APRNs’ Knowledge and Attitudes About Pharmacogenetic Testing

Pharmacogenetic Testing (PGx)

- Will most likely be one of the most profound and earliest influences of the Human Genome Project on clinical practice

Goal of Pharmacogenetic Testing: Deliver Right Medicine to Right Patient

Benefits of Personalized or Genotype-Guided Drug Therapy

- Better, safer drugs the first time
- More accurate methods of determining appropriate drug dosages
Other Benefits

- Better Vaccines
- Decrease in Overall Cost of Health Care
- Improvements in the Drug Discovery and Approval Process

Growing Recognition that...

- Individualized or Genotype-Guided Drug Therapy is an improvement over the current “one size fits all” approach to drug therapy

However,

- After more than half a century of pharmacogenomic research, the clinical use of pharmacogenomic testing remains uncommon, despite many examples showing that inherited genomic variation causes substantial interindividual differences in drug effects. *Relling, Altman, Goetz, & Evans (2010)*

Genetics & Warfarin

- Genetics factors account for 35-40% of the variation in how patients respond to Warfarin.

In 2007 the FDA approved updated labeling for Warfarin


Patients with a CYP2C9 variant

- Take a median of 95 days longer to achieve stable dosing when compared to those with the wild type
- Have a higher risk of acute bleeding complications

**CYP2C9 Variants/ Polymorphisms**

- **(*) wild type**
- **(2) Arg → Cys codon 144**
- **(3) Ile → Leu codon 359**
- **(4) Ile → Thr codon 359**
- **(5) Asp → Glu codon 360**
Sample of FDA Approved Drug Labels Containing Genomic Biomarkers Information

<table>
<thead>
<tr>
<th>Genomic Biomarkers</th>
<th>Drug</th>
<th>Testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Her2/neu Over-expression</td>
<td>Herceptin (trastuzumab)</td>
<td>Required</td>
</tr>
<tr>
<td>HLA B*5702</td>
<td>Zagen (dacavir)</td>
<td>Recommended</td>
</tr>
<tr>
<td>CYP2C9 Variants</td>
<td>Coumadin (warfarin)</td>
<td>Recommended</td>
</tr>
<tr>
<td>Vitamin K epoxide reductase (VKORC1) Variants</td>
<td>Coumadin (warfarin)</td>
<td>Recommended</td>
</tr>
<tr>
<td>CYP2D6 Variants</td>
<td>Prozac (fluoxetine)</td>
<td>Information</td>
</tr>
</tbody>
</table>

Currently

Little is known about understanding of and attitudes toward pharmacogenetic testing among APRNs and other clinicians.

Online Survey

Interdisciplinary group of experts developed an online survey to assess knowledge and attitudes of clinicians about pharmacogenetic testing
- Initially, included a specific focus on PGx with Warfarin
- Eventually expanded to include a focus on PGx with Tamoxifen

Clinicians’ Knowledge & Attitudes about Pharmacogenetic Testing

Core Research Project for the UNC Genomics & Society CEER
Funded by NIH: NHGRI Grant Number P50HG004488

Over 2200 Respondents

- Pharmacology
  - 753 pharmacists
  - 88 pharmacy students
- Nursing
  - 560 advanced practice nurses
  - 244 registered nurses
  - 35 licensed practical nurses
  - 428 nursing students
- Medicine
  - 4 physicians
  - 9 residents/fellows
  - 48 medical students
  - 1 physicians assistant
- Genetic Counselors
  - 35 genetic counselors
- Other - 35
Purpose of this Presentation

To examine knowledge and attitudes about pharmacogenetic testing among APRNs

Participants

560 APRNs
– NONPF listserve
– ONS listserve

Demographics of Participants

Highest Level of Education
– 22% PhD
– 13% DNP or Other Doctorate
– 63% MS/MA/MSN
– 2% BS/BSN
52% Educator/Faculty Member

Years in Practice
– 54% >20 years
– 37% 10-20 years
– 9% <10 years

Prescriptive Privileges
– 82% Yes
– 18% No

Results

Most participants rated their understanding of genetics as good (28%) or fair (48%)
Most participants rated their understanding of PGx as fair (44%) or poor (33%)

Basic Genetic Questions: True or False?

<table>
<thead>
<tr>
<th>Question</th>
<th>Correct</th>
</tr>
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<tbody>
<tr>
<td>Humans are over 99% identical at the DNA level.</td>
<td>57%</td>
</tr>
<tr>
<td>Most cells in the human body contain 47 chromosomes.</td>
<td>68%</td>
</tr>
<tr>
<td>Every time the human body produces a sperm or an egg, approximately 3 billion nucleotides (bases) must be copied and packaged so they can be passed along to future offspring.</td>
<td>50%</td>
</tr>
<tr>
<td>The nucleotides (bases) in DNA, always match up the same way - Adenine (A) always pairs with the Cytosine (C) and Guanine (G) always pairs with the Thymine</td>
<td>69%</td>
</tr>
<tr>
<td>A number of genetic conditions, such as sickle cell anemia, are caused by a mutation in a single gene</td>
<td>76%</td>
</tr>
</tbody>
</table>

Questions about Pharmacogenetic Testing: True or False?

<table>
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</tr>
</thead>
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<tr>
<td>Subtle differences in a person’s genome can have a major impact on how the person responds to medications</td>
<td>87%</td>
</tr>
<tr>
<td>Genetic determinants of drug response change over a person’s lifetime.</td>
<td>33%</td>
</tr>
<tr>
<td>Genetic variations can account for as much as 95% of the variability in drug disposition and effects.</td>
<td>58%</td>
</tr>
<tr>
<td>The package insert for warfarin includes a warning about altered metabolism in individuals who have specific genetic variants.</td>
<td>44%</td>
</tr>
<tr>
<td>Pharmacogenetic diagnostic testing is currently available for most medications</td>
<td>61%</td>
</tr>
</tbody>
</table>
**Attitudes: Benefits**

65% of the participants thought it was likely that PGx would help decrease the number of adverse drug reactions.

18% thought PGx would help decrease the cost of new drugs.

56% thought it was likely that PGx will help decrease the time it takes to find an optimal dose of Warfarin.

63% thought it was likely that PGx will help decrease adverse drug reactions to Warfarin.

**Attitudes: Concerns**

47% expressed concern that PGx may result in discrimination by employers and insurance companies.

41% expressed concern that unauthorized individuals may gain access to PGx information.

**APRNs and Pharmacogenetic Testing**

26% would be comfortable interpreting and using the results of pharmacogenetic testing on their own.

1% have ordered pharmacogenetic testing before prescribing Warfarin.

Reasons for not ordering pharmacogenetic testing for Warfarin:

- 65% I was not aware this type of testing was available
- 50% I do not feel confident about how to interpret & apply results
- 49% I do not know of or have access to a lab that performs this type of testing
- 39% Clinical guidelines on how to use the results of this type of testing are lacking
- 31% This type of testing is not covered by my patient’s insurance plans
- 21% Ordering the testing and waiting for results would delay patient’s tx
- 21% I am concerned about patient confidentiality and privacy issues

14% I have not seen convincing evidence of the clinical utility of this testing

**Interest in learning more about Pharmacogenetic Testing**

96% Yes

4% No

Type of education offerings they would be interested in attending (able to choose multiple options):

- 66% CME/CE Course
- 56% Web-Based CME/CE Course
- 38% Seminar or lecture
- 35% Half-Day Conference
- 20% All Day Conference 17% Grand Rounds
- 8% AHEC
Conclusion

- The APRNs who responded to this survey are interested in receiving additional education about pharmacogenetic testing.

- Moreover, concerns about ethical and social implications may prevent APRNs from ordering pharmacogenetic testing.

Future of Pharmacogenetic Testing?

- Implementation of pharmacogenetic testing into clinical practice ultimately depends upon patients’ and clinicians’ acceptance of, and requests for, this type of testing.

Therefore,

- You and other APRNs will play a critical role in determining whether or not pharmacogenetic testing is successfully integrated into clinical practice.

We Need Your Help

Because everybody’s therapy is not your body’s therapy.

http://www.ipit.unc.edu