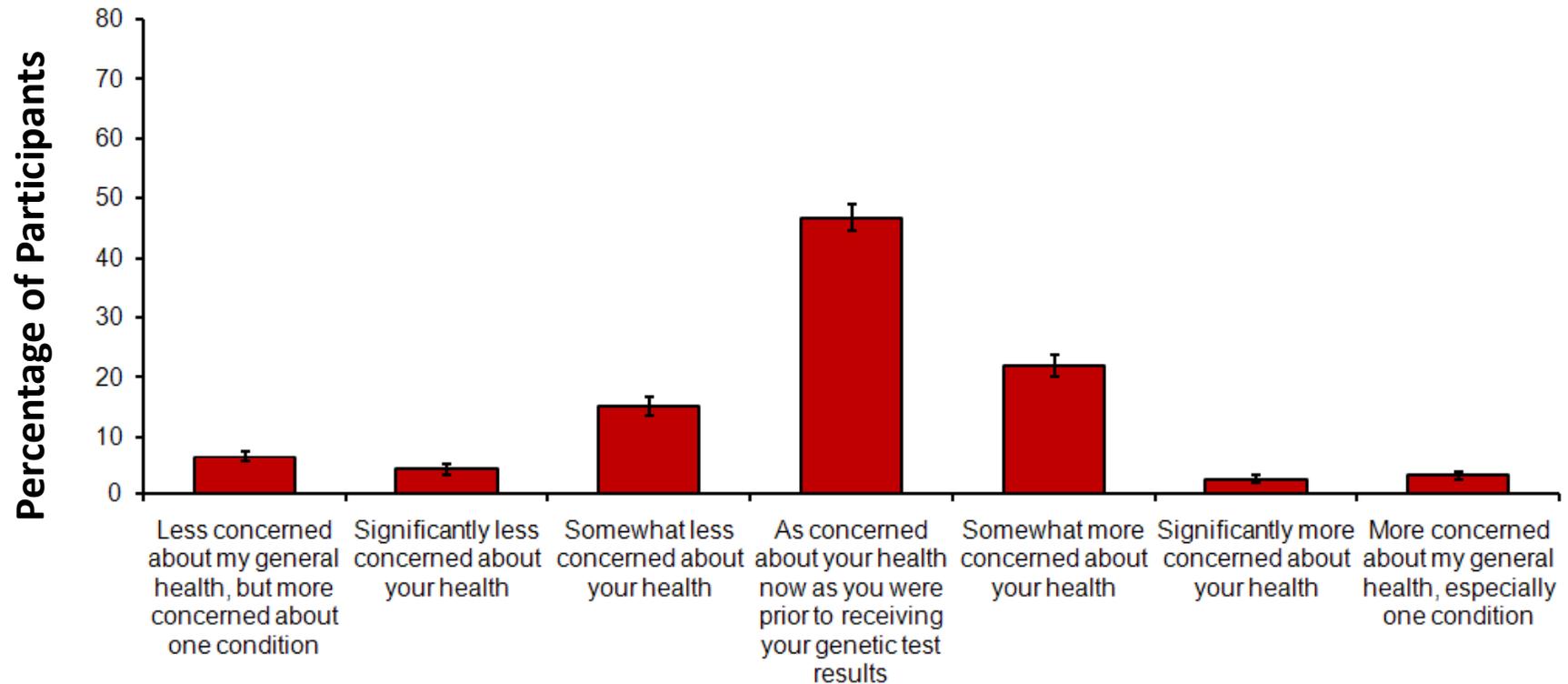


**Life Changes as a Result of Genomic Risk Testing**

Bloss, Schork & Topol, *NEJM*, 2011

# Perceptions of Health

*Most say as concerned about their health as prior to testing*



**Perceptions of Health Following Genomic Risk Testing**

# Summary



- **No measurable adverse psychological changes, improvements in diet/exercise, or increases in actual health screening behaviors**
- **Possible that health screening may increase in the future, debatable as to whether this is positive**
- **Large proportion of sample shared with physician, highlights notable void in physician education**
- ***Limitations***
  - Sample of convenience
  - Based on single follow-up assessment

# Future Directions



- **Long-term effects of testing**
  - e.g., Actual completion of screening tests
- **Modifying factors**
  - Salience of diseases for which risk estimates are provided
  - Beliefs about the actionability of diseases
  - Level of understanding of results (health or genetic literacy)
  - Other disease risk factors (e.g., family history)

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