Integration of Genomics into Nursing Practice

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National Cancer Institute
Definitions

- **Genetics** – study of individual genes and their impact on relatively rare single gene disorders

- **Genomics** – study of all the genes in the human genome together, including their interactions with each other, the environment, and other psychosocial and cultural factors
Top 10 Leading Causes of Death

- Heart Disease: 24.8%
- Malignant Neoplasms: 23.5%
- Chronic Respiratory Disease: 5.7%
- Cerebrovascular: 5.3%
- Unintentional Injury: 4.8%
- Alzheimer's Disease: 3.3%
- Diabetes Mellitus: 2.9%
- Influenza & Pneumonia: 2.2%
- Nephritis: 2.0%
- Suicide
Emerging Science/Technology
The Race for the $1000 Genome

1000 Genomes Project Promises Closer Look at Variation in Human Genome

A comprehensive catalog of genetic variation in the human genome is a key goal of the 1000 Genomes Project. When the $1000 genome is realized, researchers will be able to understand how rare genetic variation relates to disease, screen for risk factors for common diseases, and develop new diagnostic tests.

Inquiries about NHGRI’s program interests should be addressed to the Division of E. Program Staff

Mardis Genome Medicine 2010, 2:84
http://genomemedicine.com/content/2/11/84

The $1,000 genome, the $100,000 analysis?

Elaine R Mardis*

Having recently attended the Personal Genomes meeting at Cold Spring Harbor Laboratories (I was an organizer this year), I was struck by the number of talks that described the use of whole-genome sequencing and analysis to reveal the genetic basis of disease in patients required for it to occur. I therefore offer the following as food for thought.

One source of difficulty in using resequencing approaches for diagnosis centers on the need to improve the quality and completeness of the human reference sequence.

Another Stop on the Road to the $1,000 Genome

Posted by Dan Vitハウス on January 12, 2010

The latest stop on the road to the $1,000 genome? San Francisco, CA, where J.P. Morgan’s 22nd Annual Healthcare Conference is in full swing. There is an abundance of real-time Twitter coverage from the conference, but certain announcements warrant a more detailed discussion.

The announcement generating the biggest buzz today comes from Illumina, Inc., whose CEO Jari Fluitt revealed a new genome sequencing machine, the HiSeq 2000. According to Matthew Herper of Forbes.com, Illumina’s new machine will $1,000 worth of computing power and can in March, the machine will have a custom software system to analyze the data, and will be able to perform high-throughput DNA sequencing.

The HiSeq 2000 will be able to sequence 100 billion base pairs every day, which is about 10 times faster than the current state-of-the-art sequencing machine, the SOLiD platform. Illumina’s new machine will also be able to sequence up to 100,000 samples in a single run, which is 10 times more samples than any current machine.

The HiSeq 2000 will be used for a variety of applications, including personalized medicine, genomics research, and forensic analysis. It will be available in the first quarter of 2010, and will cost $1 million.

The HiSeq 2000 will be a game-changer for the sequencing industry, and will likely lead to a decrease in the cost of sequencing. This will make it more affordable for researchers and clinicians to use sequencing to identify disease-causing variants.

The HiSeq 2000 is also expected to have a significant impact on the field of genetics. By providing a more complete and accurate picture of the human genome, researchers will be able to better understand the role of genetic variation in disease and develop new treatments.

In summary, the announcement of the HiSeq 2000 is a major milestone in the race to the $1,000 genome. It will undoubtedly lead to a decrease in the cost of sequencing, making it more accessible to researchers and clinicians. It will also provide a more complete and accurate picture of the human genome, which will be invaluable for understanding the role of genetic variation in disease and developing new treatments.
Direct to Consumer Marketing and Testing

- Tests available direct to the consumer without an ordering healthcare provider
  - Varied test types
    - High penetrance diseases
    - Polygenic diseases
    - Risk Assessment
    - Low penetrance genes
    - Enhancement tests
      - Pharmacogenomic
      - Nutrigenomic
  
- Most require only a saliva sample
- Costs vary based on test but can be as low as $99

http://www.cancer.gov/cancertopics/pdq/genetics/risk-assessment-and-counseling/HealthProfessional/page5#Section_362
Consumer Perspectives on DTC

• 1,087 Facebook users, aged 18-81, mean 35
• 47% were aware of personal genetic testing (PGT)
• 6% had used PGT
• 64% indicated that they would consider using PGT
• 34% mistakenly understood that results of PGT indicated a diagnosis of disease
• 78% would consult their physicians to interpret PGT results

Scope of Genome Analysis

- Has expanded to include any whole genome analysis such as:
  - Whole genome sequencing
  - Whole exome sequencing
  - RNA and RNAi sequencing
  - Whole genome SNP analysis

- Consideration for incidental findings:
  - Previously unknown information
    - Clinical and analytic validity of finding
    - Immediacy and seriousness of risk
    - Actionable finding
  - Timing
  - Confirmation in CLIA approved laboratory
Research Ethical Considerations

- Stability of DNA
  - Storage and future use
- Broad sharing of samples/data
- Limited control of downstream use
- Limited right to withdraw
- Identifiability

- Incidental findings
  - Duty to re-contact

- Implications for family/community


Wolf, S., et al. (2012). Managing incidental findings and research results in genomic research involving biobanks and archived data sets. Genetics in Medicine, 14, 361-384

Incidental Findings, Public Perspectives

- 89 individuals from 10 focus groups
- Nearly all would want individual research results (IRR) returned
  - Priority on results that are well understood
  - Magnitude of the risk and actionability was less important
- Reasons to obtain IRR
  - Potential utility of IRRs to improve health
  - Encourage learning more about their health, change health-related behaviors, share the information with family members, and participate in research studies
- Most wanted as much information as possible

Bollinger, J.M., et al. (2012). Public preferences regarding the return of individual genetic research results: findings from a qualitative focus group study. GIM, 14, 451-7
Considerations in the Genomic Era

Who is the “patient”
- Individual AND family AND community AND population
- Can be healthy with only a predicted risk for a health condition or suffering from a health condition
- Extend across the lifespan
  - Fetus through end of life and beyond
Genetic and Genomic Influences Across the Healthcare Continuum

- Preconception/Prenatal
- Newborn Screening
- Risk Identification
- Screening/Diagnosis
- Disease Characterization
- Individualized Therapy
- Management At End of Life
- After End Of Life

# Genomics and the Nursing Workforce

<table>
<thead>
<tr>
<th>Study</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Nursing Workforce Study in collaboration with ANA (NNWF)</td>
<td>619</td>
</tr>
<tr>
<td>ANA House of Delegates (HOD)</td>
<td>244</td>
</tr>
<tr>
<td>National Coalition of Ethnic Minority Nurses (NCEMNA)</td>
<td>392</td>
</tr>
<tr>
<td>Expanding RN Scope of Practice: A Method for Introducing a New Competency into Nursing Practice (MINC)</td>
<td>7347</td>
</tr>
<tr>
<td>MINC Admin Only</td>
<td>439</td>
</tr>
</tbody>
</table>
Preconception Prenatal Genetics

Preconception

• Testing for carrier status prior to pregnancy, often for autosomal recessive disorders
  • i.e. cystic fibrosis

Prenatal testing

• Performed during pregnancy
• Indications include
  • Advanced maternal age, increases the risk for chromosomal abnormalities i.e. Down Syndrome
  • Family history of an inherited condition i.e. Duchenne muscular dystrophy
  • Ancestry/ethnic background of parents associated with a higher chance of an inherited disorder
Newborn Screening

- Newborn screening consists of a public health approach to the identification and management of health conditions identifiable in the newborn
  - Approximately 4 million newborns screened annually
  - About 12,500 new diagnoses as a result of testing
  - Newborn screening constitutes the most extensive use of genetics for public health benefit
  - All states provide newborn screening

- US Secretary of Health and Human Services Discretionary Advisory Committee on Heritable Disorders in Newborns and Children (DACHDNC) provides national guidance about which health conditions should be included
Newborn Screening, cont

- Health conditions included in newborn screening panels vary by state
- States can opt to include screening for health conditions not recommended by the DACHDNC
- Health conditions recommended for screening meet the following criteria:
  - Adequate evidence that early diagnosis can improve health outcomes
  - Screening benefits outweigh possibility of harm
Newborn Screening, cont

- Family members may derive benefit from newborn screening even if there is little to no benefit for the newborn
  - Facilitate diagnostic assessments.
  - Inform future reproduction decisions.
  - Prepare for care requirements of the child.

- Newborn screening tests can provide false positive, false negative, or ambiguous results

- Newborn screening is conducted using a dried blood spot from a heel prick.

- Residual dried blood spots can be stored for future uses
Newborn Screening, cont

- Policies for the disposition of dried blood spots and research use vary
- Exploration of next generation genome technologies (i.e., whole genome sequencing) for newborn screening
  - Funding for research exploring this type of technology application is being conducted
  - Plans for management of potential findings, changing evidence base of genetic variations identified and management of incidental findings
Risk Assessment

- More than 55 hereditary cancer syndromes have been identified.
- The most common syndromes are those associated with breast, ovarian, and gastrointestinal cancers.
  - Tumor features at diagnosis are now being used as an indication for genetic assessment.
- Germline cancer susceptibility gene testing:
  - Relevant to individuals diagnosed with cancer whose cancer management may be altered.
  - Individuals unaffected with cancer who could benefit from mutation specific cancer risk management.
  - At-risk family members.
## Family History

In the prior three months nurses seeing patients who RARELY OR NEVER assessed a family history

<table>
<thead>
<tr>
<th></th>
<th>family history: Assessed age at dx</th>
<th>family history: Assessed maternal and paternal lineages</th>
<th>AGREED OR STRONGLY AGREED that family history taking should be a key component of nursing care</th>
</tr>
</thead>
<tbody>
<tr>
<td>NNWFS</td>
<td>41% (n=200/483)</td>
<td>66% (n=320/484)</td>
<td>84% (n=369/442)</td>
</tr>
<tr>
<td>HOD</td>
<td>51% (n=116/227)</td>
<td>75% (n=168/224)</td>
<td>91% (n=219/242)</td>
</tr>
<tr>
<td>NCEMNA</td>
<td>Not Done</td>
<td>78% (n=280/361)</td>
<td>Not assessed</td>
</tr>
<tr>
<td>MINC</td>
<td>29% (n=1564/5348)</td>
<td>53% (n=2850/5336)</td>
<td>71% (n=4051/5701)</td>
</tr>
</tbody>
</table>
51.7% (n=2962/5724) reported they were not at all or only a little confident in deciding what family history information is needed to identify genetic susceptibility to common diseases.

64.0% (n=3642/5688) reported they were not at all or only a little confident in deciding which patients would benefit from a referral for genetic counseling and possible testing.
Family History in Nursing Practice

“It’s one of those times in your life that you are grateful you had the knowledge.”

Quote from: Barbara Ganster, RN, BSN
Breast Cancer Case Manager
National Naval Medical Center
Screening

- Genetic information is being used to personalize health screening recommendations.
- SNP test results are being studied as a means to increase the specificity of risk calculation models (i.e. Gail model for breast cancer risk).
- Screening tests that include DNA analysis are being developed such as the DNA stool test, a less invasive means to screen for colon polyps or cancer.
Diagnosis/Prognosis

- Establish an accurate diagnosis
- Tumor profiling is being used to identify recurrence risk to guide adjuvant therapy

Targeting Treatment to a Specific Variant in the Melanoma Gene

<table>
<thead>
<tr>
<th>Gene</th>
<th>Genetic Alteration</th>
<th>Tumor Type</th>
<th>Therapeutic Agent</th>
</tr>
</thead>
<tbody>
<tr>
<td>EGFR</td>
<td>Mutation, amplification</td>
<td>Lung cancer, glioblastoma</td>
<td>Gefitinib, erlotinib</td>
</tr>
<tr>
<td>ERBB2</td>
<td>Amplification</td>
<td>Breast cancer</td>
<td>Lapatinib</td>
</tr>
<tr>
<td>FGFR1</td>
<td>Translocation</td>
<td>Chronic myeloid leukemia</td>
<td>PKC412, BIBF-1120</td>
</tr>
<tr>
<td>FGFR2</td>
<td>Amplification, mutation</td>
<td>Gastric, breast, endometrial cancer</td>
<td>PKC412, BIBF-1120</td>
</tr>
<tr>
<td>FGFR3</td>
<td>Translocation, mutation</td>
<td>Multiple myeloma</td>
<td>PKC412, BIBF-1120</td>
</tr>
<tr>
<td>PDGFRA</td>
<td>Mutation</td>
<td>Glioblastoma, gastrointestinal stromal tumor</td>
<td>Sunitinib, sorafenib, imatinib</td>
</tr>
<tr>
<td>PDGFRB</td>
<td>Translocation</td>
<td>Chronic myelomonocytic leukemia</td>
<td>Sunitinib, sorafenib, imatinib</td>
</tr>
<tr>
<td>ALK</td>
<td>Mutation or amplification</td>
<td>Lung cancer, neuroblastoma, anaplastic large-cell lymphoma</td>
<td>Crizotinib</td>
</tr>
<tr>
<td>c-MET</td>
<td>Amplification</td>
<td>Gefitinib-resistant non–small-cell lung cancer, gastric cancer</td>
<td>Crizotinib, XL184, SU11274</td>
</tr>
<tr>
<td>IGF1R</td>
<td>Activation by insulin-like growth factor II ligand</td>
<td>Colorectal, pancreatic cancer</td>
<td>CP-751, 871, AMG479</td>
</tr>
<tr>
<td>c-KIT</td>
<td>Mutation</td>
<td>Gastrointestinal stromal tumor</td>
<td>Sunitinib, imatinib</td>
</tr>
<tr>
<td>FLT3</td>
<td>Internal tandem duplication</td>
<td>Acute myeloid leukemia</td>
<td>Lestaunitinib, XL999</td>
</tr>
<tr>
<td>RET</td>
<td>Mutation, translocation</td>
<td>Thyroid medullary carcinoma</td>
<td>XL184</td>
</tr>
<tr>
<td>Non-receptor tyrosine kinase</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABL</td>
<td>Translocation (BCR-ABL)</td>
<td>Chronic myeloid leukemia</td>
<td>Imatinib</td>
</tr>
<tr>
<td>JAK2</td>
<td>Mutation (V617F), translocation</td>
<td>Chronic myeloid leukemia, myelo-proliferative disorders</td>
<td>Lestaunitinib, INCB018424</td>
</tr>
<tr>
<td>SRC</td>
<td>Overexpression</td>
<td>Non–small-cell lung cancer; ovarian, breast cancer; sarcoma</td>
<td>KX2–391, dasatinib, AZD0530</td>
</tr>
<tr>
<td>Serine–threonine–lipid kinase</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BRAF</td>
<td>Mutation (V600E)</td>
<td>Melanoma; colon, thyroid cancer</td>
<td>SB-590885, PLX-4032, RAF265, XL281</td>
</tr>
<tr>
<td>Aurora A and B kinases</td>
<td>Overexpression</td>
<td>Breast, colon cancer; leukemia</td>
<td>MK-5108 (VX-689)</td>
</tr>
<tr>
<td>Polo-like kinases</td>
<td>Overexpression</td>
<td>Breast, lung, colon cancer; lymphoma</td>
<td>BI2536, GSK461364</td>
</tr>
<tr>
<td>MTOR</td>
<td>Increased activation</td>
<td>Renal-cell carcinoma</td>
<td>Temsirolimus (CCI-779), BEZ235</td>
</tr>
<tr>
<td>PI3K</td>
<td>PIK3CA mutations</td>
<td>Colorectal, breast, gastric cancer; glioblastoma</td>
<td>BEZ235</td>
</tr>
<tr>
<td>DNA damage or repair</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BRCA1 and BRCA2</td>
<td>Mutation (synthetic lethal effect)</td>
<td>Breast, ovarian cancer</td>
<td>Olaparib, MK-4827 (PARP inhibitors)</td>
</tr>
</tbody>
</table>

*PARP denotes poly(adenosine diphosphate–ribose) polymerase.
Pharmacogenomic Influences

PK = absorption, distribution, metabolism and excretion
PD = mechanism of action, drug concentration and effect
Polymorphisms and Phenotype

- **UM-Ultrarapid Metabolizer**
  - Unusually high activity of a drug metabolizing enzyme (DME) or drug transport protein (DTP)
  - Limited response to recommended doses

- **EM-Extensive Metabolizer**
  - Wild-type (normal activity) form of a DME or DTP
  - Expected efficacy at recommended doses

- **IM-Intermediate Metabolizer**
  - Reduced activity of a DME or DTP
  - Some decreased efficacy at recommended doses

- **PM-Poor Metabolizer**
  - Very low or no activity of a DME or DTP
  - Increased toxicity
  - Decreased efficacy at recommended doses

Inhibitors and Inducers

- **Inhibitors**
  - Reduce the drug metabolizing enzyme or drug transport protein

- **Inducers**
  - Increase the drug metabolizing enzyme or drug transport protein
Symptom Management

- Priority area of nursing research is the study of the genetic influences of symptom clusters

- Pharmacogenomics
  - Inhibitors and/or Inducers
    - Implications for:
      - Medications used for other health conditions
      - Selecting medications to control
      - Use of over the counter medications like St. Johns’ Wort
      - Consumption of certain foods or supplements like grapefruit/grapefruit juice
The Quest for Personalized Health Care

- Use of an individual's genetic/genomic information in addition to traditional health information to guide health care decision-making
- Disease prevention, risk reduction, diagnosis, treatment, symptom management and palliative care
  - Pharmacogenomics
    - Medication selection
    - Dose selection
    - Inhibitors
    - Inducers
Essentials of Genetic and Genomic Nursing

- Define essential genetic and genomic competencies for ALL nurses regardless of level of academic preparation, practice setting or specialty
- Endorsed by 50 nursing organizations
- October 22-24 2006 Strategic Implementation Meeting
- 2nd Edition incorporated Outcome Indicators
  - Specific Areas of Knowledge
  - Clinical Performance Indicators
- 3rd Edition may be published in 2013 which includes some updates

http://www.genome.gov/Pages/Careers/HealthProfessionalEducation/geneticscompetency.pdf
Define essential genetic and genomic competencies for ALL graduate nurses regardless of level of academic preparation, practice setting or specialty.

Established by a process of consensus.
## Genomic Knowledge

<table>
<thead>
<tr>
<th></th>
<th>Rate their understanding of the genetics of common diseases as EXCELLENT or VERY GOOD</th>
<th>Have heard or read about the Genomic Nursing Competencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>NNWFS</td>
<td>14% (73/510)</td>
<td>32.7% (166/506)</td>
</tr>
<tr>
<td>MINC</td>
<td>5% (276/5100)</td>
<td>9% (n=453/5021)</td>
</tr>
<tr>
<td>Cancer Center</td>
<td>13% (n=8/61)</td>
<td>27% (n=18/66)</td>
</tr>
</tbody>
</table>

### Objective Measure of Knowledge and Competency

- **Total Knowledge Score**
  - 12 knowledge/competency questions
    - Correct or incorrect
  - Total Knowledge Score calculations done on ONLY those who answered ALL 12 questions
Total Knowledge Scores

<table>
<thead>
<tr>
<th>Group</th>
<th>Total Knowledge Score</th>
<th>CORRECTLY Answered</th>
<th>INCORRECTLY Stated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total knowledge score was calculated from 12 knowledge questions</td>
<td>question about whether genomic risk (as indicated by Fm Hx) has clinical relevance for coronary heart disease</td>
<td>that diabetes and heart disease are caused by a single gene variant</td>
</tr>
<tr>
<td>NNWFS</td>
<td>8.99/12, Range 1-12, SD 1.69</td>
<td>99% (n=437/442)</td>
<td>61% (n=268/442)</td>
</tr>
<tr>
<td>HOD</td>
<td>9.24/12, range 3-12, SD 1.50</td>
<td>98% (n=216/220)</td>
<td>62% (n=137/220)</td>
</tr>
<tr>
<td>NCEMNA</td>
<td>Not Done</td>
<td>74% (n=275/274)</td>
<td>66% (n=92/138)</td>
</tr>
<tr>
<td>MINC</td>
<td>8.09/12, range 0-12, SD 1.62</td>
<td>82% (n=4116/5118)</td>
<td>71% (n=3580/5008)</td>
</tr>
<tr>
<td>MINC Admin</td>
<td>Not Done</td>
<td>89% (n=386/434)</td>
<td>76% (n=330/435)</td>
</tr>
</tbody>
</table>
Diffusion of Innovations

# Genomic Attitudes

<table>
<thead>
<tr>
<th></th>
<th>Reported it was SOMEWHAT OR VERY IMPORTANT for nurses to become more educated about genetics of common disease</th>
<th>Believe senior staff see genetics as an IMPORTANT part of the survey respondent’s personal role</th>
<th>WOULD attend a genetics course on their own time</th>
</tr>
</thead>
<tbody>
<tr>
<td>NNWFS</td>
<td>92% (n=572/607)</td>
<td>Not assessed</td>
<td>73% (n=368/506)</td>
</tr>
<tr>
<td>HOD</td>
<td>98% (n=239/244)</td>
<td>Not assessed</td>
<td>75% (n=182/240)</td>
</tr>
<tr>
<td>NCEMNA</td>
<td>97% (n=374/385)</td>
<td>24% (n=87/359)</td>
<td>Not Assessed</td>
</tr>
<tr>
<td>MINC</td>
<td>89% (n=5992/6741)</td>
<td>26% (n=1302/5110)</td>
<td>64% (n=3248/5087)</td>
</tr>
<tr>
<td>MINC Admin</td>
<td>93% (n=406/438)</td>
<td>27% (n=118/431)</td>
<td>68% (n=294/433)</td>
</tr>
</tbody>
</table>
Clues to Educational Needs

Most:

- Indicate a potential disadvantage to integrating genomics into practice was that it would increase insurance discrimination.
- Felt that genetics could increase patient anxiety about risk, despite behavioral studies in many conditions indicating that most patients do well with genetic information.
- Felt genetics is not reimbursable or too costly.
- Feel genetics is important BUT do not think that senior staff feel it is important to their role.
- Are willing to learn more, and are willing to do so on their own time.
Overall Education Impact

Total Knowledge Score By Highest Level of Nursing Education

- Doctorate: 8.8
- Master's: 8.6
- BSN: 8.4
- AD: 8.2
- Diploma: 8
## Genetic Education Impact

<table>
<thead>
<tr>
<th></th>
<th>Prior Genetics Education</th>
<th>No Prior Genetics Education</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reported hearing or reading about the Competencies</td>
<td>24.9%</td>
<td>6.4%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Self described genetic/genomic knowledge and Good/Fair</td>
<td>44.6%</td>
<td>29.5%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Mean age of nurses reporting genetics in their curriculum</td>
<td>41.8 years</td>
<td>46.1 years</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
Potential Policy Implications

- **Regulatory**
  - Guidance to IRBs and researchers using whole genome analysis

- **MINC Participant Policy Initiatives**
  - Genetic education, counseling and informed consent for genetic tests
  - Pathways for referrals to genetic services
  - Documentation of family history
  - Genomic Nursing Competency

- **MINC Existing Policies**
  - Genomic Advanced Directives
Personalized Health Care Requirements


Published by AAAS
Establish a blueprint for genomic nursing science that can be used to focus research efforts to fill identified evidence gaps

Establish the blueprint through

- Analysis of the evidence
- Expert evaluation of the current state of the science
- Public comment
Methods

- State of the Science Advisory Panel Convened
- Evidence Reviews
- Meetings
  - Interactive Webinars (2)
  - In-person meetings (2)
- Public Comment

Advisory Panel Conclusions

- Focus on research producing clinically evidence along the translation science continuum
  - Use multifaceted methodologies and measurements
  - Build on existing work
- Framework is NINR Strategic Plan Areas
- Clients definition consistent with Genomic Nursing Competencies
  - Persons, families, communities, and/or populations
- Two major research areas
  - Focus on the Client
  - Focus on the context in which health care is delivered
- Cross cutting themes

http://www.genome.gov/27552093
Challenges and Opportunities

- Funding
- Capacity to Understand Relevance
- Lack of Outcome Evidence
- Faculty Capacity to Teach Genomics
- Size of Workforce
- Diversity of Workforce

Interprofessional Collaboration to Improve Health Outcomes
Resources

- Journal of Nursing Scholarship Genomic Special Issue
  Webinar Series with Issue Authors
  http://www.genome.gov/27552312

- Genetics/Genomics Competency Center for Education (G2C2)
  http://www.g-2-c-2.org

- CDC Public Health Genomics
  http://www.cdc.gov/genomics/

- Genomic Competency Listserv
  Email: calzonek@mail.nih.gov
Resources, continued

- Global Genetics and Genomics Community
  http://www.g-3-c.org
- NHGRI and Smithsonian collaborative exhibit
  Genome: Unlocking Life’s Code
  Museum of Natural History
  http://unlockinglifesc ode.org/
ISONG is Celebrating 25 Years!

Conference Dates
October 4-6, 2013

Conference Hotel
DoubleTree by Hilton
Bethesda, Maryland USA

Abstracts Accepted
March 1 - April 8, 2013

For More Information
Visit
www.isong.org
Summary

- Recognize the relevancy and value of genomics to your responsibilities
- Utilize your leadership and skills to be a change agent/champion in your healthcare environment
- Recognize policy opportunities to ensure safe, effective and efficient translation of genomic clinical care
- Think creatively and be innovative about designing services, staff education, clinical infrastructure (i.e., EHR) that facilitates adoption of genomics in care
- Visualize how you can leverage interprofessional teams to assure that all healthcare providers are adequately prepared to be able to transform healthcare delivery
Questions/Discussion

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