For my Course Development Project I chose to improve HLTH 310 – Chronic Diseases: Prevention and Control. Anonymous student evaluations from my first year of teaching this course indicated that the course was not adequately challenging for students. Therefore, my primary goal was to raise the bar for student achievement with more challenging writing assignments and exams that would cause the students to stretch, grow, and learn more than before. Now, one year later, I am very confident that I am providing a course that is indeed more challenging, better aligned with my students’ abilities and capacities for learning and growth.

Course Background
As stated in my current version of the course syllabus, “The purpose of HLTH 310 is for you to analyze chronic disease prevention and control strategies in the context of a conceptual framework to understand the public health significance of chronic diseases, and to effectively communicate your analyses.” HLTH 310 is a core course in the undergraduate public health curriculum, required for all students majoring in public health. Len Novilla has been teaching HLTH for years, and now Len and I each offer at least 3 sections of HLTH 310 annually. My version of the course is loosely based on Len’s version, but I have developed my own ways of helping students achieve the Learning Outcomes.

Learning Outcomes
As stated in my current version of the course syllabus,

Our conceptual framework for learning about the public health significance of chronic diseases, and analyzing prevention and control strategies, is expressed in the following expected learning outcomes:

1. PATHOPHYSIOLOGY. Describe changes to the body’s normal structure and function that occur in chronic diseases.
2. POPULATION PATTERNS. Explain person-, place-, and time-related patterns of chronic diseases, their causes & risk factors, and their consequences.
3. CAUSES & RISK FACTORS. Describe causes & risk factors for chronic diseases, which arise from our physical & social environment, personal behavior, and human biology.
4. CONSEQUENCES. Explain physical, emotional, social, and economic consequences of chronic diseases on individuals, families, and society.
5. PREVENTION & CONTROL. Explain major primary and secondary prevention strategies for chronic disease prevention & control.
6. PUBLIC HEALTH SIGNIFICANCE. Integrate your understanding of chronic diseases from multiple perspectives, including pathophysiology, population patterns, causes & risk factors, consequences, and prevention & control, to draw conclusions about the public health significance of chronic diseases.
7. RESEARCH & ANALYSIS. Analyze peer-reviewed scientific studies and other sources of information about chronic diseases, synthesize this information to identify strengths and limitations of current prevention & control strategies, and recommend improvements to these strategies.

Learning outcomes 1 through 5 are preparatory; 6 and 7 represent the course purpose.
The learning outcomes for HLTH 310 support the BS in Public Health Core program-level learning outcomes stated on learningoutcomes.byu.edu:

- Evaluate the behavioral, social, environmental, genetic, and cultural determinants of individual and population health. See HLTH 310 learning outcomes 2, 3, 6, and 7.

- Communicate public health information effectively both orally and in writing. See HLTH 310 learning outcomes 6 & 7.

- Describe chronic and infectious disease and injury processes and strategies for prevention and control. See HLTH 310 learning outcomes 1, 3, 4, 5, 6, and 7.

- Describe how the methods of epidemiology and surveillance are used to safeguard and promote public health. See HLTH 310 learning outcomes 2, 3, 5, 6, and 7.

The learning outcomes for HLTH 310 also support the BS in Public Health – Health Science Emphasis program-level learning outcomes states on learningoutcomes.byu.edu:

- Review and critically evaluate scientific literature and analyze how the findings of these studies could be potentially used in public health. See HLTH 310 learning outcome 7.

- Identify health challenges and outcomes including health disparities and their distribution in the population; identify, discuss, and/or apply public health strategies that address trends in health outcomes and health disparities by promoting health, preventing disease and injuries, and/or assisting in building sustainable communities. See HLTH 310 learning outcomes 2, 3, 4, 5, and 7.

Course Activities
During my first year teaching HLTH 310, I developed course activities that mainly addressed learning outcomes 1 through 5 above – the preparatory learning outcomes. Through my course development project I developed new or improved course activities that more strongly address learning outcomes 6 and 7, and thus help students better achieve the course purpose. The new or improved course activities include guided reading assignments, more rigorous writing assignments, and more rigorous exams.

- Guided reading assignments. During my first year, I discovered that most students did not prioritize the assigned readings because they perceived the readings as “optional” and the readings were not very well-connected with the class sessions. As a result, students were not really learning the things I wanted them to learn from the readings.

As part of my course development project, I developed a series of 20 or so guided reading assignments for students to complete and submit throughout the semester. Each assignment is designed to help students prepare for a specific class session, usually contains readings from at least two sources (for example, a physiology textbook and a public health journal article), and always includes questions students should answer and
submit prior to class. I have found that students respond very well to this format. Nearly all students prioritize the readings now, and submit their guided reading assignments on time. Students are now noticeably better prepared for class, so the quality of class discussions has increased tremendously. Students get exposed to a lot of current research in the field of chronic disease prevention & control, and increase their ability to discuss and analyze this information.

The guided reading assignments mainly support learning outcomes 1 through 5, to help students build the foundation they need for achieving learning outcomes 6 and 7.

- **More rigorous writing assignments.** During my first year, I had students write a series of short essays addressing learning outcomes 1 through 5 sequentially. Each student chose a chronic disease to focus on in their essays, for example, coronary heart disease, breast cancer, or diabetes. Because students were to draw upon current peer-reviewed research in the field to support their essays, the activity also partly supported learning outcome 7. However, learning outcome 6 was not very well addressed at all, because the series of short essays turned out to be mainly focused on description and summary, rather than analysis or argument.

As part of my course development project, I developed two new writing assignment that are significantly more challenging, allowing students to integrate what they learn from the series of short essays and push into the realm of analysis and argument rather than being stuck in the realm of description and summary. The first new writing assignment I’ve termed the “Public Health Significance Essay.” In this essay, which occurs about one third of the way into the semester, students integrate all they have learned about their disease from the perspectives of learning outcomes 1 through 5, into an argument for why the disease matters for public health, and why the State Health Department should allocate money, energy, and time to support prevention & control of the disease. The second new writing assignment I’ve termed the “Final Paper.” In this paper, which students work on during the second half of the semester, students identify a specific controversial problem or unresolved question in the prevention & control of their disease, and develop a thesis-based paper the proposes a potential solution to the problem or answer to the question, backed up by solid analysis of current public health literature.

The new writing assignments are undoubtedly leading my students to learn much more than before. These assignments involve learning outcomes 1 through 5, and now also strongly support learning outcomes 6 and 7, helping students fulfill the course purpose.

- **More rigorous exams.** During my first year, I developed multiple choice exams that mainly addressed learning outcomes 1 through 5. I found that I was not skilled in writing appropriately difficult multiple choice questions. Therefore, the exams were far too easy, and did not adequately challenge students at all. I moved to short-answer exams, instead of multiple choice, but all the questions were still aimed at learning outcomes 1 through 5 and were too easy for most students.
As part of my course development project I developed more rigorous short-answer exam questions that push more into learning outcomes 6 and 7. Instead of exams with 50 or more items that emphasized recall of basic information, I moved to exams with just 10-20 items that emphasize synthesis of information, and application of information to solving new problems the students haven’t seen before. For example, I will present students with data from a research study, relevant to the prevention & control of a particular chronic disease, and ask the students to use their knowledge of the pathophysiology, population patterns, causes & risk factors, consequences, and prevention & control to evaluate the information and offer an interpretation of what it means, or why it matters.

The exams still provide a way of assessing student achievement of learning outcomes 1 through 5, but also now help assess student achievement of learning outcomes 6 and 7.

**Assessment of Student Learning**

The key assessments I am using now are the Public Health Significance Essay, the Final Paper, and the improved Exams, including Midterm Exams and a Final Exam. The relationship of these assessments to the learning outcomes is explained above. The current version of the Public Health Significance Essay prompt and grading rubric, and the most recent version of the Final Exam and answer key, are included in an appendix to this report.

The Public Health Significance Essay and Final Paper both emphasize depth – can the student effectively achieve the course purpose through an in-depth exploration and analysis of issues pertaining to the specific chronic disease they chose to focus on? Each student becomes an expert on their chosen disease, increasing their ability to tackle important and timely public health problems related to that disease.

The Exams emphasize breadth – can the student effectively achieve the course purpose through a survey of several major chronic diseases that account for large portions of the overall burden of disability and premature death that occurs in a society? Each student learns the same diseases and answers the same questions.

The emphasis on depth in the writing assignments and breadth in the exams affords students multiple and varied opportunities to demonstrate their mastery of the learning outcomes and their fulfillment of the course purpose.

**Student Achievement of Learning Outcomes**

Currently, my most convincing evidence that my students are achieving the learning outcomes and course purpose is a comparison of essays my students wrote during the first year with essays students wrote more recently. The essays from the first year showed that many students achieved learning outcomes 1 through 5, but that very few achieved learning outcomes 6 and 7. In contrast, student essays from Fall 2014, and the first part of Winter 2015, indicate strongly that my students are now achieving outcomes 6 and 7 to a much greater extent. My recent and current students write essays that go far beyond mere description and summary, to persuasively present the public health significance of chronic diseases, and to persuasively argue in favor of certain strategies to improve the prevention and control of chronic diseases.
In Fall 2014, three students wrote final papers that I felt were worthy of developing further for potential publication in appropriate venues. I list these below; the full papers are available in my personal files. I am now encouraging all three of these students to further develop their work and eventually publish it. Benji Lambson is actively pursuing this further development now.

1. **Parker Dow.** Alternative screening methods for CHD in developing countries.

2. **Angela Hirschi.** The Word of Wisdom and type 2 diabetes.

3. **Benji Lambson.** Water fluoridation and osteosarcoma.

The exams are my second piece of evidence that my students are achieving the learning outcomes and course purpose. Because I have changed from multiple choice exams to short answer exams, and I have shifted more of the questions toward synthesis and application instead of mere recall, I know my recent and current students are working harder to do well on the exams than my students during my first year. I am very confident that my current exams are stimulating my students to learn much more than my students during the first year were learning.

However, in Fall 2014, most of my students did very well on my exams, even though I had made the exams more rigorous. It is not clear to me whether so many did so well because the exams are still too easy, or because I provided too much support and help to the students, or because the students truly are rising to my expectations and working hard to clear a higher bar. So, going forward, I feel I need to determine whether the exams are challenging enough, and whether the level of support I am offering to the students is appropriate. Once I answer those questions, I will be able to better rely on exam scores as a reliable measure of whether students have achieved the learning outcomes and course purpose.

**Steps Planned or Taken to Improve Teaching and Student Learning**

Based on what I’ve written above, I feel confident that I have brought the rigor of the writing assignments up to an appropriate level, but less confident about the rigor of the exams. So, going forward in HLTH 310, one of my goals is to improve the exams until I am satisfied that they are sufficiently rigorous. To achieve this, I plan to consult with the Center for Teaching and Learning, engage some students from the Student Consultation on Teaching program, and consult with other faculty members in my department.

In the Fall 2014 anonymous student ratings, I received feedback that I’ve improved students’ learning. I noted improvements in the ratings for several key items, compared with Fall 2013:

<table>
<thead>
<tr>
<th>Item</th>
<th>Fall 2013</th>
<th>Fall 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Course</td>
<td>6.8</td>
<td>7.1</td>
</tr>
<tr>
<td>I learned a great deal in this course</td>
<td>6.7</td>
<td>7.1</td>
</tr>
<tr>
<td>Course materials and activities effective</td>
<td>6.4</td>
<td>7.1</td>
</tr>
<tr>
<td>Intellectual skills developed</td>
<td>6.8</td>
<td>7.1</td>
</tr>
</tbody>
</table>

The student comments indicate that I am on the right track, and I intend to stay on the same track to further improve HLTH 310 going forward.
Appendix to Course Development Project Final Report

Item 1: Public Health Significance Essay prompt for Winter 2015 semester

Item 2: Public Health Significance Essay grading rubric for Winter 2015 semester

Item 3: Final Exam for Fall 2014 semester, including answer key
Writing Assignment: Public Health Significance Essay

Now that you have learned some basics about your disease, you are ready to tie everything together. The purpose of this assignment is for you to make a persuasive argument that your disease matters for public health.

There are three components to this Public Health Significance Essay writing assignment:

1. By 11:59 pm on **Tue Feb 10**\textsuperscript{th}, submit your **first draft** of your essay for your Writing Fellow to review. This submission is worth 1\% of your course grade and is graded on completion.
2. During the **week of Feb 16**\textsuperscript{th}, **meet with your Writing Fellow** to discuss your essay, then report in Learning Suite that you did so. This meeting is worth 1\% of your final course grade and is graded on completion.
3. By 11:59 pm on **Tue Feb 24**\textsuperscript{th}, submit your **final draft** of your essay. This assignment is worth 10\% of your final course grade and is graded on quality, not just completion. You must complete the essay in 1,200 words or less; submissions over 1,200 words will not be accepted.

**WRITING PROMPT:** Why does your disease matter for public health? In other words, why should anyone care about this disease, if they personally don’t have the disease, and nobody in their family has it? Why is this disease important for “the public” to deal with? Why should the State Health Department devote money, energy, and time to support the prevention & control of this disease?

**AUDIENCE:** Envision the State Health Department in Utah or your home state (or a similar organization in your home area if you are from outside the United States). A leadership team at the State Health Department allocates money annually to various efforts across the spectrum of disease prevention & control, from primary prevention (including primordial prevention), to secondary prevention, to tertiary prevention (and maybe even to quaternary prevention). Activities to support disease prevention & control might come in the form of public health prevention programs, but they might also come in the form of public health research to better understand pathophysiology, population patterns, causes & risk factors, and consequences.

**Your audience is this leadership team at the State Health Department.** They will decide how to allocate time, energy, and money this year to support the prevention & control of various diseases, including the chronic disease you are writing about. They will review essays like the one you will write to help them determine what their priorities should be. **Their goal** is to fund activities that will address diseases that matter for public health. **Your goal** is to persuade the leadership team at the State Health Department that your disease is worth their time, energy, and money.

Assume your audience is well educated and has a public health background, but includes non-experts on your disease. Assume they are willing to consider your arguments and potentially agree with you; that they will **not** reject your arguments out of hand without careful review.

**PREPARATION:** To address the writing prompt well, in an essay suited to your audience, you will need to draw upon what you’ve already learned by writing about pathophysiology, population patterns, causes & risk factors, consequences for individuals & families, consequences for society, primary (including primordial) prevention, and secondary & tertiary prevention. You might feel like you are still a naïve beginner. But the fact is you know a lot more now than the average Joe knows about your disease and why it matters.

Use what you learned through writing your series of short essays to support the arguments you will make in your Public Health Significance essay. If needed, seek out additional information to support the arguments you want to make. Do not just string all your short essays together one after another. Instead, prioritize information from your short essays, or perhaps new information you seek out, that will **best** support your goal of persuading the leadership team that your disease matters for public health. You will likely find yourself relying more heavily on some components of the “public health significance” framework, and less on other components. What you emphasize now is **your** choice.
GENRE: PERSUASIVE (ARGUMENTATIVE) ESSAY: In the Public Health Significance Essay you will make a persuasive argument about the public health significance of your disease. In a persuasive or argumentative essay you introduce a premise, or thesis, and support that thesis with evidence or arguments in an attempt to persuade your audience that they should accept your thesis as valid.

So, this means that your essay should have a thesis statement. I suggest you state your thesis in one sentence or maybe two sentences, and place it near the beginning of your essay. This will help your audience understand the purpose of your essay from the very beginning. It also means your essay will need to contain pieces of evidence, or arguments, which you think best support your thesis.

If there are points of view that run contrary to your thesis, address those opposing viewpoints in your essay, showing why you prefer your point of view. This is particularly important if members of your audience – the leadership group at the State Health Department – might harbor views opposed to the thesis you present in your essay.

If you would like to read more about the genre of persuasive (argumentative) essay writing, see this article on the Purdue Online Writing Lab website: owl.english.purdue.edu/owl/resource/685/05/

SAMPLE THESIS STATEMENTS: Consider specifying a thesis statement that is something like one of the following examples:

“The State Health Department should allocate resources to support XYZ aspect of the prevention & control of Disease Q, because of Reason A, Reason B, and Reason C.”

“Disease Q is important for public health, and warrants State Health Department resources to support XYZ aspect of prevention & control, because of Reason A, Reason B, and Reason C.”

Of course, you will want to be much more specific in your thesis statement.

ADDITIONAL INFORMATION: At the top of your essay please include the following information. (This additional information does not count in the 1,200 word limit.)

- Your name
- The names of any students you worked with while completing this writing assignment
- How much time you spent on this writing assignment (approximate)
- A brief title
- A word count for your submission

WRITING IN YOUR OWN WORDS: Write sentences in your own words. Do not lift sentences, or chunks of sentences, from sources of information you refer to, and plunk them into your essay. Instead, study sources of information, then set those sources aside and express the points you want to make in your own words. If you need to include a phrase or sentence verbatim from a source, because the meaning would be lost if the wording were modified, use quotation marks.

CITING SOURCES: Please review the instructions “How to cite sources” in the “Content” section of Learning Suite. In particular, pay attention to the instructions for how to list a book, a peer-reviewed journal article, and a website. If you choose to use UpToDate as a source, pay attention to the instructions for how to list UpToDate. At the end of your essay, put a heading REFERENCES and then list your sources under that heading. (The heading REFERENCES and the list of sources do not count in the 1,200 word limit.) Throughout your essay, use numbering after sentences or paragraphs to indicate sources of information that support the points you are making.

There is no minimum number of sources; but it is essential that you provide adequate references for factual statements and key ideas in your essay that did not spring directly out of your own mind.

FORMATTING: I suggest 12 point font, double-spaced, 1-inch margins; but I don’t care much as long as you adhere to the word limit and include the heading REFERENCES before your source citations.

Grading Rubric: Public Health Significance Essay

Your public health significance essay is worth 10% of your final course grade, or 100 points out of 1,000. Your essay will be graded on the basis of the criteria below, listed roughly in order of priority.

Grade “A” – Superior; ready to share with members of your target audience

- Public health significance of the disease is conclusively demonstrated
- Call for the audience to prioritize time, energy, or money to support some aspect of prevention & control of the disease is unequivocally persuasive
- Thesis is clearly stated, and very well supported by up-to-date information drawn from appropriate sources
- Essay identifies and solidly addresses opposing views, if applicable
- Essay is well-organized and easy for a reader to follow
- Factual statements and key ideas stemming from sources other than the author’s own mind are appropriately acknowledged, and direct quotations are not over-used
- Citations in the reference list are correctly formatted
- Scope, content, and tone of the essay are appropriate for the intended audience
- Graphs, charts, or tables, if used [optional], strongly support and enhance the essay’s main message
- Essay is free of errors in spelling, grammar, etc.

Grade “B” – Competent; nearly ready to share with members of your target audience

- Public health significance of the disease is well demonstrated
- Call for the audience to prioritize time, energy, or money to support some aspect of prevention & control of the disease is moderately persuasive
- Thesis is clearly stated, and fairly well supported by up-to-date information drawn from appropriate sources
- Essay identifies and partially addresses opposing views, if applicable
- Essay readability could be improved with better organization of ideas
- Factual statements and key ideas stemming from sources other than the author’s own mind are appropriately acknowledged, though reliance on direct quotations may be too heavy
- Citations in the reference list are mostly correctly formatted, but may need minor revisions
- Scope, content, and tone of the essay need minor revisions to appropriately target the intended audience
- Graphs, charts, or tables, if used [optional], moderately support and enhance the essay’s main message
- Essay is mostly free of errors in spelling, grammar, etc.

Grade “C” – Developing; good start but still needs a lot of work

- Public health significance of the disease is partly demonstrated, but with some apparent gaps
- Call for the audience to prioritize time, energy, or money to support some aspect of prevention & control of the disease is mildly persuasive
- Thesis is present but not very clearly stated, and may be only somewhat supported by up-to-date information drawn from appropriate sources
- Essay identifies opposing views, if applicable, but poorly addresses those opposing views
- Essay may be difficult to follow due to organizational weaknesses
- Factual statements and key ideas stemming from sources other than the author’s own mind are appropriately acknowledged, but the essay essentially regurgitates other people’s published ideas with no originality
- Citations in the reference list may need major formatting revisions
- Scope, content, and tone of the essay need major revisions to appropriately target the intended audience
- Graphs, charts, or tables, if used [optional], mildly support and enhance the essay’s main message
- Essay may have substantial errors in spelling, grammar, etc.

Grade “D” – Rudimentary, inappropriate, or faulty; go back to the drawing board and try again

I will leave to your imagination what such an essay might consist of. If you write one, I will discuss it with you and send you back to the drawing board to try again. 😊
Questions are shown in normal type, numbered Q1, Q2, etc. Suggested answers are shown in bold type.

“OPEN-BOOK” EXAM, WHICH YOU DID IN LEARNING SUITE (200 POINTS TOTAL)

Coronary Heart Disease

Q1. [20 points] Consider the graph below, which shows the cumulative incidence of cardiovascular disease according to the number of ideal cardiovascular health factors, in 5 groups of middle-aged American adults who were tracked by researchers for over 20 years. "Cumulative incidence" means, over time, the percentage of people in each group who developed cardiovascular disease. "Cardiovascular disease" means, in this study, coronary heart disease as well as other related diseases. The 5 groups of people are represented by lines on the graph labelled as 0, 1, 2, 3, and 4. The meaning of the labels is as follows:

- 0 = people who have zero ideal cardiovascular health factors
- 1 = people who have one ideal cardiovascular health factor
- 2 = people who have two ideal cardiovascular health factors
- 3 = people who have three ideal cardiovascular health factors
- 4 = people who have four, five, six, or seven ideal cardiovascular health factors

QUESTIONS: What are the seven factors that are used to measure cardiovascular health? Based on the graph above, what conclusion can you draw about the importance of the seven factors for preventing coronary heart disease and related diseases? To support your conclusion, refer to the data shown in the graph for the 5 groups of people.

The seven factors are smoking, diet, physical activity, body mass index, blood pressure, blood sugar, and blood cholesterol.

From the graph, we can conclude that people who have higher numbers of ideal factors also have lower risk of developing cardiovascular disease (including coronary heart disease and related diseases). About 45% of people with zero ideal factors developed cardiovascular disease over the course of 20 years, but only about 35% of people with one ideal factor, 25% of people with two ideal factors, 15% of people with three ideal factors, and less than 10% of people with four or more ideal factors developed cardiovascular disease over the course of 20 years. The seven factors are very important for preventing coronary heart disease and related diseases.

Stroke

Q2. [20 points] Consider the map below, which shows the rates of death from stroke in various geographic locations in the United States. Darker purple shading indicates higher rates of death from stroke, ranging from about 100 stroke deaths per 100,000 population (lightest purple) to about 200 stroke deaths per 100,000 population (darkest purple). The southeastern states where most of the darkest purple is concentrated are known as the "Stroke Belt" states.
QUESTION: What data would you need to collect in order to adequately address the hypothesis that the Stroke Belt is partly caused by fried chicken?

(While grading the exam, I realized this question had some conceptual problems, so I decided to give every student 20 points regardless of how the question was answered.)

Lung Cancer
Q3. [20 points] Consider the stacked bar chart below, which shows DALYs for lung cancer per 100,000 population in China from 1990-2010, attributable to three risk factors:

- Dark blue: lung cancer DALYs attributable to smoking
- Light blue: lung cancer DALYs attributable to ambient PM pollution (which means outdoor "particulate matter" air pollution from car exhaust, etc.)
- Yellow: lung cancer DALYs attributable to household air pollution (which comes from cooking inside the home over an open fire made with unclean solid fuels)

QUESTION: Based on the patterns you see in the graph, which would you expect will contribute more to the burden of lung cancer in China in the year 2020 -- ambient PM pollution or household air pollution? Refer to the time-related trends in your answer.

We would expect ambient PM pollution to contribute more than household air pollution to the burden of lung cancer in China in 2020. This is because from 1990 to 2010 the rate of lung cancer DALYs due to ambient PM pollution was increasing, so we would expect it to continue to increase, and the rate of lung cancer DALYs due to household air pollution was decreasing, so we would expect it to continue to decrease.

Colorectal Cancer
Q4. [20 points] Consider the maps below. The first map ranks US states in groups by colorectal cancer incidence (occurrence of new colorectal cancer cases). The second map ranks US states in groups by colorectal cancer mortality (deaths from colorectal cancer). In both maps, dark red marks the highest states, and dark blue marks the lowest states. The data are from 2002-2003.

QUESTION: Suppose it is the year 2004, and the Centers for Disease Control (CDC) invited State Health Departments from across the US to apply for funding to initiate colorectal cancer prevention programs. If you were working in the State Health Department in Kentucky, what arguments could you make, based on the maps, to persuade the CDC to fund a colorectal cancer prevention program in Kentucky, instead of other states?

We could argue that CDC should prioritize funding a program in Kentucky because Kentucky has one of the highest colorectal cancer incidence rates, and Kentucky has one of the highest colorectal cancer mortality rates, compared with other states. According to the incidence map, Kentucky is among the top 6 states (among states with data available). According to the mortality map, Kentucky is among the top 7 states (all states had data available). Kentucky is one of only two states (along with West Virginia) to be at the top of
both the incidence and mortality lists. Therefore, the problem of colorectal cancer appears to be worse in Kentucky than almost any other state.

Breast Cancer

Q5. [20 points] Mutations in BRCA1 and BRCA2 genes confer a lifetime risk of breast cancer of about 80%. This means that about 80% of women who have BRCA1 or BRCA2 mutations will develop breast cancer during their lifetime, in the absence of preventive interventions. One such preventive intervention is a double mastectomy, or removal of both breasts. The rationale for this intervention is that if breast tissue is removed, breast cancer will not develop.

Consider the data below from two cohorts of 40-year-old women who had never previously been diagnosed with breast cancer. Women in both cohorts had BRCA1 or BRCA2 mutations. Women in cohort 1 underwent double mastectomy. Women in cohort 2 did not undergo double mastectomy.

<table>
<thead>
<tr>
<th>Cohort</th>
<th>Number of women in cohort</th>
<th>Average time women were followed in study</th>
<th>Number of breast cancers diagnosed during follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – double mastectomy</td>
<td>247</td>
<td>3.1 years</td>
<td>0</td>
</tr>
<tr>
<td>2 – no double mastectomy</td>
<td>1,372</td>
<td>3.1 years</td>
<td>98</td>
</tr>
</tbody>
</table>

QUESTIONS: Based on the data in the table above, how effective was double mastectomy as a preventive intervention? Refer to specific information from the table to support your answer. For women in this study, what level of prevention would double mastectomy represent -- primordial prevention, primary prevention, secondary prevention, or tertiary prevention? Why?

The double mastectomy intervention was very effective. In this study, there were zero breast cancers diagnosed among the women who had double mastectomy (0% of women), compared with 98 breast cancers diagnosed among women who did not have double mastectomy (7% of women).

For women in this study, double mastectomy represents primary prevention, because the goal was to prevent the occurrence of a disease – breast cancer – in women who already had an important risk factor present (BRCA mutation).

Obesity

Q6. [20 points] In the article by Cassaza and colleagues, "Myths, Preumptions,and Facts about Obesity," which we studied in GRA #18, one of the "facts" stated was "Physical activity or exercise in a sufficient dose aids in long-term weight maintenance." In support of this "fact," Cassaza and colleagues cited an article by Wu and colleagues entitled "Long-term effectiveness of diet-plus-exercise interventions vs. diet-only interventions for weight loss: a meta-analysis." The article by Wu and colleagues provides some evidence in favor of diet-plus-exercise causing weight loss more effectively than diet-only.

Please see excerpts from the abstract, or summary, of the article by Wu and colleagues below:

**Long-Term Effectiveness of Diet-Plus-Exercise Interventions vs. Diet-Only Interventions for Weight Loss: a Meta-Analysis**
Wu T, Gao X, Chen M, van Dam RM

Diet and exercise are two of the commonest strategies to reduce weight. Whether a diet-plus-exercise intervention is more effective for weight loss than a diet-only intervention in the long-term has not been conclusively established. The objective of this study was to systemically review the effect of diet-plus-exercise interventions vs. diet-only interventions on both long-term and short-term weight loss.
Studies were retrieved by searching MEDLINE and Cochrane Library (1966 - June 2008). Studies were included if they were randomized controlled trials comparing the effect of diet-plus-exercise interventions vs. diet-only interventions on weight loss for a minimum of 6 months among obese or overweight adults. Eighteen studies met our inclusion criteria. Data were independently extracted by two investigators using a standardized protocol.

... The pooled weight loss [across 18 studies] was 1.14 kg ... greater for the diet-plus-exercise group than the diet-only group. ... Even in studies lasting 2 years or longer, diet-plus-exercise interventions provided significantly greater weight loss than diet-only interventions. In summary, a combined diet-plus-exercise programme provided greater long-term weight loss than a diet-only programme. However, both diet-only and diet-plus-exercise programmes are associated with partial weight regain, and future studies should explore better strategies to limit weight regain and achieve greater long-term weight loss.

QUESTIONS: Of the 8 criteria for assessing causality listed below, which are addressed in the abstract by Wu and colleagues? Which are not addressed? Use specific phrases from the abstract to support your answer. (If you need to review what the 8 criteria mean, recall that they were part of GRA #6.)

8 Criteria for Assessing Causality
- Strength of association
- Consistency of association
- Specificity
- Temporal relationship of the association
- Biological gradient
- Biological plausibility
- Coherence
- Experimental evidence

Strength of association is addressed: “... pooled weight loss was 1.14 kg ... greater for the diet-plus-exercise group than the diet-only group.”

Consistency of association is addressed: “... [across 18 studies] ...”

Specificity is addressed: “Diet and exercise are two of the commonest strategies to reduce weight.” (This sentence shows that specificity is not met, because weight loss is not related to just one specific cause or exposure.)

Temporal relationship of the association is addressed: “randomized controlled trials comparing ... interventions ... for a minimum of 6 months” or “... studies lasting 2 years or longer ...”

Biological gradient is not addressed. (There is no information given about more exercise or higher intensity exercise leading to more weight loss than less exercise or lower intensity exercise.)

Biological plausibility is not addressed. (There is no information given about why, biologically, we would expect exercise or diet to be related to weight loss.)

Coherence is not addressed. (There is no information given about different types of studies – all the studies were of the same type, randomized controlled trials.)

Experimental evidence is addressed: “Studies were included if they were randomized controlled trials ...”

Diabetes

Q7. [20 points] A 48-year-old woman attended a regular annual check-up with her doctor. At the check-up, the woman's weight was measured as 220 pounds and her height was measured as 5 feet 6 inches, leading to a body mass index of 35.5 kg/m². When the doctor asked the woman how much she exercised, the woman answered, "not much." The doctor took a blood sample, and sent it to the lab to measure the woman's A1C, also known as glycosylated hemoglobin. Later, the lab reported that the woman's A1C was 7%. The doctor contacted the woman again and asked her to come in after an overnight fast to provide a fasting blood sample. The
woman did so, and this time the lab measured her fasting plasma glucose level as 140 mg/dL. This information led the doctor to diagnose the woman with diabetes. The doctor did not measure the woman’s insulin levels.

**QUESTION:** Which type of diabetes does this woman most likely have -- type 1 diabetes or type 2 diabetes? Use information given above, and your knowledge of population patterns of diabetes or causes of diabetes, to justify your answer.

The woman most likely has type 2 diabetes. Population patterns indicate that 80% to 90% of all diabetes is type 2 diabetes, and we know that type 2 diabetes tends to occur in adults who are overweight or obese and engage in little physical activity. In contrast, population patterns indicate that only 10% to 20% of all diabetes is type 1 diabetes, and we know that type 1 diabetes tends to occur in children or adolescents who are normal weight. Because the person in this case study is 48 years old, obese, and gets little exercise, she probably has type 2 diabetes.

**Chronic Obstructive Pulmonary Disease (COPD)**

Q8. [20 points] **QUESTIONS:** In lung function, what does "ventilation" mean, and what does "gas exchange" mean? Which of these concepts is more directly related to the "straws and stairs" activity we did in class? Justify your answer by explaining how "straws and stairs" partly simulates the experience of a person who as COPD.

Ventilation means moving air into and out of the lungs by breathing. Gas exchange means oxygen (O\(_2\)) gas moving from the air to the blood, and carbon dioxide (CO\(_2\)) gas moving from the blood to the air, in the alveoli. Straws and stairs is more directly related to ventilation than to gas exchange, because breathing through a straw simulates the difficulty COPD patients have in breathing in and out (especially breathing out).

**Major Depression**

Q9. [20 points] Consider the stacked bar charts below, which show the rates of DALYs per 100,000 population in the United States for several mental and behavioral disorders, by age group and for men and women separately. Note that major depressive disorder (MDD) appears in a blue-ish purple-ish color, just below bipolar disorder which is in dark blue. Note also that the Y-axis scale is slightly different for men than for women, but not much different.

**QUESTIONS:** Based on these data, what is the sex-related (male vs female) population pattern of the rate of DALYs for major depressive disorder (MDD)? What is the age-related population pattern of the rate of DALYs for MDD? How does the rate of DALYS for MDD compare with the rates of DALYs for other mental and behavioral disorders, in males and females, and in stages of life including childhood/adolescence (up to age 19), early adulthood (ages 20-44), middle adulthood (ages 45-64), and late adulthood (ages 65 and up)?

Females have a higher rate of DALYs than males for MDD at all age groups beginning at ages 5-9. There are no DALYs for MDD before age 5, but from ages 5-9 to 15-19 the rate of DALYs for MDD rapidly increase for both sexes. The rate of DALYS for MDD stays somewhat constant throughout early to middle adulthood, then declines a little (not much) in late adulthood.

For males, MDD has a higher rate of DALYs than any other disorder on the graph from ages 5-14, but from ages 15-54 self-harm is at least as prominent as MDD, and drug use disorders tend to be much more prominent than MDD. Alcohol use disorders and schizophrenia tend to be less prominent than MDD, but have similar rates of DALYs as MDD during middle adulthood. Eating disorders, anxiety disorders, bipolar disorder, and dysthymia seem to be less prominent than MDD at all ages.
For females, MDD appears to have a higher rate of DALYs than any other disorder on the graph across all ages from 5-79. Self-harm never becomes very prominent in the females, unlike the males. Drug use disorders peak in early adulthood, and alcohol use disorders and schizophrenia peak in middle adulthood, but never become as prominent as MDD. Eating disorders, bipolar disorder, and dysthymia seem to be less prominent than MDD at all ages. Anxiety disorders are much more prominent in the females than the males at all ages, but don’t become quite as prominent as MDD, even in the females.

**Alzheimer’s Disease**

Q10. [20 points] Consider the graph below which shows employment-related consequences of taking care of a person who has Alzheimer’s disease, reported by women and men who are caregivers.

![Graph showing employment-related consequences of taking care of an Alzheimer's disease patient, reported by women and men.]

**QUESTIONS:** For women, which employment-related change is most commonly reported? For men, which employment-related change is most commonly reported? In general, which gender experiences more employment-related changes, men or women? What is a potential reason that the patterns of employment-related changes differ for women vs. men?

For women, going from full time to part time work is most common. For men, taking a leave of absence is most common. In general, women experience more employment-related changes than men. This could be because of at least two cultural reasons: (1) our culture tends to prioritize women taking care of health-related needs of other family members, and (2) our culture tends to prioritize men being breadwinners.
For my Citizenship Project I chose to foster collaborations with two fellow faculty members in the Dept of Health Science, including collaborative teaching with Len Novilla and collaborative research with Ray Merrill.

**Collaborative teaching with Len Novilla**
Len and I both teach sections of HLTH 310 – Chronic Diseases: Prevention and Control. We share a similar set of learning outcomes for the course, but we have different approaches for helping students achieve those learning outcomes. We decided to implement some collaborative strategies to enhance our teaching.

1. **Leading guest sessions in each other’s sections of HLTH 310.** Beginning in Fall 2014, and continuing now into Winter 2015, I have provided a guest session on stroke to Len’s students, and Len has provided a guest session on breast cancer to my students. For me, this has been a positive experience because I have been able to interact with a larger number of students, expose my students to more than one teacher, and observe Len’s approach to teaching the class.

2. **Meeting together periodically to discuss our ideas for teaching HLTH 310.** During Fall 2014 we met approximately twice a month. I shared my ideas with Len, especially about new learning activities or assessments I was developing as part of my Course Development Project. Len also shared with me some of her learning activities and teaching strategies.

My efforts to collaborate with Len on teaching HLTH 310 have been positive. I look forward to continuing our trading guest sessions and discussing potential improvements to our courses.

**Collaborative research with Ray Merrill**
Ray and I intended to do a collaborative research paper together, about correlates of carotid artery intima-media thickness (IMT) in adults, using a dataset available to Ray containing IMT and various lifestyle variables obtained from adults attending the World Senior Games in St. George, Utah, or a community health fair in Spanish Fork, Utah. Unfortunately, that project did not pan out, partly because I ended up prioritizing other research papers described in my Scholarship Strategies Project, as well as papers lingering from my PhD and postdoc; and partly because Ray discovered that the dataset did not indicate any compelling associations of lifestyle variables with IMT.

Ray and I still intend to create opportunities to work together on a collaborative research project. More than likely, this will occur as we join forces to mentor students. One of my students, Hilary Collins, is working on a research project about atrial fibrillation and stroke. Hilary and I have invited Ray to participate as a coauthor and additional mentor to Hilary. Just recently, another of
my students, Benji Lambson, decided he wants to further develop a paper he wrote in my HLTH 310 Chronic Diseases class, about water fluoridation and osteosarcoma, in hopes of publishing the paper in the future. Benji and I intend to invite Ray to participate as a coauthor and additional mentor to Benji. So, although Ray and I have not yet submitted a paper together, I am confident we will do so in 2015, along with the student researchers we are mentoring.

In addition to these preliminary efforts to do collaborative research with Ray, I have started to engage in collaborative research with Len Novilla, which I didn’t anticipate when I wrote my Citizenship Project proposal. Another one of my students, Jordan Westra, is working on a project about cardiovascular health and cognitive decline. Jordan and I invited Len to participate as a coauthor and additional mentor to Jordan, in order to draw on Len’s interests and expertise in health of elderly adults and social determinants of health.

Over the next several years, I anticipate publishing multiple papers with Ray, with Len, and possibly with other faculty members in my department. Based on my experience over the past year, it appears that a good model for these collaborations will be for me to identify opportunities for me and another faculty member to co-mentor student researchers.
Scholarship Strategies Project Final Report

Evan Thacker

February 2015

For my Scholarship Strategies Project I chose to focus on publishing peer-reviewed articles about connections of cardiovascular health with cognitive function. This is an area in which I want to become a recognized expert, and successfully mentor BYU student researchers.

Success in accomplishing scholarly goals
I set a specific goal to submit three articles to peer-reviewed journals with BYU students serving as first authors, by February 2015:

1. **Heart failure and cognitive decline**, with student Christa Schank as first author. Christa and I submitted an abstract to the March 2015 American Heart Association Epidemiology & Prevention Conference, to be held in Baltimore, MD. Her abstract was accepted for oral presentation:


   The full-length manuscript is in progress, to be submitted to a journal in 2015.

2. **Adiponectin, leptin, resistin, and cognitive impairment**, with student Reena Karki as first author. Reena and I submitted an abstract to the June 2015 Society for Epidemiologic Research Conference, to be held in Denver, CO. Her abstract is under review:


   The full-length manuscript is in progress, to be submitted to a journal in 2015.

3. **Coronary heart disease, CABG surgery, and cognitive decline**, with student Monica Scrobotovici as first author. The data analysis is in progress. We plan to submit an abstract to a conference and a full-length manuscript to a journal in 2015.

   In addition to the student-authored projects listed above, I initiated student-authored projects with two other BYU students, Hilary Collins and Jordan Westra. I also prioritized publishing some papers from my PhD and postdoc during the Scholarship Strategies Project time period:

Experience in applying strategies to enhance scholarly productivity

The most important strategy I adopted was to write every weekday, for at least 15 minutes, on the relationship of cardiovascular health with cognition. I tracked daily whether I engaged in this writing, and which specific writing projects I worked on. These writing projects included, for example, supporting the student-authored projects above, writing my own first-authored papers, or developing proposals for future papers.

For the past six months I have engaged in daily writing most days, not all days. I am certain my habit of tracking my daily writing behavior actually increased the number of days I wrote. Some days I chose to spend time writing on projects not directly connected to the theme of cardiovascular health and cognition, for example, some papers from my PhD and postdoc that were on other topics in cardiovascular epidemiology. However, most days I chose to write on cardiovascular health and cognition, especially to support my students working on projects listed above. These collaborative writing projects have been productive for both me and the students.

I intend to continue pursuing my habit of daily writing. I am convinced it will help me continue to move forward in publishing my own future first-authored papers, as well as the student-authored papers where I am mentoring BYU student researchers.

Plans for enhancing future scholarly productivity

With several of my own PhD and postdoc first-authored papers now published, several student-authored manuscripts underway, and several more student-authored or first-authored manuscripts waiting in the wings, I feel we are in a position to be very productive in publishing peer-reviewed articles over the next few years. Daily writing to move these projects forward is more important now than ever; without daily writing, the projects tend to stagnate.

In addition to maintaining and improving my daily writing habit, I plan to consistently give highest priority to whichever manuscript is closest to journal submission. This way, my students and I will move well-developed projects off our plates, enabling medium-developed projects to move into priority, and eventually enabling us to pursue new projects that are currently at the proposal stage or the idea stage.