Victoria Rodriguez Week 1: Research Question and Hypothesis HHA 506

**Research Question**: In U.S. female patients with HER2-positive breast cancer aged 30-65, how could nano therapy interventions compare to traditional trastuzumab chemotherapy in regards to more effective breast cancer treatment 30-60 days after initial diagnosis?

**F**easible:

1. Adequate Number of Subjects
2. This research question follows this criterion because invasive breast cancer is a common disease diagnosed in women in the United States. The population group also follows this criterion since HER2-positive breast cancer has a high diagnosis and incident rate in adults aged 65 years and younger, with about 44% of diagnoses found in the 30-49 age group alone (Levitan, 2019).
3. Adequate Technical Expertise
4. This research question involves the use of health technology, but more specifically aims to compare the existing trastuzumab chemotherapy technologies to recently developed nanotherapy tools arising for breast cancer treatment.
5. Affordable in Time and Money
6. Being that cancer nanotechnology is a relatively new science, the costs are currently high during the developmental stages and accessibility for the tools already in existence are limited (Mohandas, Gayathri & Priya, 2018, p. 2725). However, the expansion of nanobiotechnology tools is expected to help decrease costs and cancer treatment duration and improve treatment outcomes. (Krukemeyer, Huebner, Wagner & Resch, 2015).
7. Manageable in Scope
8. This research aligns with this criterion because studies from JAMA Oncology observed that delaying cancer treatment had a major impact on a patient’s chance of survival. The time frame in this question is manageable since majority of breast cancer patients begin chemotherapy treatment 30-60 days after surgery (BreastCancer.org, 2015).

**I**nteresting:

1. Getting the Answer Intrigues Investigators, Peers, and Community
2. This research question intrigues all three groups enlisted since breast cancer is such a renowned disease that is continuously being improved upon within the scientific community. Nano therapy and its role in cancer treatment is still in development but it has the potential to benefit so many individuals and possibly branch out into other forms of medicinal treatment.

**N**ovel:

1. Confirms, Refutes, or Extends Previous Findings
2. In general, chemotherapy has its flaws such as: delay in diagnosis, nonspecific distribution during treatment, toxic substances entering the body, and limited monitoring of response to treatment (Mohandas, et al., 2018). Nano therapy’s capability in having the ability to improve site specificity and delivery of medication during cancer treatment is a driving force or its research and development.

**E**thical:

1. Amendable to a Study that Institutional Review Board would Approve
2. This research questions follows this criterion because there have been nanotechnology-based drugs and breast cancer trials approved by the FDA in recent years (NCI, 2017). This study would simply compare these existing nanotechnologies to traditional trastuzumab chemotherapy currently being used for HER2-positive breast cancer patients.

**R**elevant:

1. To the Scientific Community

This question relates to the scientific community since invasive breast cancer is one of the common types of cancer seen in a huge portion of the U.S. female population. The answer to this research question could guide the scientific communities to more efficient forms of breast cancer treatment and literature to educate future generations on more effective measures.

1. To Clinical and Health Policy
2. This research question relates to clinical and health policy because the answer to the proposed question could help so many individuals and shift the course of HER2-positive breast cancer treatment altogether. It could also diminish health disparities and the number of people whose death relates to inadequate diagnosis or treatment of this form of breast cancer.
3. To Future Research
4. This research question only pertains to female HER2-positive breast cancer patients, but nanotechnologies and related tools could be analyzed for numerous other forms of cancer and possibly provide better options to the treatment measures being used to treat cancer patients today.

**Hypothesis**: Developing nano therapy interventions will greatly improve the effectiveness of

HER2-positive breast cancer treatment in comparison to the traditional trastuzumab chemotherapy being used today for women in the U.S. aged 30-65.

This hypothesis is classified as a one-tailed, or one-sided, hypothesis because it is predicting that cancer nano therapy will greatly improve the efficiency of breast cancer treatment in comparison the trastuzumab chemotherapy currently being utilized. Recent advancements in nano-based medicine for breast cancer treatment have aided in drug delivery via active targeting and eliminating the issue of drug resistance in cancer treatment (Wu, Si, Xue & Wong, 2017). Additionally, the National Cancer Institute has looked into the ability for nano therapy tools to passively target tumors and achieve higher drug delivery via the Enhanced Permeability and Retention effect, solutions to tissue barriers via extracellular matrix through nano-based medicine, and resolving the blood brain barrier obstacle by using the physical and biological properties of nanoparticles (NCI, 2017).

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