Public Health Applications of Genomics

Colleen M. McBride, Ph.D.
Grace Crum Rollins Professor & Chair
Behavioral Sciences and Health Education Dept.,
Emory Rollins School of Public Health
March 23, 2016

Financial Disclosures

No financial interests to report that would influence the content of this presentation
Today’s talk

- Importance of research to shape translation of genomics for Public Health
- Overview of social and behavioral research approaches
- Principles of public health
- Examples of translation research in priority areas
- Take home messages

Genomic Translation: research agenda

Optimal application

Lost in translation

Premature translation

Your genes offer a real help to optimal health
The Washington Post

Walgreens won’t sell genetic test over FDA objections

BY ROB SIEFF

The nation’s largest drugstore chain backed out Wednesday of plans to sell a saliva test that promised to scan a customer’s DNA to assess his or her risk for breast cancer, heart attacks and a host of other illnesses.

Walgreens had planned to offer the Pathway Genomics test at more than 6,000 of its 7,500 stores nationwide beginning Friday, but it reversed course after the Food and Drug Administration questioned whether the test could be sold legally without the agency’s authorization.

"In light of the FDA contacting Pathway Genomics about its genetic test last and anticipated on Monday, we’ve elected to no longer pursue availability of the test to our customers until we have further clarity on this matter," said Jim Cohn, a Walgreens spokesman.

The Washington Post reported Tuesday about plans by Pathway and Walgreens to start selling the over-the-counter test. Pathway said its saliva test could evaluate a propensity for developing medical conditions such as Alzheimer’s disease, diabetes and obesity; the likelihood of passing a baby with cystic fibrosis, Duchenne disease and other genetic disorders; and the possible reaction to calcium, cholesterol-lowering drugs, blood thinners and other medications.

Other companies have been selling or offering tests that can analyze genes for a person’s risk of some diseases, and genetic tests for paternity and ancestry have been widely available in stores. But the plan by Pathway Genomics of San Diego represented the boldest move yet to bring personalized genetic screening to the public without FDA approval.

It was welcomed by those who hope that deciphering the genetic code will launch a new era in biomedical science. But it raised objections from those who worry that the average consumer would have problems interpreting the results, leading to dangerous complacency about some diseases.


*Human genomics*  *HuGE*
Assumed Path to Translation

Trailblazing

- Stage 5: Consider existing health challenges/unmet needs
- Stage 5: Anticipate how discovery could address challenges
- Stage 1: Basic Research
- Stage 2: “Treatment” Development
- Stage 3/4: Efficacy/Effectiveness

Genomics & Society Research

Anthropology
Communication Sciences
Cross-disciplinary studies
Economics
Ethics
Health Services
History
Law
Literature & the Arts
Philosophy
Political Science
Psychology
Public Health
Public Policy
Sociology

Archival Research
Community Based Research
Comparative Effectiveness Research
Conceptual/Critical Analysis
Content Analysis
Simulation Modeling
Ethnography
Focus Groups
Legal Analysis
Network Analysis
Oral History
Quasi-experimental
Experimental Trials
Structured Interviews
Survey methods
Textual Interpretation
Time series analysis

Basic Knowledge
Tools & Methods
Validated Interventions
Research Guidance
Practice Guidance
Public Policy
Social & Behavioral Research Approaches: What is an intervention?

Efforts directed at a target group to influence a desired outcome:
- Informed decision-making
- Individual or group behavior change
- Individual or group attitude change
- Public policy change

Intervention Objectives at the Intersection of Genomic Applications

**Primary Prevention**
- Healthy populations to prevent illness & injury
- Susceptibility testing
- Tailored interventions

**Secondary Prevention**
- Early detection, testing, hazard surveillance
- Predictive testing of high risk groups, newborn screening

**Tertiary**
- Those with disease conditions & injuries
- Assisting those affected – e.g., living with rare conditions
Health Promotion – Art and a Science
Theories by Intervention Level

Planned Behavior
Trans-theoretical Model
Goal-Setting Theory
Attribution Theory
Health Belief Model
Self-Regulatory Theories

Social Cognitive Theory
Interdependence Theory
Diffusion of Innovation
Social Network & Social Support

Stage Theory of Organizational Change
Organizational Development
Inter-organizational Relationship Theory

Community Organization
Agenda Building
Policy Window Theory

Individual

Interpersonal

Organization

Societal

Bartholomew (2001) Intervention Mapping

Research Questions & Hypotheses

Background
Demographics
Context Size

Mechanisms
Cognitive factors (e.g., attitudes)
Interpersonal skills (e.g., communication)
Systems
Incentives

Outcomes
Behavior
Organizational change
Policy
Reducing common chronic disease

- Prevention is key
- Decrease risk behaviors
- Public health & primary care
- Genomic information add value?
- Widespread health disparities
Real World

Efficacious Intervention

Public health interventions

Example: HNPCC Genetic counseling

Current approach

High dose:
- 2-3 hour sessions

Resource intensive
- Certified genetic counselor
- Face to face sessions

Demanding to sustain
- Few genetic counselors
- Reimbursement lacking
- Expensive

Highly efficacious
- Low reach

Public Health approach

Low dose:
- < 1 hour

Resource light
- Implemented by clinic staff or health educators
- Telephone, mail, internet

Sustainable
- Employ existing infrastructure
- Inexpensive

Effectiveness is the goal
- Broad reach
Clinical Genetic vs. Public Health Applications

Efficacy – Effectiveness Trade-off

**Current approach**
- Efficacy = 0.80
- Reach = 0.10
- \[0.80 \times 0.10\]
- Effectiveness = 0.08

**Public Health model**
- Efficacy = 0.20
- Reach = 0.50
- \[0.20 \times 0.50\]
- Effectiveness = 0.10

---

Table 1. Areas of emphasis for genomic translational research:

<table>
<thead>
<tr>
<th>Priority research areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public understanding and use of genomic information</td>
</tr>
<tr>
<td>Potential for genomics to improve risk communication and health behavior change</td>
</tr>
<tr>
<td>Using genomics and other emerging technologies to identify new behavioral intervention targets and more sensitive intervention outcomes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Crosscutting themes</th>
</tr>
</thead>
<tbody>
<tr>
<td>The need to anticipate directions of genomic discovery</td>
</tr>
<tr>
<td>The importance of framing research questions based on the assumption that genomics innovation may or may not add value to either individual or population-level health outcomes</td>
</tr>
<tr>
<td>The importance of systems thinking and ecologic or multilevel modeling, and transdisciplinary collaborations</td>
</tr>
</tbody>
</table>

McBride, Bowen, Brody, Condit et al., 2010
Suppositions

- Public will be exaggerate genetic contributions to common diseases/downplay behavioral contributors
- Majority of individuals would want to know even low probability susceptibilities
- Health care providers would be overwhelmed with patient follow-up
- Inappropriate health care use would increase

Public Understanding of Genomics

Multiplex Prototype Test

- 8 health conditions & 15 genes
- Diabetes
  - KCNJ11
  - CAPN10
  - PPARg
  - TCF7L2
- Heart Disease
  - APOB
  - NOS3
  - CETP
- High Cholesterol
  - LIPC
- Hypertension
  - AGT
- Lung cancer
  - MPO
- Colon Cancer
  - MTHFR
- Skin Cancer
  - MC1R
- Osteoporosis
  - ESR1
  - IL6
  - COL1A1
Information About Genes

What is someone’s chance of getting diabetes in the KCNJ11 risk versions?

- People who have no risk versions of KCNJ11 will have a chance of getting diabetes.
- People who have 1 risk version of KCNJ11 will have a chance of getting diabetes.
- People who have 2 risk versions of KCNJ11 will have a chance of getting diabetes.

How common are the risk versions of KCNJ11?

- About 6% of people in the general public have 0 risk versions.
- About 25% of people in the general public have 1 risk version.
- About 6% of people in the general public have 2 risk versions.

Percentage of People With 0, 1, or 2 Risk Versions of KCNJ11 in the General Public

- 0 Risk Versions: 29%
- 1 Risk Version KCNJ11: 15%
- 2 Risk Versions KCNJ11: 4%

Study Design

- NCI-funded Cancer Research Network
  - Henry Ford Health System clinical recruitment site
    - Group Health Cooperative Survey coordination
- Sample: Healthy adults
  - Ages 25-40
  - Without diseases on test battery
Multiplex Study Flow

1. Identify HFHS Sample
2. Conduct Baseline Survey
3. Provide Access to Web Site
4. Schedule Clinic Visit and Test
5. Provide Results
6. Conduct Three-Month Follow-Up

Mean ratings for behavior & genetics as contributors to common health conditions

<table>
<thead>
<tr>
<th>Condition</th>
<th>Behavior contributes</th>
<th>Genetics contributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 2 Diabetes</td>
<td>5.6</td>
<td>4.8</td>
</tr>
<tr>
<td>Heart disease</td>
<td>5.9</td>
<td>5.1</td>
</tr>
<tr>
<td>High blood pressure</td>
<td>5.7</td>
<td>5.9</td>
</tr>
<tr>
<td>High Cholesterol</td>
<td>5.2</td>
<td>4.4</td>
</tr>
<tr>
<td>Colon Cancer</td>
<td>5.3</td>
<td>4.4</td>
</tr>
<tr>
<td>Skin Cancer</td>
<td>4.1</td>
<td>3.5</td>
</tr>
<tr>
<td>Lung Cancer</td>
<td>6.1</td>
<td>4.5</td>
</tr>
<tr>
<td>Osteoporosis</td>
<td>4.4</td>
<td>4.4</td>
</tr>
</tbody>
</table>
Multiplex Initiative Uptake

Surveyed +
egligible | Went to
website | Want testing | Blood drawn
---|---|---|---
1959 | 612 | 350 | 266

About 14% got tested

Results discussed with...

HCP | Spouse | Family | Friends
---|---|---|---
11 | 64 | 57 | 12

Reid et al., Genetics in Medicine, 2012
Health Care Use by Test Group

All Physician Visits

- Pre-test Period
- Post-test Period

Mean Number of Visits per Quarter

Reid et al., Genetics in Medicine, 2012

Potential to motivate behavior change

Genetic risk communication

↑ Perceived susceptibility
↑ Motivational relevance
↓ Controllability
↓ Confidence to change

MOTIVATION

Likelihood of behavior change

Cognitive capabilities
Motivations
Dispositional factors
Attitudes, beliefs, affect
Early Clinical Trials:
Genetic feedback effects on smoking cessation

**CYP2D6**
N=426

**GSTM1**
N=308

Can genetic risk information motivate smokers to quit?

Welcome to the FAMILY RISK AND LUNG CANCER STUDY

Thank you for Participating!
Which smokers visited the website to consider genetic testing?

<table>
<thead>
<tr>
<th>Demographics</th>
<th>Logged on (n = 58)</th>
<th>Did not log on (n = 58)</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>59%</td>
<td>48%</td>
<td>NS</td>
</tr>
<tr>
<td>Mean Age (yrs)</td>
<td>40.1 (8.3)</td>
<td>36.5 (10.5)</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High school or less</td>
<td>28%</td>
<td>36%</td>
<td>NS</td>
</tr>
<tr>
<td>Technical degree / some college</td>
<td>50%</td>
<td>41%</td>
<td></td>
</tr>
<tr>
<td>College degree</td>
<td>22%</td>
<td>23%</td>
<td></td>
</tr>
<tr>
<td>Unemployed</td>
<td>14%</td>
<td>14%</td>
<td>NS</td>
</tr>
<tr>
<td>Non-Hispanic white</td>
<td>96%</td>
<td>96%</td>
<td>NS</td>
</tr>
<tr>
<td>Daily internet use</td>
<td>85%</td>
<td>62%</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Aware of cancer genetic testing</td>
<td>61%</td>
<td>42%</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Motivation to quit smoking¹</td>
<td>6.3 (1.1)</td>
<td>5.6 (1.7)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Closeness to patient¹</td>
<td>5.5 (1.1)</td>
<td>5.2 (1.1)</td>
<td>NS</td>
</tr>
</tbody>
</table>

¹1-7 scale

Uptake of offered cessation services

<table>
<thead>
<tr>
<th>Service</th>
<th>Pharmacological</th>
<th>Self-help</th>
<th>Active support</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSTM1-present (lower risk)</td>
<td>41%</td>
<td>50%</td>
<td></td>
</tr>
<tr>
<td>GSTM1-missing (higher risk)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

O’Neill et al., Genetics in Medicine, 2008
Sanderson et al., Cancer Epi, Biomarkers & Prevention, 2009
Optimal contexts for genomic information?

Intervention Dose

Low

Genomic information

High

Motivation

Low

High

College smokers’ responses to genetic risk of lung cancer
Lipkus PI (NCI-funded)

Primary Prevention:
- College smokers important target group (Patterson, Lerman et al., 2004)
- Interested in genetic testing: low risk (McBride, Lipkus, Jolly, Lyna)

Conceptual models
- Protection motivation theory (Rogers, 1983)

<table>
<thead>
<tr>
<th></th>
<th>Desire to quit smoking</th>
<th>Can quit at any time</th>
<th>Harms of smoking happen when old</th>
</tr>
</thead>
<tbody>
<tr>
<td>N= 640</td>
<td>3.8</td>
<td>4.6</td>
<td>3.2</td>
</tr>
</tbody>
</table>
Use genomic information to counteract backfiring public health messages

Another major theme reported by 32% of participants related to media reports of speed and ease of lung repair after individuals quit smoking, e.g. “Possibly lung cancer, but I’m not too worried about that. On a scale of 1 to 10, I’m a 2 on that worry. It (smoking) helps with school stress and they say that once you quit your lungs will repair within 2 years, or something. So I figure I can quit after graduate school and my lungs will be great by the time I’m 25.”

Docherty et al., Journal of Community Genetics, 2011

Leverage points for genetic risk communications

- Young smokers do not understand association between susceptibility & exposure
- Underestimate potential for addiction

Could social media be a viable tool for engaging target groups in discourse for learning?

ThinkGene
How might genetic risk information affect parenting practices?
Wade, Wilfond, McBride, Genet Med. 2010

Challenges for Research on Clinical Integration of Genomics

- Changing nature of genomic technology
- Future situations difficult to envision, predict
- Concepts & contexts complicated, technical, unfamiliar

IVETA useful tool:

- Improves upon hypothetical scenarios
- Enables rigorous behavioral outcomes
- Avoids practical challenges of food preparation

Persky, Kaphingst, Condit & McBride, 2007
Mothers’ TAKE: Virtual Reality Assessment of Mothers’ Behavioral Responses to Children’s Genomic Risk

Aims

- Explore concerns that genetic risk info for obesity may increase restrictive parenting practices
- Evaluate behavioral effects of providing family history-based obesity risk information about children to parents
**Mothers’ TAKE**
- Overweight mothers
- Child age 4-6

**Baseline web survey**
- Ineligible

**In-lab screening**
- Withdraws
- Ineligible

**Baseline practice buffet scenario**
- Food safety Information Control
- Behavioral Risk Information
- Family History Assessment + Behavioral Risk Information

**Post-Information Survey**

**Main buffet scenario**

**Post-Buffet survey**

---

**Total Calories by Experimental Arm**

<table>
<thead>
<tr>
<th></th>
<th>Estimate</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>248.73**</td>
<td>88.83</td>
</tr>
<tr>
<td>Pre-calorie</td>
<td>0.67***</td>
<td>0.20</td>
</tr>
<tr>
<td>Mother’s age</td>
<td>-2.68</td>
<td>1.61</td>
</tr>
<tr>
<td>Mother is white</td>
<td>-34.65</td>
<td>18.22</td>
</tr>
<tr>
<td>Mother’s BMI</td>
<td>2.75</td>
<td>1.80</td>
</tr>
<tr>
<td>Beh. Risk arm</td>
<td>-35.48</td>
<td>21.10</td>
</tr>
<tr>
<td>Beh + Fam hx arm</td>
<td>-45.26*</td>
<td>21.19</td>
</tr>
<tr>
<td>Index child is overweight</td>
<td>15.19</td>
<td>17.80</td>
</tr>
<tr>
<td>Index child is male</td>
<td>35.72*</td>
<td>17.32</td>
</tr>
<tr>
<td>Family has one child</td>
<td>0.48</td>
<td>20.13</td>
</tr>
</tbody>
</table>

*p ≤ 0.05; **p ≤ 0.01; ***p ≤ 0.001; ****p ≤ 0.0001

McBride, Persky et al., *Obesity*, 2012
Influence of Risk Message on Total Calories for Family Hx Arm

<table>
<thead>
<tr>
<th>Estimate</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>176.92</td>
</tr>
<tr>
<td>Pre-calorie</td>
<td>0.73</td>
</tr>
<tr>
<td>Mother’s age</td>
<td>-2.66</td>
</tr>
<tr>
<td>Mother is white</td>
<td>21.23</td>
</tr>
<tr>
<td>Mother’s BMI</td>
<td>0.75</td>
</tr>
<tr>
<td>Two overweight parents</td>
<td>71.48*</td>
</tr>
<tr>
<td>Index child is overweight</td>
<td>19.38</td>
</tr>
<tr>
<td>Index child is male</td>
<td>23.55</td>
</tr>
<tr>
<td>Family has one child</td>
<td>-23.93</td>
</tr>
</tbody>
</table>

*p ≤ 0.05

Is the effect of risk message specific to the family history arm?

<table>
<thead>
<tr>
<th>Food Safety</th>
<th>Beh Risk Info</th>
<th>Beh Risk + Fam Hx</th>
</tr>
</thead>
<tbody>
<tr>
<td>One Plated calories</td>
<td>One Number of overweight biological parents</td>
<td>One Number of overweight biological parents</td>
</tr>
<tr>
<td>Two</td>
<td>sig</td>
<td>Two</td>
</tr>
<tr>
<td>n=31</td>
<td>372.20</td>
<td>n=29</td>
</tr>
<tr>
<td>n=42</td>
<td>406.52</td>
<td>n=43</td>
</tr>
<tr>
<td>0.275</td>
<td>0.784</td>
<td>0.039</td>
</tr>
<tr>
<td>Sweetened beverage</td>
<td>Number of overweight biological parents</td>
<td>Number of overweight biological parents</td>
</tr>
<tr>
<td>45.2%</td>
<td>47.6%</td>
<td>48.3%</td>
</tr>
</tbody>
</table>
Promoting Global Public Health?

Promoting footwear among genetically high-risk children

- Podoconiosis - non-filarial elephantiasis
- Inflammatory lymphatic response to soil irritants
- Clusters in families in Highland Ethiopia.
- Preventable with consistent footwear > inconsistent adherence
- 50% of population < age 15
- Inadequate public health infrastructure
- Targeting shoes to high risk
The Characteristics of Study Sites

<table>
<thead>
<tr>
<th>Site</th>
<th>Site 1</th>
<th>Site 2</th>
<th>Site 3</th>
<th>Site 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Cases*</td>
<td>1,754</td>
<td>2,420</td>
<td>2,233</td>
<td>868</td>
</tr>
<tr>
<td>Duration of Relationship with MFTPA (Years)</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distance from MFTPA (Km)</td>
<td>35</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Registered annually with MFTPA

28 Focus groups
38 Individual interviews
7 Case studies
307 Participants

Ayode et al., Am. J. Tropical Medicine & Hygiene, 2012

Common sense beliefs about the cause of podoconiosis

**Heredity**
- ↓ perceived importance of preventive behaviors
- ↑ interpersonal stigmatizing behavior

**Stigma**
- Social distancing
- Partner selection
- Self stigma

**Not Heredity**
- ↑ perceived importance to wear shoes for prevention
- ↑ empathy to patients
- Fear of contagion
Baseline Beliefs about Podoconiosis
(Affected n=591; Unaffected n=1195)

<table>
<thead>
<tr>
<th></th>
<th>Inherited</th>
<th>Contagious</th>
<th>Can't prevent</th>
<th>Can prevent</th>
<th>Spread by shoes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affected</td>
<td>42%</td>
<td>34%</td>
<td>39%</td>
<td>81%</td>
<td>62%</td>
</tr>
<tr>
<td>Unaffected</td>
<td>68%</td>
<td>68%</td>
<td>61%</td>
<td>62%</td>
<td>93%</td>
</tr>
</tbody>
</table>

Stigma Experiences of & Reported Willingness to Socially Distance

Affected families: Experiences

- Felt ashamed: 40%
- Felt inferior: 44%
- People distanced: 42%

Unaffected families: Willingness

- Live next door: 46%
- Share meals: 41%
- Help tx feet: 22%
- Marry into family: 16%
**Aim**

To evaluate in comparison to the usual care: the effects of household skills-building with and without inherited susceptibility module on:

- Consistent shoe wearing by index children 3-6 years
- Experienced & enacted stigma

**Selection of households**

**Affected households:**
1. NGO ledgers used to identify children ages 3-6 participating in shoe distributions
2. Random sample of 100 households selected form each site
3. An adult who cared for “index child” agreed to participate in the study

**2 neighboring households:**
1. Within 500 meters of the participating affected household
2. Child in the target age group
3. No one was a blood relative of an affected individual
4. An adult who cared for “index” child agreed to participate in the study
Study Design

Randomization

6 communities assigned using a Lottery draw method

Intervention Arms

- Standardized health education (UC)
- Household-based skills training plus community awareness campaign (HB)
- HB plus education about inherited soil sensitivity (GE)

Intervention Elements

HB & GE Arms

- **Intervention window – 6 months**
  - Household-based skills building sessions
  - Booster sessions at 3 months
- **Public Health Campaign at Market & Kebeles**
  - Posters
  - Local musicians wrote a song played at locations
GENETIC SUSCEPTIBILITY EDUCATION:
Individual Variation in Tolerance of Direct Sun Exposure

Adapted from Peay & Austin, 2011
Primary Outcomes

**Affected observed shoe-wearing**

<table>
<thead>
<tr>
<th>Intervention Arm</th>
<th>Baseline</th>
<th>Chg 3 mos</th>
<th>Chg 12 mos</th>
</tr>
</thead>
<tbody>
<tr>
<td>UC</td>
<td>51</td>
<td>-7</td>
<td></td>
</tr>
<tr>
<td>HB</td>
<td>16</td>
<td>31</td>
<td>14</td>
</tr>
<tr>
<td>GE</td>
<td>32</td>
<td>22</td>
<td>19</td>
</tr>
</tbody>
</table>

3-months HB and GE > UC; p<.09

McBride, Price et al., Intl J Health Sci., 2016

**Affected Experienced Stigma**

<table>
<thead>
<tr>
<th>Intervention Arm</th>
<th>Baseline</th>
<th>Chg 3 mos</th>
<th>Chg 12 mos</th>
</tr>
</thead>
<tbody>
<tr>
<td>UC</td>
<td>1.78</td>
<td>-0.83</td>
<td>-0.5</td>
</tr>
<tr>
<td>HB</td>
<td>2.69</td>
<td>-0.08</td>
<td>-0.35</td>
</tr>
<tr>
<td>GE</td>
<td>2.25</td>
<td>0.12</td>
<td>-0.71</td>
</tr>
</tbody>
</table>

McBride, Price et al., Intl J Health Sci., 2016
The Precision Medicine Initiative

- Move away from “one-size-fits-all” treatments
- Treat and prevent disease based on individual differences in genetics, environment and lifestyle

McBride, Price et al., Intl J Health Sci, 2016

Mean enacted stigma

Baseline  Chg 3 mos  Chg 12 mos

Intervention Arm

UC  HB  GE

p=.09

McBride, Price et al., Intl J Health Sci, 2016

The Precision Medicine Initiative

Precision Public Health for the Era of Precision Medicine

The Precision Medicine Initiative promises a new healthcare era. It proposed a multi-billion-dollar program that would create a deeper understanding of disease and its progression to identify specific biological targets for new medications. Through genomic technology, precision medicine aims to personalize drug treatment, addressing the individual differences in genetics, environment and lifestyle of each patient.
**Public Awareness**

**The Behavior – Intervention Disconnect**

![Graph showing the relationship between inadequate physical activity (PA) and cigarette smoking.](image)

**Clinical Significance**

- Over the last 18 years, obesity has increased from 28% to 36%; regular physical activity has decreased from 53% to 43%; and eating 5 or more fruits and vegetables a day has decreased from 42% to 26% among adults aged 40-74 years.
- Adherence to all 5 healthy habits has gone from 15% to 8% ($P < .05$).
- Adherence to healthy habits is no more likely in people with cardiovascular disease, hypertension, diabetes, or hypercholesterolemia. *King et al., AJPM 2009 – NHANES*

---

**Smoking Relapse**

![Graph showing the percentage of smokers who relapse over time.](image)

---

**Weight Regain**

![Graph showing weight regain over time.](image)
Randomized controlled trial of four commercial weight loss programs in the UK

**Recruited (n=300)**
- Excluded after baseline tests (n=7)
- Not eligible for study (n=4)
- Withdrew consent (n=3)

**Randomised (n=293):** 214 (72%) women, 79 (27%) men

**Subjects:**
- Atkins diet (n=57) Man (n=15) Woman (n=42)
- Weight Watchers (n=58) Man (n=16) Woman (n=42)
- Slim-Fast (n=59) Man (n=17) Woman (n=42)
- Rosemary Conley (n=58) Man (n=16) Woman (n=42)
- Control group (n=51) Man (n=15) Woman (n=36)

**Withdrawn (dissatisfied with allocated regimen):**
- Atkins diet: 28% (16 men, 49 women)
- Weight Watchers: 46% (40 men, 47 women)
- Slim-Fast: 54 men, 52 women
- Rosemary Conley: 52 men, 48 women
- Control group: 49 men, 45 women

**Withdrawn by 6 mos / dropped out / lost to f/u by 12 months: 46%**

**Reasons for withdrawal:**
- Dissatisfied with randomization
- Could not tolerate diet
- Dissatisfied with weight loss
- Non-compliant / lost to f/u

Fig 1. Flow of participants through the BBC diet trials

Truby et al, BMJ, 2006
A Transdisciplinary Model: Genetic, Physiological & Psychological Correlates of Voluntary Exercise

Differential acute physiological response to exercise

Genetic factors

Exercise Behavior

Motivation to Exercise

Subjective experience of exercise

Bryan et al., 2007; Health Psychology; Bryan et al., 2010, Psychology of Sport and Exercise, Magnan et al., 2011
BDNF
N=64
63% GG, 37% G/A,A/A

Positive Affect

Perceived Exertion

Nutrition Journal

Research
Improved weight man;
personalize a calorie ci
Ioannis Arkadianos, Ana
Rosalynn D Gill and Keit

- Patients with hx of failed wt loss
- 50 patients
- 43 controls
- 19 genes categories amenable to intervention
- Personal & specific advice based on genotype

Figure 1
Odds ratio of losing weight (adjusted for age and gender) for individuals in the nutrigenetic test group compared to the control groups. age and sex adjusted odds ratio for weight loss > 0 between the nutrigenetic test group and the non-tested group.
Take home messages

- Translation research is important to do now!
- Many possible avenues for genomics to improve public health
- Conceptual models & practicability to guide research questions
- Full armamentarium of methods
  - to anticipate and test potential applications of genomics
- Research inherently interdisciplinary
Special Acknowledgements

Sharon Hensley Alford, Henry Ford Health System
Desta Ayode, Addis Ababa University
Andy Baxevanis, NHGRI
Larry Brody, NHGRI
Gail Davey, Brighton & Sussex Medical School
David Farrell, People Designs
Isaac Lipkus, Duke University
Susan Persky, NHGRI

THANK YOU

Thank You!

Colleen.marie.mcbride@emory.edu

Social and Behavioral Research Branch
National Human Genome Research Institute  www.genome.gov