UNIT 11 - APPLICATION OF THEORY IN PRACTICE PART 2

Precision Healthcare: Genomics-Informed Nursing by Andrea Gretchev

Please visit the web version of Precision Healthcare: Genomics-Informed Nursing (https://ecampusontario.pressbooks.pub/personalizedhealthnursing/) to access the complete book, interactive activities and ancillary resources.

Unit 11 Contents

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11.1 UNIT OVERVIEW

Learning Objectives

- Apply course content to practice scenarios

Practice questions and case studies are provided for independent practice for students to apply what they have learned thus far in the course. Please see Blackboard for the group discussion assignment for this week which will also provide an opportunity to apply learning.

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11.2 APPLICATION OF THEORY IN PRACTICE - CASE STUDIES

Pediatric Genetic Disorders

Rady Children's Institute for Genomic Medicine has three pediatric case studies. Watch a vignette, follow the patient through their trajectory, or read the full story if you prefer print.

- Mario (https://radygenomics.org/case-studies/marios-story/) – a stomachache turns into a serious heart condition. Genome sequencing identifies the cause.
- Hudson (https://radygenomics.org/case-studies/hudsons-story/) – quick deterioration leads to respiratory distress and a genetic diagnosis.
- Fitz (https://radygenomics.org/case-studies/fitzs-story/) – newborn screening reveals Severe Combined Immunodeficiency (SCID)

Pharmacogenomics

Pharmacogenomics Exercises

Pharmacogenomics exercises (text version)

1. Match the words to the correct blanks to complete the sentences:
   Words: pharmacodynamics, pharmacogenomics, pharmacokinetics
   The study of the absorption, distribution, metabolism and excretion of drugs is called **[Blank a]**.
   The study of the biochemical and physiological effects of drugs and their mechanism of action is called **[Blank b]**.
   Check your answer in footnote[1]

2. Sara is a 17-year-old patient who comes to the clinic today after struggling with a number of symptoms for 2 months. She reports sad and lonely feelings daily, an inability to leave her bed, poor appetite, and a 10 lb weight loss. She has not had suicidal tendencies.Sara meets with the clinic's psychiatrist for 1 hour who conducts a number of diagnostic tests and inquires more about her symptoms. The psychiatrist diagnoses Sara with major depressive disorder (or depression). The doctor recommends weekly behavioral therapy with the clinic's psychologist and discussed medication options with Sara. The prescriber is considering treating with Citalopram (Celexa).**Q: How does this drug work to treat this disease?** Hint: pharmacodynamics; use the Drugs with Variant Annotations (https://www.pharmgkb.org/annotatedDrugs) database from PharmGKB.

    a. By blocking dopamine reuptake to increase dopamine levels in the brain
    b. By inhibiting serotonin reuptake, leading to increased levels of the neurotransmitter in the synaptic cleft
    c. By increasing norepinephrine release at the synaptic cleft
    d. By acting as an antagonist at glutamate receptors to decrease excitatory neurotransmission

    Check your answer in footnote[2]

3. **Key pharmacogene for citalopram: *CYP2C19* – Metabolized by the liver**You recommend preemptive testing of Sara's CYP2C19 genotype before initiating therapy with citalopram. In the meantime, you have the genotypes of Sara's parents in the electronic medical records. Parent 1 (male): *1/*2 Parent 2 (female): *2/*3Q: What genotypes are possible for Sara based on parental genotypes (Hint: there are four correct answers)?

    a. *1/*2
    b. *2/*2
    c. *1/3
    d. *2/*3
    e. *1/*1
    f. *3/*3

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1. **Blank a** – pharmacokinetics; **Blank b** – pharmacodynamics

2. b. By inhibiting serotonin reuptake, leading to increased levels of the neurotransmitter in the synaptic cleft

Check your answer in footnote[3]

4. Sara's genotype for *CYP2C19*: *2/*3
   True or false? her phenotype would be "normal metabolizer." Use PharmGKB (https://www.pharmgkb.org/haplotype/PA165980635/variantAnnotation) to find the answer.
   Check your answer in footnote[4]

Activity source: Adapted from Engaging Students in Pharmacogenetics: Patient Case Studies Using the PharmGKB Website, CC BY-NC-SA 4.0

Various Additional Case Studies for Practice

Select a case study on a topic of interest from below or work through them all.

Case #1

Read Sally's story of survivor's guilt (http://www.tellingstories.nhs.uk/index.php/joys-story?id=243) – growing up with cystic fibrosis in the family.

Question for reflection – Sally's story

1. Can you think of reasons why parents would and would not want to talk to their children about genetic conditions in the family? Use cystic fibrosis (an autosomal recessive condition) as an example. Consider the taboo that surrounds the issue of talking about a dead child with others outside the family.

3. a, b, c and d are all possible.

4. False. She would be a poor metabolizer and the drug dose should be reduced or another drug selected

2. What sort of information/ resources could a nurse pass on to the family to help them learn and understand about cystic fibrosis and their own risk?
3. What could the nurse offer to parents in case they might want to tell their children about their own risk?
4. Discuss the role hospital-based health care staff might play in supporting siblings of children with life-limiting conditions.

Source: Questions based on Sally's Story In *Telling stories: Understanding real life genetics* © National Genetics and Genomics Education Centre (NHS).

Case #2

Read Eve's story (http://www.tellingstories.nhs.uk/index.php/joys-story?id=287) about her son's chromosomal condition mosaic ring 22 trisomy.

Question for reflection – Eve's Story

1. Eve describes some of the anxieties she and her husband have about Caleb's health and care needs and how they worry about his future. Consider what it must be like for a parent with anxieties and concerns over their child's long-term health needs and what the psychosocial impact on the family might be. How might a healthcare professional be able to support parents in this situation?
2. Eve has found support groups such as Unique and Chromosome 22 Central and Contact a Family to be a great source of help. Think about the role support organizations can play in helping families like Eve's. How might they be able to provide a different kind of support to that of a healthcare professional?
3. Eve explains that the geneticist tried to explain Caleb's rare chromosomal condition to her and her husband by writing on paper and showing diagrams to help with the explanation. Reflect on your own practice as a healthcare professional. Have you experienced a situation where you had to explain a complex clinical or scientific concept to an individual? How did

you go about it? Did you check that the individual had understood the explanation? Was there anything further you could have done to improve the explanation? Were there any other resources you could have used?

Source: Questions based on Eve's story In *Telling stories: Understanding real life genetics* © National Genetics and Genomics Education Centre (NHS).

Case #3

Read Joy's story (http://www.tellingstories.nhs.uk/index.php/cancer/38-joys-story) about her experience with a *BRCA2* gene variant and the impact on her family.

Question for reflection – Joy's story

1. Joy describes how she feels about her sons' decision not to be tested, saying "It's their decision. I would like to know, if there was a way I could have the test done on their behalf and know the result without telling them, that obviously would satisfy my wants, you know, of the knowledge, but they decide and so their decision we have to wait..."
    - Discuss the ethical issues that would arise if a mother could learn the genetic status of her adult children without their consent?
2. What further family history questions might you want to ask someone like Joy when discussing a family history?
3. Would you know how to refer someone to your local genetics service or where to find out information about this?
4. Joy talks about the implications that having a BRCA2 gene alteration has for her three sons. Search the internet to find out what you can about familial breast cancer in men, including what the incidence is, what the increased risk of developing breast cancer would be in a man with a BRCA2 gene alteration, and whether a BRCA2 gene alteration is also associated with an increased risk of developing other types of cancer in males. The Macmillan website has

specific webpages on breast cancer in men (http://www.macmillan.org.uk/Cancerinformation/Cancertypes/Breastmale/Breastcancerinmen.aspx) that you might like to refer to.

Source: Questions based on Joy's story In *Telling stories: Understanding real life genetics* © National Genetics and Genomics Education Centre (NHS).

Attribution & References

References

Mosquera, A. M., & Aleksunes, L. M. (2023). Engaging students in pharmacogenetics: Patient case studies using the PharmGKB website. *CourseSource*, *10*, 10.24918/cs.2023.10. https://doi.org/10.24918/cs.2023.10

National Genetics and Genomics Education Centre (NHS). (n.d.). *Telling stories*. http://www.tellingstories.nhs.uk/index.php

11.3 GROUP DISCUSSION

Assignment – Group Discussion

This week students will engage in group discussions on Blackboard. Students will be randomly assigned to groups. See the Blackboard course shell for assignment directions and rubric. Students may also want to use this unit and unit 11 to work on their case study assignment.

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