Utilization of Genomics to advance the care of chronic disease in diverse populations: Case Study: Hepatitis C

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Disclaimer

• The contents of this presentation are based on data and results of a large sample of patients within the Veterans Administration Health Care system.

• This presentation is the sole property of the authors and does not officially represent the VA health care system.

• The newest group of medications for treatment of Hepatitis C are out and are replacing the use of Interferon and Ribavirin.
Rationale

• Advancements in genetics can inform health care practices.
• Utilizing genetic testing to enhance care is paramount to decreasing the morbidity and mortality of chronic diseases such as hepatitis C.
• The following is an example of how genomics is influencing health care.
Research study

• This presentation is the results of a national review of hepatitis C screening tests utilized within the Veteran’s Administration health care system.

• Dr. Julie Lynch, one of the co-authors of this presentation/study has been instrumental in establishing access to the use of genetic testing results in treatment of chronic diseases such as Hepatitis C.

• A retrospective review of approximately 2,025 patients who had hepatitis C testing done including the single nucleotide polymorphism (SNP) and genoctype testing was the focus of this study.
Overview of VA health care system in the USA-2014

• Veterans health care system was created in 1931 to provide health care services to service members who were transitioning out of the military to civilian life.
• The VA motto is “To care for him who shall have borne the battle and for his widow, and his orphan.”
  
  Abraham Lincoln

• Currently, there are 8.57 million veterans enrolled in the VA health care system. 91.7% are male and 8.3% are female.
• The VA health care system currently consists of 152 hospitals and 817 community based outpatient clinics in 50 states and Puerto Rico.
VA statistics on Hepatitis C

- VA is the largest single provider of medical care for hepatitis C in the USA.
- There are approx. 226,000 veterans diagnosed with hepatitis C.
- This statistic represents approx. 10% of the veteran population who are infected with hepatitis C.
- In the past, only 45% of patients being treated for hepatitis C would respond to traditional therapy.
Previously, the drug treatment for hepatitis C consisted of two drugs: **Ribavirin and Pegylated Interferon (Peg-IFN)**. These meds must be given for up to 48 weeks. Peg-IFN is given by injection weekly.

- **Side effects** can be significant and include: fever, chills, muscle aches, headaches, oral ulcers, nausea, vomiting and diarrhea, insomnia and depression.
- Many patients refuse to take meds due to side effects and poor response rates or stopped treatment due to side effects.
- **Overall effectiveness of these meds to cure hepatitis C is only 45%.**
In the early 90s, genetic testing became available for identification of viral genotypes of hepatitis C. Testing consists of a blood test that will identify one of seven different genotypes of the virus in the infected population. HCV Genotyping allows the providers treating Hepatitis C, the opportunity to identify patients who will respond most or least favorably to the previous two drug Hepatitis C treatment. The most common type identified is HCV- Genotype 1. African Americans are most likely to belong to this genotype subgroup.
Sequence of Tests for Hepatitis C

1. HCV testing (+)
2. Sustained viral response (SVR)
3. HCV Genotyping
4. Single nucleotide polymorphism (SNP)
Testing for Hepatitis C

• Hepatitis C
• Sustained viral response (SVR)/Load
Genetic testing

- Genomics in the treatment of Hepatitis C includes two aspects: Genotyping of the Hepatitis C virus and identification of a single nucleotide polymorphism (SNP) test. This SNP is known as the Interleukin-28B (IL-28B).

- **Genotyping** identifies which of seven major genotypes of hepatitis C virus: 1-7. Genotype 1 is the most common but is also known to be the most resistant to standardized treatment for hepatitis C.

- **SNP** testing helps to identify the patient’s genetic pattern which includes one of these three types: CC, TT and TC. This test is known as the Interleukin-28b or IL28b.

- It is known, that patient’s with genotype 1, SNP-CC are most likely to be cured with the current medication regime.
# Types of genotypes identified

<table>
<thead>
<tr>
<th>Genotype: % of HCV infected population in USA</th>
<th>Comments</th>
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<tbody>
<tr>
<td>1</td>
<td>80%</td>
</tr>
<tr>
<td>2</td>
<td>10%</td>
</tr>
<tr>
<td>3</td>
<td>6%</td>
</tr>
<tr>
<td>4</td>
<td>combined = 4%</td>
</tr>
<tr>
<td>5</td>
<td>combined = 4%</td>
</tr>
<tr>
<td>6</td>
<td>Common in South China, Hong Kong and SE Asia. SVR bet. 50-80%</td>
</tr>
</tbody>
</table>
Genotype 1 by race and IL28B CC status - * Thomas, et al, 2012

<table>
<thead>
<tr>
<th>Ancestry</th>
<th>% likely to have IL28B CC genotype</th>
</tr>
</thead>
<tbody>
<tr>
<td>African</td>
<td>23-55 %</td>
</tr>
<tr>
<td>European</td>
<td>53-86 %</td>
</tr>
<tr>
<td>South Asian</td>
<td>65-98 %</td>
</tr>
<tr>
<td>East Asian</td>
<td>90-100 %</td>
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</tbody>
</table>
SNP types Identified by Ethnicity in general population with hepatitis C.
Veterans in our study with Genotype 1: and their SNP status.
Customizing care based on genetics

- Prior approaches to treatment involved diagnosing a patient with a disease and treating them with the known med(s) that would help treat the disease or cure them.
- At times it was a “stab in the dark” as we would treat everyone in the same way but the outcome for hepatitis C patients, was less than satisfactory with only a successful response rate of 45%.
- Treatment was often complicated by significant side effects and the treatment period could last up to one year further complicating compliance issues.
- With genetic testing, we can begin to customize treatment to the individual patient not just the disease with much better outcomes.
- With the introduction of the new DAA, the need for Interferon may be eliminated but time will tell............
References/Bibliography

• Centers for Disease Control (2013).


