Communication in the Genomic Era: Virtual Reality versus Internet Approaches

Susan Persky¹, William D. Kistler¹, William M.P. Klein², Rebecca A. Ferrer²

¹ National Human Genome Research Institute; ² National Cancer Institute
Rise of genetics and genomics

Rewriting Life

2017 was the year consumer DNA testing blew up

by Antonio Regalado  February 12, 2018

Up, up, and away
Total number of people tested by consumer genetics companies, in millions:

- AncestryDNA only
- All major testing companies

NIH
All of Us Research Program
Precision Medicine
Consumer Genetics
NIH Working Group Report—Using Genomic Information to Guide Weight Management: From Universal to Precision Treatment

Molly S. Bray¹, Ruth J.F. Loos², Jeanne M. McCaffery³, Charlotte Ling⁴, Paul W. Franks⁴, George M. Weinstock⁵, Michael P. Snyder⁶, Jason L. Vassy⁷, Tanya Agurs-Collins⁸, and The Conference Working Group⁹
Genetic factors in common complex disease: Estimated heritability of selected conditions and traits

- Colon Cancer: 13%
- Type-2 Diabetes: 26%
- Hypertension: 30%
- Stroke: 32%
- Breast Cancer: 40%
- Colon Cancer: 49%
- Depression: 50%
- Alcoholism: 55%
- Height: 68%
- ADHD: 70%
- Obesity: 70%
- Type-1 Diabetes: 88%
- Eye Color: 98%

Source: SNPedia
Clinical information provision model: Genetic counseling

News > Medscape Medical News > Conference News > 10th Future of Genomic Medicine (FOGM) Conference

Shortage of Genetic Counselors in Face of Growing Need

Damian McNamara
March 13, 2017
Addressing impending provider shortage

- Leapfrog from clinic to internet-based counseling
- Considering middle-ground approaches?
- Virtual Reality
Virtual Reality
The Diverse Potential of VR & AR Applications

Predicted market size of VR/AR software for different use cases in 2025*

Enterprise and public sector
$16.1b

$5.1b

$11.6b

$4.7b

$2.6b

$1.6b

$1.4b

$0.7b

$3.2b

Total
$35b

Consumer
$18.9b

- Healthcare
- Engineering
- Real estate
- Retail
- Military
- Education

Videogames
Live events
Video entertainment

* Base case scenario

Source: Goldman Sachs Global Investment Research
VR for Research: IVETA at NIH Clinical Center

Immersive Virtual Environment Testing Area
Why is VR attractive for clinical, counseling uses?

- **Automates communication**
  - Reduces provider demand
  - Easily repeated

- **Social presence**
  - Feels more immediate
  - Benefit for trust?

- **Clinic based for now**
  - Clarifications in med setting
  - Distributable later?

- **Measurement opportunities**
Research questions & context

What is the influence of using a lab-based VR approach (versus a distributed, internet platform) on participant responses to an avatar-based health care provider giving weight-related genomic information?

- Comparison of two studies, designed in tandem with overlapping procedure and measures
- Approach > just media platform

Does this influence differ for genomic versus non-genomic information?
- Is genomic information “special”
Common procedure

Screening
Lab-based VR vs. distributed internet

**Lab-Based VR Approach**  
N~200  
- IVETA visit  
- Convenience sample  
- BMI 25+  
- ages 18-50

**Distributed, Internet Approach**  
N~800  
- Distributed location  
- Nationally-representative  
- BMI 25+  
- all ages (included 18-50 in analysis)
Common procedure

- Screening
- Emotion induction

Post-test questionnaire
Common procedure

Screening

Emotion induction

VR-based OR Internet-Based interaction with virtual provider
Interaction with virtual provider

Lab-Based VR Approach
N~200

- During lab visit
- nVisor SX60 + Worldviz PPT system, 3D, stereoscopic, 6 dof
- Verbal conversation with health care provider avatar
- ‘Conversation’ controlled by research assistant
Interaction with virtual provider

- In participant space (e.g., home)
- Online flat-screen video recordings of VR interaction
- Verbal or mental conversation with avatar HCP
- ‘Conversation’ controlled by participant

Distributed, Internet Approach
N~800
Patient Perspectives
Common procedure

- Screening
- Emotion induction
- VR-based OR Internet-Based interaction with virtual provider
- Post-test questionnaire
Shared measures

- Behavior change intentions: diet and physical activity
- Self-efficacy for weight management
- Social presence with virtual provider
- Trust in provider
Results: Study samples

<table>
<thead>
<tr>
<th></th>
<th>Internet Setting Study</th>
<th>VR Setting Study</th>
<th>χ² or t-test</th>
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<tbody>
<tr>
<td>Race</td>
<td></td>
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<tr>
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<td>66%</td>
<td>45%</td>
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<td>Black</td>
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<td>Education - college degree</td>
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<td>Perceived health status - VG+</td>
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<td>59%</td>
<td>p&lt;.0001</td>
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<tr>
<td>BMI</td>
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<td>M=32.66 (6.50)</td>
<td>NS</td>
</tr>
<tr>
<td>Age</td>
<td>M=36.45 (8.27)</td>
<td>M=35.91 (9.24)</td>
<td>NS</td>
</tr>
</tbody>
</table>
Health behavior-related outcomes

Controlling for: education, race, perceived health status, age, BMI

* = effect of platform
Social presence and trust

Controlling for: education, race, perceived health status, age, BMI

* = effect of platform
Is genomic information special?

No difference by information type on any outcome variable, no interactions
Summary

No effect of information type

- Genetics not ‘exceptional’
- Increased generalizability

May be benefit to integrating VR-based platforms for information provision

- Evidence for health-promoting attitudes/beliefs
Conclusion

Growth in consumer VR opens opportunities for applications in healthcare.

- Application is already occurring
- Must be thoughtful & evidence-based
- Is risk information provision the ‘right opportunity’?
- Requires formative research
Acknowledgements

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Genomic vs. behavior information variable

**Genomic**
- Body weight has a sizeable heritable component
- Weight is controlled in part by genes interacting with and influencing behavior and environment

**Behavior**
- Body weight has a sizeable personal behavior component
- Weight is controlled by energy in versus energy out, balance can be complicated

**All**
- Importance of diet and physical activity
- Importance of realistic weight loss goals