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Blue Zones: Unlocking Key Themes in the Centenarian's Life

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Certificate of Approval

Blue Zones: Unlocking Key Themes in the Centenarian's Life

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Blue Zones: Unlocking Key Themes in the Centenarian's Life

Submitted in partial fulfillment

Of the requirements

For the Murray State University Honors Diploma

Grace Beer

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Abstract

Longevity has been sought after in certain areas of the world, and there are specific regions where this has been achieved. There is an American average life expectancy of 72 years old, but individuals in “Blue Zones” here in America and other areas of the world are expected to and have proven to live well beyond 100. The areas of Okinawa, Sardinia, Nicoya, Ikaria, and Loma Linda are classified as Blue Zones, and there could be more of an understanding of how these people live the way they do to have such healthy physical outcomes. To deeply understand the strategy and routine that individuals have been practicing for years, researchers in multiple fields have set out to be informed and educated on the habits of centenarians. For this project, a pre-test was given to students to gauge their level of knowledge concerning Blue Zones prior to an educational session. Following the presentation, the same students took a post-test to reveal the knowledge they had acquired. By conducting literary as well as educational research through this study, students at Murray State were encouraged to be involved to understand what it means to live a healthy lifestyle to possibly increase their quality of life in all areas: physically, mentally, and spiritually.

Blue Zones: Unlocking Key Themes in the Centenarian's Life

Introduction

There are populations around the globe today that live healthy lifestyles causing them to live well beyond the average American threshold. A region in California is said to have 34 percent less heart disease deaths than the rest of the United States, and this region is classified as a Blue Zone (Casale, 2022). Poulain et. al (2013) describes these areas, or Blue Zones, as a "rather limited and homogenous geographical area where the population shares the same lifestyle and environment and its longevity has been proved to be exceptionally high" (p. 89). Looking at different explorers' and researchers' findings has led to an understanding that there may just be truth to trending healthy lifestyles adding years, maybe decades, to people's lives.

Background and Significance

In 1973, a physician named Alexander Leaf made discoveries in Pakistan, the Soviet Union, and in Vilcabamba where there were ten times the number of centenarians than western regions (Poulain et al., 2013). Years later, Dan Buettner, Michel Poulain, and Gianni Pes founded the Blue Zones as they explored different regions around the world that held the same characteristics. Populations that these explorers are still researching today are found in Ikaria, Greece; Sardinia, Italy; Loma Linda, California; Okinawa, Japan; and Nicoya, Costa Rica. Buettner has written a book titled *The Blue Zones: 9 Lessons for Living Longer from the People Who've Lived the Longest* that explains his discoveries as well as links between regions that support the idea that a certain lifestyle or version of it can lengthen one's lifespan.

It is essential to understand the process of aging and what that generally means for humanity in order to understand the impact that healthy living has made on centenarians. The director of the Center on Aging at the University of Minnesota in Minneapolis states that "aging

starts at birth" and that it is a "failure to be able to maintain internal control and balance" (Kane, 2008). Steven Austad, the author of *Why We Age: What Science is Discovering About the Body's Journey Through Life*, goes even further to say humans are not "designed to maintain [their] physical integrity forever" (Austad, 2008). The average American lives to his/her late 70s, early 80s, and this is profound in understanding the significance when comparing populations in the Blue Zones where it is not uncommon to live to 100.

Buettner outlines the beginning of his curiosity in aging and if there is truth to living a healthier or the healthiest lifestyle (Buettner, 2008). He tells the story of Juan Ponce de LeÓn and of his quest for a Fountain of Youth that did not exist. After explaining this idea that started as an attempt to escape a government decision against him, he links this to the continued "boneheaded" quest that many look to embark on today through placing hope in pills, medical procedures, or diets (Buettner, 2008). He then expounds upon the fact that to live a long life is nothing if it is not quality and enjoyed.

Purpose

It is important for individuals to be aware of their health potential as they live their lives. Whether this information changes others' actual lifestyles or not, there is importance to conveying the information so that it might be contemplated. The purpose of this study was to investigate and understand Murray State students' knowledge on Blue Zone facts and their awareness of them. The aim as the researcher was to educate students about healthy living habits of individuals that varied by age, culture, and location. Real life experiences and testimonies from centenarians as well as actual researchers' experiences were included in the education to the students. The information that was conveyed was also meant to give students tangible steps to take in making healthier choices, although this outcome was not measured nor recorded.

Hypothesis

The hypothesis regarding this study was that educating college students attending Murray State about Blue Zones will increase their post-test scores from their pre-test scores. The hypothesis is that they would learn what these cultures and lifestyles entail and actual differences that real humans have seen in their lives because of the way they live healthily. Being a Murray State student, there are plenty of opportunities to examine peers' lifestyles as well as take note of their own patterns of living that may or may not influence their overall lifespan. Understanding that not all students are aware of the world around them and of the lifestyles of different cultures, a hypothesis can be formed that not as many students would be aware of Blue Zones. Specifically, the goal of this study was to see whether there was a statistically significant increase in post-test scores compared to pre-test scores prior to teaching. The independent variable in this study was the educational session. The dependent variable was the scores that the participants made based on the influence of the presentation.

Review of Literature

Defining Blue Zones

As stated in the background section, Blue Zones came to be when Dan Buettner, a researcher, and two of his partners, Michel Poulain and Gianni Pes, started to notice significant similarities between inhabitants' lifestyles and the effects that these lifestyles had on overall life span. These inhabitants are known as centenarians, and they inhabit regions where the populations have exceptionally higher longevity, and this is what characterizes these regions as Blue Zones (Poulain, et al., 2013). The geographical regions that these researchers have studied include Nicoya, Costa Rica; Okinawa, Japan; Loma Linda, California; Sardinia, Italy; and Ikaria,

Greece . Understanding how old individuals live to be in Blue Zones is essential in knowing if these lifestyles are comparable to those in the United States.

Aging

Those that live to be beyond 100 years old are known as "centenarians." The high centenarian population in Blue Zone regions contributes to the uniqueness of these areas. Centenarians in these areas are not living sick, debilitative lives past 100 years of age which sets them apart from those that live quite dependently in their later years. Some scholars define aging and sort through its nature. Dr. Robert Kane argues that humans naturally start to decline physically by their mid 30s and 40s (Buettner, 2008). He goes on to talk about old age, and how naturally there is a negative stigma to that stage of life. The loss of autonomy and the increase in physical, mental, and social dependence is what makes some dread this season.

Robert Butler, the President and CEO of the International Longevity Center in the United States, educates on the practices that many humans take part in that are ill-advised and decrease longevity. Human growth hormone, an anabolic steroid, affects the aging population increasing health issues such as Carpal Tunnel Syndrome, insulin resistance, Type-2 Diabetes, edema, joint pain, cardiac abnormalities, and increased risk of a variety of cancers (Mayo, 2021). He also discourages use of melatonin and DHEA, a "junk hormone," as these speed up the aging process negatively (Mayo, 2015).

There are opinions that follow in the book titled *The Blue Zones: Lessons for Living Longer From the People Who've Lived the Longest* (Buettner, 2008) that explain the advantages of living 100 percent healthy to avoid the risk of aging in an unhealthy way. It is one practice to take vitamins every day, but what are humans consuming in all of the other hours of the day? In

later sections, Blue Zone testimonies and examples of some healthy lifestyles describe the reason why elders in these regions are as wholly healthy as they are.

Power 9 Principles

Dan Buettner, based on his research and discoveries, formulated a list of nine principles that help categorize and define the different areas of health for those living in Blue Zones. They are as listed: Natural movement, having purpose, down shift, 80 percent rule, plant slant, wine at five, right tribe, belong, and loved ones first. These evidence-based principles define living one's life to its full health capacity. Grand Rapids Community College describes wellness as something that reaches all corners, not just the physical side (*Seven*, n.d.). Understanding that neglect to any area of wellness for an extended amount of time will decline health is essential in understanding the nine principles that Buettner has laid out.

Moving Naturally

Movement is extremely essential in increasing endurance and immobility prevention, therefore preventing active decline in health. An article concerning adding small bursts of exercise every 20 minutes or so highlights the importance of making movement a continual preventative measure (Cook, 2021). Substitutes for activities of daily living may seem convenient at the moment, but Cook explains the long-term impact of, for example, skipping the electric mixer by using a mixing utensil, activating neuromuscular motion (Cook, 2021*).*

Ikaria, Greece is a prime example of a Blue Zone that facilitates movement simply by its geographical location. Living on the side of mountains off of the Aegean Sea, centenarian inhabitants exercise without even contemplating it as they are always walking to their neighbors' homes, gardening, and moving from place to place on steady inclination (*Ikaria*, 2021). In Okinawa, Japan, a traditional hobby and exercise that most enjoy is martial arts. An article about

physical activity explains that centenarians believe that as long as the body is moving with rigor or purpose for five to ten hours a week, muscles are being activated that are increasing overall physical health (*Cook*, 2021).

Dr. David Agus states that "our bodies were designed to move" (Kotifani, 2021). This does not necessarily mean going to the gym to get a daily dose of movement. Among all of the Blue Zones, walking is an extremely essential activity that all of their centenarians say improved their whole well-being. Some of walking's benefits include activating toxins, fighting infection, strengthening immunity, and eliminating toxins (Leonard, 2021*)*. Breaking up movement throughout the day rather than going to the gym once a day is more beneficial long-term as the American Cancer Society highlights data that links walking to a lower risk of dying from cardiovascular and/or respiratory disease (Simon, 2017).

Down Shift, Knowing Your Purpose

Emotional well-being is as important as physical health in the journey to wellness. Finding time to eliminate stress in life can seem impossible at times, but the inhabitants of Sardinia are optimal examples of incorporating stress-relief into every moment of their day through laughing. Laughter is a mindless, non-pharmacological antidepressant. Laughing can control levels of serotonin in the brain and decrease release of cortisol that can wear down immunity over time (Gibson, 2020). There is a balance between not letting life become so serious as well as knowing that one has a specific purpose in their life that also affects the lives of others. Having a healthy perspective on life has been pivotal in centenarians' lives as they mentally resolve situations before letting themselves overreact, therefore eliminating the feeling of burden or stress.

Feeling needed or having a purpose in life is an essential value for the Costa Rican centenarian. Contributing to a greater good and having an influence on others' lives makes one's life seem more valuable, in turn increasing diligence and endurance in hard times (*Nicoya*, 2021). Asking themselves why they wake up in the morning is very integral in Okinawan and Costa Rican culture as they contemplate their *ikigai* or *plan de vida* (*The Right*, 2021). Thinking about "ideals, principles, standards, and morals" helps clear the mind, progressing the quest to find one's contribution to the world. The same article states that volunteering has been shown to decrease rates of cancer, heart disease, and depression as a sense of accomplishment and purpose related to service is established.

80% Rule, Plant Slant, Wine at 5

Diet contributes significantly to the overall well-being and stretched lifespans of individuals in Blue Zones. Knowing how much food to eat as well as when to eat it makes centenarians' lives different in comparison to those that do not put much thought into their diet or routine in eating. Dan Buettner's research includes his time with Gonzei Shinzata, an Okinawan woman, who recites "Hara hachi bu" before eating to remind herself to only eat until she is 80 percent of the way full (Leonard, 2021). Buettner has also found that eating the smallest meal in the late afternoon or evening is most effective, and eating mostly plants and small three to four-ounce portions of meat only five times a month increases nutrition. Drinking alcohol moderately is also found to be in relation to the optimal health of centenarians (Barclay, 2015*)*. Nicoya, Costa Rica incorporates Meso-American agriculture such as squash, corn, and beans into their diet, and they use these ingredients to make delicious recipes high in nutrients to keep their diets interesting and enjoyable (Barclay, 2015). Other foods included in this Blue Zone include papayas, peach palms, bananas, and yams. As most of the centenarians focused on in Loma

Linda are Seventh-Day Adventists, they contribute a lot of their wellness to their faith. Loma Linda, California follows a very simple, "biblical" diet focusing on vegetables, fruits, nuts, and grains. However, those that added a serving of fish a day, as seen in the Mediterranean diet, were seen to live longer than those that were vegan (Barclay, 2015).

The Mediterranean diet practiced in a few of these Blue Zones shows major beneficial factors. Aspects of this diet are kept very simple as a lot of the thought behind meals comes from making small changes in past habits. Switching to olive oil from butter or eating potatoes and meat fewer days in the week can cause a substantial shift in overall wellness as mood can be increased (Aubrey, 2013). Heart benefits and other long-term wellness effects are seen as well in those that take part in this diet. An associate professor from Brown University states that olive oil is so good for your heart that she considers it "more medicine than food" (Aubrey, 2013). Eating up to three ounces of fish daily has seen to be more beneficial than those practicing the vegan diet as well (Buettner, 2021).

Centenarians that inhabit various locations of Blue Zones have the habit of drinking a glass or two of wine at night to downshift, and this actually increases physical well-being as well. Those in Italy gravitate toward the Cannonau wine (*News*, 2020). Dr. Kawas, a speaker at the American Association for the Advancement of Science's annual conference, reveals that those that are not nearing their centennial years of life truly do benefit from having a glass or two of beer or wine a day, and that they are "18 percent less likely to experience a premature death than those who abstained" (*News*, 2020). This applies to moderately drinking a cup or two of coffee a day as well.

Right Tribe, Belong, Loved Ones First

Social aspects of individuals' health are often pushed aside as they do not seem as influential in wellness. However, many centenarians report that living with their grandchildren under the same roof as well as celebrating milestones and other ceremonies that are held dear in their cultures improves their social well-being. Scientists observed habits of civilians in 1965 in a town known as Roseto where they observed only nine heart attacks in nine years compared to a nearby town of Bangor, and the link was found to be in the thriving familial relationships and friendships, the low crime rates, and the self-sufficiency that these people were known for. These practices naturally strengthen bonds between individuals as "no one [is] ever alone, no one [is] ever lonely, no one [is] without overwhelming support and friendships" (Kahn, 2020).

Belonging to a religious organization or denomination is something that almost all centenarians interviewed by Dan Buettner said they practiced. Research proves that although denomination does not matter for centenarians, attending four or more religious services a month creates a feeling of belonging as they associate themselves with that belief, and it also increases life expectancy by four to 14 years (Project, n.d.).

Something that Okinawan centenarians take part in that increases their social interaction is participating in one or multiple *moais*. Klazuko Manna, a 77 year old woman from Okinawa, participates in her moai that includes women that build her up and support her. Dan Buettner says from their interview that "each member knows that her friends count on her as much as she counts on her friends. If you get sick or a spouse dies or if you run out of money, we know someone will step in and help. It's much easier to go through life knowing there's a safety net" (Leonard, 2021). These social support groups increase overall happiness in these individuals as there is respect and support bonding the centenarians.

Implementing Blue Zones into the United States

Currently in the United States, there are seven communities that have implemented Blue Zone practices into their population's lives and have seen effects. Albert Lea, Minnesota; Beach Cities, California; Klamath Falls, Oregon; Southwest Florida; Spencer, Iowa; Hawaii; and Fort Worth, Texas are among these areas that show proof of transformed environments due to improved well-being (*Project*, 2021). In Spencer, Iowa, fruit and vegetable consumption went up 11 percent, "more than 25 percent of elementary students moved naturally to and from school," and 25 percent of restaurants shifted to become Blue Zones restaurants (*Project*, 2021). An evaluation of the effects of the Blue Zone Project® was made and "more than 50 percent [of the Spencer, Iowa community] believe the Blue Zones Project helped create this positive impact" (Spencer, 2016).

Albert Lea, Minnesota worked to increase the cessation of smoking as the Blue Zones Project® implemented their strategies. In 2010, 23 percent of residents were smokers, and by 2016 that number had declined to only 14.7 percent saving $8.6 million in health care costs annually from that decline (Albert Lea, n.d.). These statistics have only driven communities to keep pushing the implementation of easy access to healthy lifestyles for their residents. In Fort Worth, Texas, miles of bicycle infrastructure increased from 9.6 miles to 86.8 miles in eight years, and bike route miles increased from 68 miles to 87.2 miles in eight years (Fort Worth, n.d.). To further explain this surge in community teamwork, Dan Buettner states in reflection of the Iowa community that "In communities with higher well-being, we have found that people live longer, happier lives and business and local economies flourish. A reliable well-being metric provides community and business leaders with the data and insights they need to help make sustained transformation a reality. After all, if you can't measure it, you can't manage it" (Spencer, 2016, p. 8).

College Students' Awareness of Blue Zones

Because of the recent discovery of Blue Zones and the limited amount of peer-reviewed literature available, there has not been a specific study to compare to involving the research of college students' prior knowledge of Blue Zones. However, because of Dan Buettner's implementation of the Blue Zones Project® in multiple American states, there can be predictions made of the impact of which Blue Zone knowledge would have on students. The Blue Zones Project® has a Life Radius Model that explains how certified Blue Zone Universities show students to have higher well-being, producing stronger engagement and satisfaction in the long run (Project, n.d.).

Methods

Design and Setting

A quasi-experimental pre-test post-test study design was used for this research that involved the administration of pre and post-tests to gauge students' knowledge. The tests were also used to give students a chance to test their own knowledge of Blue Zones in order to give them an idea of where they stood without giving information beforehand. These tests consisted of close-ended questions that allowed students to choose either one or multiple answers depending on the instructions given for each question. The post-test had a section at the end that allowed the opportunity for students to give any feedback or leave any last remarks regarding the educational session.

The Honors Student Council hosted a meeting in Franklin's Residential College Commons at nine in the evening where the researcher set up the presentation materials following the meeting. The session lasted 25 minutes including the testing that took place. The presentation itself lasted about 15 minutes. Students that were willing to participate were given a cover letter

(Appendix A) explaining the purpose of the study as well as any risks or benefits that were possible. The letter was read to the participants and they were allowed to keep the letter so that they were fully able to refer back to the information and contact the researcher with any questions. A demographic questionnaire (Appendix B) was also distributed and was taken back up by the researcher at the conclusion of the presentation.

After the participants were aware of the research that was being conducted, a pre-test (Appendix C) was distributed, and about five minutes were taken to complete the questions. The students held on to their tests, being told not to change their answers, throughout the 15-minute presentation (Appendix D) about Blue Zones, and following the presentation, they were given a post-test (Appendix E) that consisted of the same questions. Once all of the documents were completed, the forms were collected, and the session concluded. Participants were aware that they were not to be compensated for their involvement in the study. Students were not scholastically involved in the study nor were under any requirement to be there.

Materials

In preparation for the research that would be conducted with Murray State students, a PowerPoint presentation was created (Appendix D) that included information regarding Blue Zones. In the presentation, the history behind Blue Zones was briefly described as well as the researchers' names and backgrounds that discovered them. The major populations of centenarians were related to each other, compared, and contrasted by their physical, mental, and spiritual health. The Power 9 Principles were intertwined into the information shared as this simplified the information and gave context. The participants were tested on their overall knowledge of Blue Zones through the tests (Appendices C and E) that were given to them at the beginning and end of the educational session. The questions on the tests were specifically related

to the presentation that participants would be listening to unless they were personal questions regarding their prior knowledge in the form of "yes" or "no" answers.

The bulk of information that was used in the presentation was found in articles produced from the Blue Zones website. Information was also collected from Loma Linda University Health, excerpts from Dan Buettner's book titled, "The Blue Zones: Lessons for Living Longer from the People Who've Lived the Longest," the *Vienna Yearbook of Population Research*, and the National Library of Medicine. At the educational session, the presentation was pulled up on a laptop, the television screen was used for participants' viewing, and small pieces of paper were distributed with four-digit codes written on them to help identify each participant.

Sampling Process

The population involved in the study consisted of Murray State students from all majors and backgrounds. The participants were recruited in a few different ways, although the sample mainly came from the Honors Student Council meeting. As the demographics (Appendix B) show, there was a variety of students based on their majors, ages, and ethnicities. All of the participants were at or above the age of 18, so all data were able to be used and recorded as stated in the cover letter's (Appendix A) rules regarding validity of participants.

Not all students involved in the study were a part of the Honors program as some heard about the educational session through an Instagram story, opening up the invite to any student attending Murray State. An email (Appendix G) was sent to the board of the Student Council a week prior to the event in order to inform students of the upcoming Honors presentation. Once all of the data was collected from testing, the sample size came out to be 26 participants.

Protection of Human Subjects

A few weeks before the research was conducted, the Institutional Review Board (IRB) approval was sought out through the submission of an application requesting allowance of research privileges. Project significance, participant selection, procedure/methods, informed consent, confidentiality/anonymity, and conflicts of interest were addressed in the application. The application was submitted on March 8, 2022 for review. On March 10, 2022 approval was given by the IRB (Appendix H) to go on conducting research, and research took place the following week on March 16, 2022.

Before the presentation started, all participants were encouraged to review a cover letter as the researcher read through the issues, and they were advised to keep the letter. The letter explained the participants' rights, the purpose of the study, the risks and benefits to participating, the voluntary style of the study, and the understanding that their responses would be anonymous and confidential (Appendix A). There was no requirement of them to stay or finish if they started the research process, and each participant was aware of their rights. As demographic sheets and pre and post-tests were turned in at the end with codes attached, there was an understanding of informed consent.

The identification administered to each participant were random four-digit codes that gave the researcher a way to group tests with demographic sheets for data purposes. As stated before, codes were written on top of the demographic sheet, the pre-test, and the post-test, and they were consistently listed for every document specific to that participant. The code numbers were completely random, and there was no order in the way they were distributed other than the participant pulling them randomly out of a bucket. All results were kept anonymous, and all rights were protected.

Information from the documents was kept completely confidential as no person had access to the results other than the researcher and the advisor. After results had been reviewed and recorded, all copies of result sheets were kept in Dr. Naber's office (219 Mason Hall). The results will be shredded after the three years are completed.

Data Collection

Explanation of the study took place at the beginning of the session with the use of the cover letter (Appendix A), and the demographic questionnaire was handed out first which asked the following questions: their gender, age, major, year of college they classified as, and their ethnicity. Their identification number is what allowed the researcher to group their demographics and their pre and post-test answer sheets together. At the end of the session, participants stacked all three of their documents on top of each other, and all results were gathered in one stack at the end of the session by the researcher and handled by the researcher only.

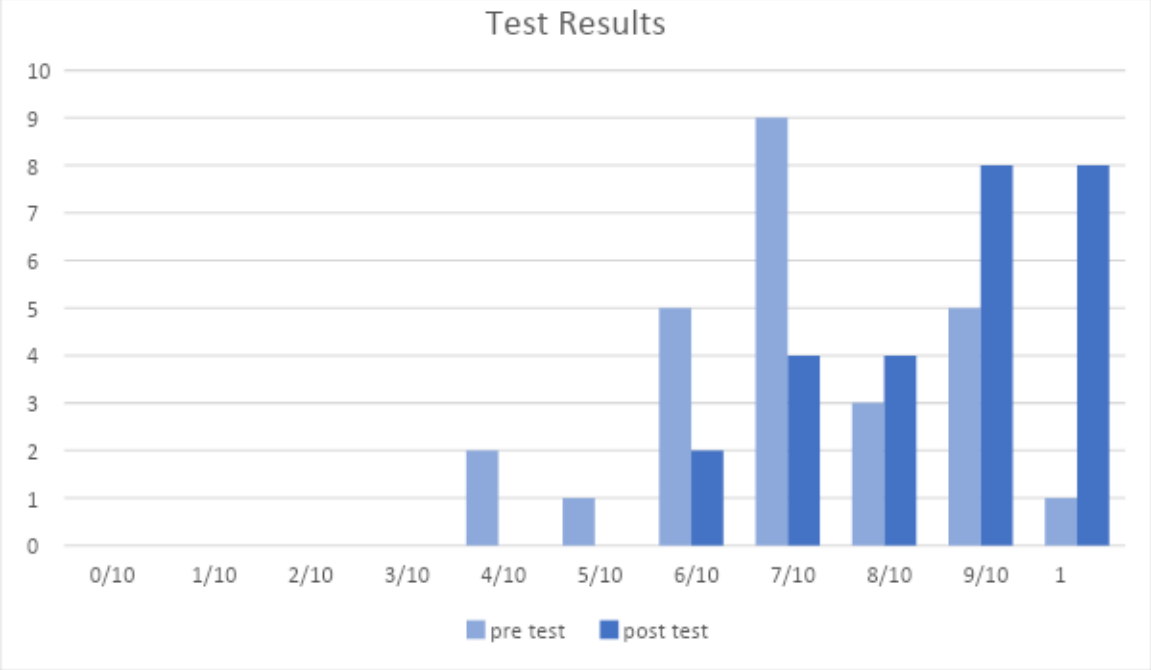
The method of data collection simply consisted of a test on paper that the students responded with their answers on. The pre-test consisted of 10 questions (Appendix B) that related to Blue Zones. Students kept their tests with them until the end of the presentation when they took the pre-test and then turned all documents in at once. The participants had as much time as they needed to complete the tests. Scores were not reviewed at all as a group to protect confidentiality and prevent any reviews between students.

Results

In all, there were 26 participants in the study. There was significance in the research outcomes as there was contrast in pre-test and post-test scores overall. The mean pre-test score was a 7.1 out of 10 which comes out to be 71%. The standard deviation of these scores was 0.15 meaning that there was a very small variation of scores from the mean. The lowest grade in the

pre-tests was a 40% with the highest being a 100%. The mean post-test score was 8.6 out of 10 which comes out to be 86%. The standard deviation of these scores was 0.13 which, again, proves that the variation between scores was very small as the scores were close to the average across the board. The lowest grade for the post-test was a 60% where the highest was a 100%. There was an increase in mean scores from pre-test to post-test by about 15% which was a positive outcome considering the presentation was supposed to increase the participants' knowledge base upon Blue Zones. In the following graph, there is a visual of the side by side data from the two tests. The x-axis signifies the score out of 10, and the y-axis includes the number of tests that consisted of those scores.

Graph 1: Results Comparing Pre-test/Post-test Scores



Testing the significance of the change in scores was done through a paired t-test. The t-value came out to be -3.80891, and the p-value was statistically significant as it was less than <0.05. Because of these values, the null hypothesis can be rejected and the alternate hypothesis

accepted that teaching Blue Zones to a group of students would increase their knowledge base to some degree.

Analysis of each question was done to see if there was any significance in the pre-test and post-test answers specifically. The following graph depicts this data. The numbers lining the left side of the table correlate with the question number on the pre-test (Appendix C) and post-test (Appendix E).

Table 1: Pre-test/Post-test Question Analysis

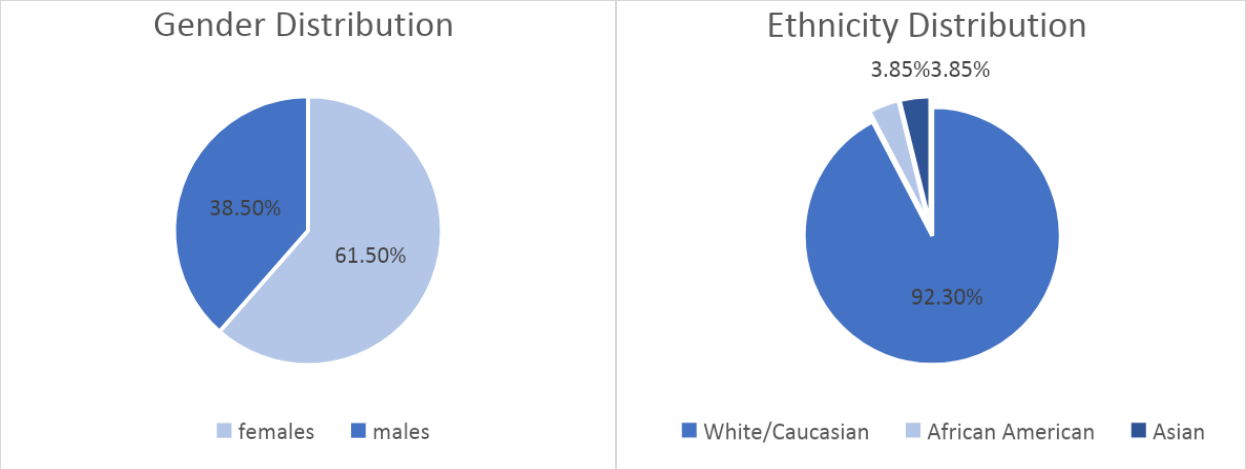
Question #	Pre-Test Score	Post-Test Score	Difference
1	21/26 (80.8%)	25/26 (96.2%)	Increase 15.4%
2	26/26 (100%)	26/26 (100%)	No change
3	26/26 (100%)	26/26 (100%)	No change
4	25/26 (96.2%)	25/26 (96.2%)	No change
5	17/26 (65.4%)	24/26 (92.3%)	Increase 26.9%
6	24/26 (92.3%)	22/26 (84.6%)	Decrease 7.7%
7	17/26 (65.4%)	18/26 (69.2%)	Increase 3.8%
8	19/26 (73.1%)	24/26 (92.3%)	Increase 19.2%
9	6/26 (23.1%)	20/26 (76.9%)	Increase 53.8%
10	16/26 (61.5%)	22/26 (84.6%)	Increase 23.1%

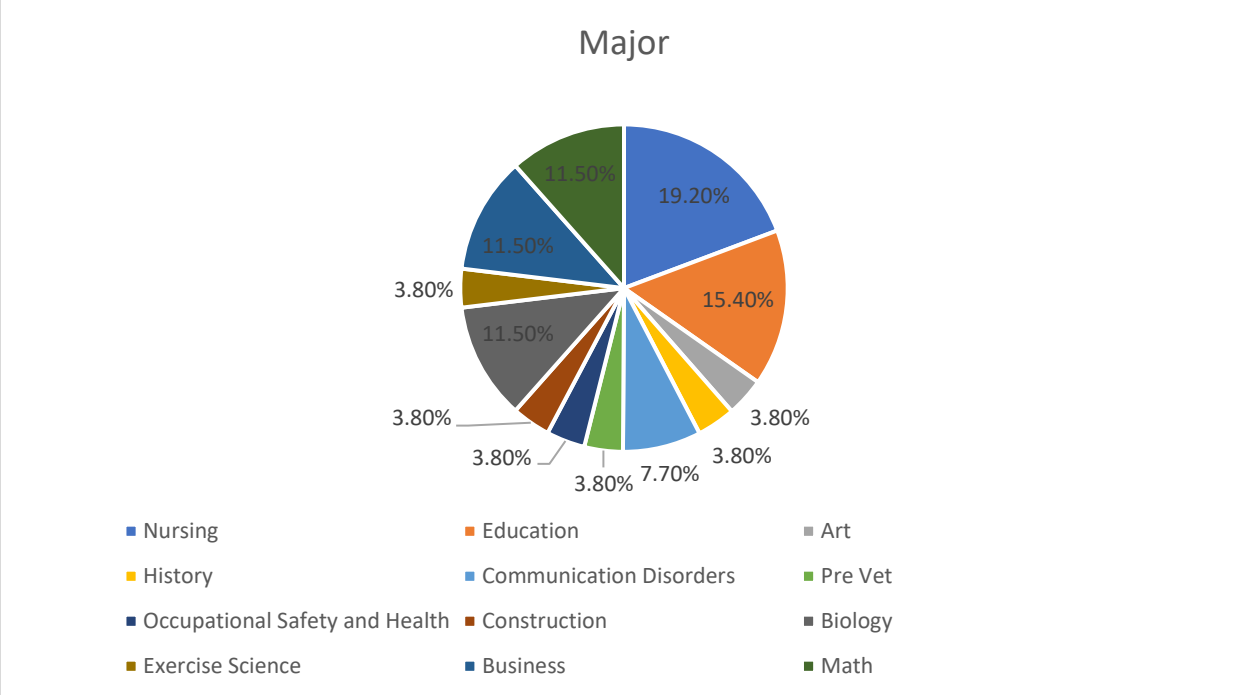
The p-value found by comparing the question number's scores between the two tests was 0.04541 which was significant as it is <0.05. The t-value was 2.32105. The average difference between the pre-test and post-test question answer was 13.45%.

Demographics

As the study materials were analyzed, there was slight diversity in the participant pool but not a large variety. 24/26 of the participants were White/Caucasian, and the other two participants were African American and Asian. Throughout the range of participants, there was a variety of majors from Nursing to Business, and these are listed in the chart below titled "Majors." There was a higher presence of females than males participating in the study by six females. There was an age range of 18 years to 22.

Charts of Demographic Distributions





Discussion

Looking through results, there were three out of the 26 participants that did worse on their post-test than their pre-test. This could be due to some unclear explanations of questions from the presentation. This could also be due to the students' accidental choosing of the wrong answer the second time when they had it right the first. Everyone else improved their test scores other than the six students that stayed at the same score. There was one participant, however, that did not change his/her score, but they scored a 100 percent on both tests. The negative t-value of -3.8 simply means that there was a significant increase in values between the pre-test and the post-test. Overall, the presentation seemed to be influential as scores were generally higher the second attempt at the test.

Something to mention about the tests was that question two was a bonus question. It asked if the participant heard of the term "Blue Zone," and they were simply supposed to circle "yes" or "no." Points were given for answering, but they were not if the student did not answer. However, there were 100 percent of answers given for question two in the pre and post-test.

The question with the most change, a 53.8% increase, was question nine as it asked which habits would contribute to longevity in an individual. Many students chose "cutting out dairy" which made sense as a lot of diets here in the United States have started to switch to non-dairy. However, after the presentation students decided against choosing that answer as they were informed that a healthy balance of dairy in the diet is common in centenarians. An article on dairy consumption explains that minimizing dairy intake is wise, and incorporating goat and sheep products can be implemented instead (Buettner, 2021). The other choice for question nine that some chose was "eating until you are 95% full" which sounds good, but after the presentation, students knew that it was actually 80% of the way full. Gaining this specific

knowledge is important as literature shows that Okinawans include a higher percentage of centenarians than anywhere else in the world because they practice this habit of stopping food intake at 80 percent. Students can realistically implement this into their lives by focusing on their food and not other distractions as they eat, eating slower, and using smaller vessels to hold their meals (Buettner, 2020).

The second most improved question from pre to post-test was question five as it asked how many Blue Zones were being researched in the world at the current time. This question was not expected to be guessed correctly the first time as the researcher understood that unless the students were researching the Blue Zones themselves, they would not have knowledge of this. Nine students missed this question at first, but after the presentation only two had missed it again.

The question that had a decrease in success rate from the pre-test to post-test was question six. There was a 7.7% decrease as four people answered "a heavy emphasis on not only the diet of an individual, but their total well-being is what produces the healthiest lifestyle" as false. As this was a True/False question, not much investigation can be put into understanding why this question's success rate decreased upon taking the post-test. However, it is important in the research of Blue Zones that students understand this triad of well-being: physical, mental, and social health. Understanding Buettner's take on the Power 9 Principles arranges this emphasis on total well-being.

At the end of the post-test, there was a section for students to give any feedback that they might have had. A few students mentioned the print being too small on the presentation slides to read. There was a comment on the consumption of alcohol as the student was not sure how accurate the correlation was between alcohol consumption and prevention of some health issues.

Comments were considered as the presentation slide font was changed for the Scholar's Week presentation. All other feedback conveyed the students' enjoyment of the presentation.

Limitations

There was a limitation in sample size as there were only 26 students that had results recorded. The results were meant to generalize Murray State students' knowledge about Blue Zones, but the sample size may not have been big enough to fully make that generalization. The location of the educational session made it more accessible to Honors students as it was held during one of their meetings. It is possible that the students in the session had more of an advantage to previous Blue Zone knowledge. This was not a reflection of the results as there was not a portion on the demographic sheet where they would note if they were Honors or not.

Another limitation was the way the tests were created and how questions were ordered. There could have been hints in preceding questions about what a Blue Zone is causing there to be changed answers based on gained knowledge as students were taking the test. Again, there was no way to test this as it was not a factor that was testable. Feedback from a few of the post-tests said that the words on the presentation slides were too small, so this could have been a factor in lower success rate on a few questions as well.

Upon review of data, there were three pre and post-tests that were not completed on the back side of the page. This possibly contributed to lower scores. The back page consisted of three questions, so for those exams there was an automatic deduction of three points. Failing to exclude this data from the results may have altered true percentages of students' knowledge of Blue Zones, making some of the data inaccurate.

Recommendations for Future Studies

The time needed for a thorough study was not as accessible leaving a lot of opportunity for improvement in future studies. For a future study involving education of Blue Zones, more students could be drawn given more time to inform them of the study parameters and timeframe. The study could also reach beyond Murray State's campus. Reaching a certain number of students from specific majors would also be beneficial to ensure variation.

As paper records are becoming less and less common, it may be wise in the future to make the questionnaires accessible on the internet to make data recording easier. It could also be beneficial in giving students the opportunity to answer each question honestly without being tempted to look back at prior questions or changing answers. However, there would still need to be a thorough regard for anonymity and confidentiality if this was carried out.

Conclusion

The hypothesis of this study is supported that a teaching session on the topic Blue Zones would increase Murray State students' knowledge or lack thereof. The difference between post-test scores and pre-test scores showed significant improvement. This study was relevant as it pointed out key elements of the Blue Zones and gave insight to centenarians' healthy lifestyles which could lead students to make more quality decisions for their lives. Educating students on the practical ways to live more healthily by simply laying out key components in others' lives can make a difference. Implementing small shifts in wellness works as Blue Zone Projects® around the United States show proof.

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Appendix A

Cover Letter

Invitation to Participate: You are invited to participate in my Honors thesis that will be focusing on the education of Blue Zone studies. The study is conducted by the primary investigator, Grace Beer, and undergraduate nursing student at Murray State University. If you would like to participate, please fill out the demographic sheet attached to this cover letter. These questions will relate to your gender, age, year of school, major, and ethnicity. This will help me gauge the population of participants in this study. You will be taking a pre-test, listening to a brief presentation, and taking a post-test at the end.

Purpose and Participation Enrollment: The purpose of this research is to understand the knowledge base of college students regarding Blue Zones. I am doing an educational setting to benefit college students as well as they will be able to evaluate their own lifestyle as they compare them to those in the Blue Zones. Participation in this study involves taking a pre-test to test your knowledge on the topic. You will take a post-test following a 20 minute presentation that will test how much you learned from the presentation. Please take the tests one question at a time, answering truthfully, understanding that this does not have any negative effect in the research as it is simply to see how many students know about Blue Zones and how much they know. Please understand that if you are under the age of 18, your results will not be used in this research study.

Risks and Benefits: There are no foreseeable risks to participating in this research. There are benefits, however, as there will more than likely be a growth in knowledge base for the student as well as helpful tools to help improve your lifestyle. The study could also have a positive impact on the community as there could be an implementation of general healthy lifestyle.

Voluntary Participation: Your participation in this study is completely voluntary. You have a right to refuse to participate without consequences or discontinue your participation at any time without any penalty. You may refuse to answer any questions within the pre and post-tests. Withdrawal or refusing to answer any questions will not result in any consequences to you. If you agree to be a part of the research, but later change your mind, you may leave at any time. There will be no compensation given for participating in the study. Your continued participation will indicate your agreement to be in this study.

Data: If you agree to participate, your responses will be anonymous. I will not collect identifying information such as your name. On the attached demographic sheet and on your pre and post-test, you will fill in the code that you drew from the bucket walking in that will identify your tests. I will be unable to know your personal results as I will not know the codes that were assigned to you. All results from the tests will be kept confidential as they will be stored on my personal computer that is password protected and only accessible to me. The results will be used for academic purposes only.

If you have any questions or concerns regarding this research study, please contact me at gbeer@murraystate.edu or my research mentor, Dr. Jessica Naber, at jnaber@murraystate.edu. Thank you.

Appendix B

Demographic Questionnaire

Code: _____

Gender (please circle your answer):

Male Female Other: _____

Age _____

Major _____

Based on hours, what year of college are you classified as? (Please circle your answer):

Freshman

Sophomore

Junior

Senior

What is your ethnicity? (Can circle more than one answer):

Caucasian/White

African American

Hispanic/Latino

Asian

Other: _____

Appendix C

Pre-Test Questions Blank

Blue Zones PreTest Code: _____

Directions: Please circle one answer per question unless otherwise specified.

1. What is a Blue Zone?

    a. a geographical region consisting of large bodies of water

    b. a geographical area where the population generally shares similar lifestyles resulting in longer lifespans

    c. a geographical area where it is exceptionally harder for individuals to live past 100 years of age

    d. a geographical area where wildlife has an abundance of resources to survive

2. Y/N Have you heard of the term “Blue Zone” before?

3. T/F The United States contains more Blue Zones than anywhere else in the world.

4. What is a centenarian?

    a. a commander of a century in the Roman army

    b. an elder that leaves a legacy for their children and grandchildren

    c. an individual that has collected coins and sells them for profit

    d. an individual that has lived to or beyond 100 years of age

5. How many Blue Zones are being researched currently in the world?

    a. 3

    b. 50

    c. 5

    d. 23

    e. 12

6. T/F A heavy emphasis on not only the diet of an individual, but their total well-being is what produces the healthiest lifestyle.

7. What is the average American lifespan?

    a. 65-75 years

b. 70-80 years

c. 90-100 years

d. 85-95 years

e. less than 65 years

8. T/F The healthiest people on the planet are strictly vegetarian.

9. The following are proven to contribute to the longevity of an individual. SELECT ALL THAT APPLY

a. laughter

b. keeping a close connection with one's family

c. eating until you are 95% full

d. cutting out dairy

e. Smoking

f. forming a "moai"

10. T/F Drinking 1-2 glasses of wine at night is a common routine in Blue Zone centenarians.

Appendix D

Presentation Slides

History behind and defining the "Blue Zone"

- Michel Poulain describes a Blue Zone as "a rather limited and homogenous geographical area where the population shares the same lifestyle and environment and its longevity has been proved to be exceptionally high."
- Physician, Alexander Leaf's, first discoveries of Blue Zones in 1973
- Okinawa, Japan
- Loma Linda, California
- Ikaria, Greece
- Sardinia, Italy
- Nicoya, Costa Rica

What is Aging?

- Begins at birth
- A risk of dying that increases as age increases (at risk for death)
  - Late 70s, early 80s
- "A loss of coping mechanism, a failure to be able to maintain internal control and balance" - Robert Kane
- Natural physical degression due to the human not being "designed to maintain [its] physical integrity forever" - Steven Austad
- Can we slow the process?
  - Tom Perls, an associate professor of medicine and geriatrics at Boston University School of Medicine, orients the human body with that of a car. Even with the best upkeep, engines will deteriorate. Bumps in the road cause a faster decline in the car's life just as health issues and general aging will progress the dying process.
  - S. J. Olshansky argues that "there are no lifestyle changes, surgical procedures, vitamins, antioxidants, hormones, or techniques of genetic engineering available today that have been demonstrated to influence the processes of aging."
- Accelerator vs. brake

Power 9 Principles

- Moving naturally
- Knowing your purpose
- Down Shift
- 80% Rule
- Plant Slant
- Wine @5
- Right Tribe
- Belong
- Loved Ones First

Moving your Body

- Gym vs. Outdoors
- Yardwork, gardening
  - "engaging effortless attention and interrupting rumination"
- Exercising in the sun for at least 15 minutes a day
  - Sufficient levels of Vitamin D
- Pastoralism
- Modifications to transportation
  - Walking to neighbor's homes
  - Stairs instead of elevators

Diet

- Comparison between Blue Zone and American diets
- Ikaria, Greece
  - Legumes, potatoes, goat milk, wild greens, fruit, fish, feta, lemon, herbs
- Okinawa, Japan
  - Bitter melons, tofu, garlic, brown rice, green tea, shitake mushrooms
- Sardinia, Italy
  - Goat's milk, sheep's cheese, flatbread, sourdough, fennel, barley, fava beans, chickpeas, tomatoes, almonds, milk thistle tea, wine from Grenache grapes
- Loma Linda, California
  - Avocadoes, nuts, salmon, beans, oatmeal, whole wheat bread, soy milk
- Nicoya, Costa Rica
  - Beans, corn, squash, papaya, bananas, peach palms, yams
- 1-3 glasses of wine a night

Lifestyle Related to Spirituality

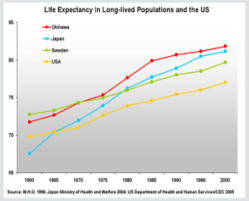
- Data collected from a survey of 96,000 Seventh-Day Adventists ranging from 30-112 years in the US and Canada
  - 1.1% smokers
  - 6.6% current alcohol use
  - 8% vegan
  - 28% lacto-ovo-vegetarian
  - 10% pesco-vegetarian
  - 6% semi-vegetarian
  - 48% non-vegetarian
- Biblically based diets
  - Nuts, fruits, vegetables
- Prayer, meditation, stress-relief

Eliminating Stress

- Okinawans
  - Meditation, prayer
  - "moai"
- Loma Linda
  - Prayer, meditation, reflection
- Greece
  - Walking, gardening
- Sardinia
  - Not taking life too seriously
  - Laughter
- Nicoya
  - Knowing your purpose

Physiologic Effects

- CDC recommendations for health in the United States
  - Regular screening tests
  - Vaccinations
  - Healthy choices
- Healthy choices made in Blue Zones have led to..
  - Lower heart disease percentages
  - Less dementia, breast cancer
  - Alzheimer's prevention
- Blue Zone Project® locations
  - Spencer, Iowa (decrease in Metabolic Syndrome, Type 2 Diabetes, cardiovascular disease)
  - Albert Lea, Minnesota (projection of 2.9 years added to lifespan within a year of implementing Blue Zones Project®)
  - Fort Worth, Texas (38,074 fewer smokers post-implementation of Blue Zones Project® in 2014)



"In communities with higher well-being, we have found that people live longer, happier lives and business and local economies flourish. A reliable well-being metric provides community and business leaders with the data and insights they need to help make sustained transformation a reality. After all, if you can't measure it, you can't manage it." – *Dan Buettner*

NY Times Bestselling Author
National Geographic Fellow
Blue Zones Founder

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Appendix E

Post-Test Questions Blank

Code: _____

Directions: Please circle one answer per question unless otherwise specified.

1. What is a Blue Zone?

    a. a geographical region consisting of large bodies of water

    b. a geographical area where the population generally shares similar lifestyles resulting in longer lifespans

    c. a geographical area where it is exceptionally harder for individuals to live past 100 years of age

    d. a geographical area where wildlife has an abundance of resources to survive

2. Y/N Have you heard of the term “Blue Zone” before?

3. T/F The United States contains more Blue Zones than anywhere else in the world.

4. What is a centenarian?

    a. a commander of a century in the Roman army

    b. an elder that leaves a legacy for their children and grandchildren

    c. an individual that has collected coins and sells them for profit

    d. an individual that has lived to or beyond 100 years of age

5. How many Blue Zones are being researched currently in the world?

    a. 3

    b. 50

    c. 5

    d. 23

    e. 12

6. T/F A heavy emphasis on not only the diet of an individual, but their total well-being is what produces the healthiest lifestyle.

7. What is the average American lifespan?

    a. 65-75 years

    b. 70-80 years

c. 90-100 years

d. 85-95 years

e. less than 65 years

8. T/F The healthiest people on the planet are strictly vegetarian.

9. The following are proven to contribute to the longevity of an individual. SELECT ALL THAT APPLY

a. laughter

b. keeping a close connection with one's family

c. eating until you are 95% full

d. cutting out dairy

e. Smoking

f. forming a "moai"

10. T/F Drinking 1-2 glasses of wine at night is a common routine in Blue Zone centenarians.

If you would like to provide any feedback from this study, please comment below:

_____
_____
_____
_____

Appendix F

Pre-Test/Post-Test Answers

1. What is a Blue Zone?

    a. a geographical region consisting of large bodies of water

    b. a geographical area where the population generally shares similar lifestyles resulting in longer lifespans

    c. a geographical area where it is exceptionally harder for individuals to live past 100 years of age

    d. a geographical area where wildlife has an abundance of resources to survive

2. Y/N Have you heard of the term "Blue Zone" before? No wrong answer

3. T/F The United States contains more Blue Zones than anywhere else in the world.

4. What is a centenarian?

    a. a commander of a century in the Roman army

    b. an elder that leaves a legacy for their children and grandchildren

    c. an individual that has collected coins and sells them for profit

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5. How many Blue Zones are being researched currently in the world?

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c. eating until you are 95% full

d. cutting out dairy

e. Smoking

f. forming a "moai"

10. T/F Drinking 1-2 glasses of wine at night is a common routine in Blue Zone centenarians.

Appendix G

Email to board of Honors Student Council

To whom it may concern,

I am an Honors student completing my thesis for the semester. Would I be able to take 30 minutes of the Honors Student Council meeting on March 15th to complete some research on my thesis topic involving those that come to the meeting? I have a specific email that I would give you to send out to the Honors students if I am able.

Appendix H

IRB Approval Letter

MURRAY STATE UNIVERSITY

Institutional Review Board

328 Wells Hall
Murray, KY 42071-3318
270-809-2916 msu.irb@murraystate.edu

TO: Jessica Naber, School of Nursing and Health Professions

FROM: Jonathan Baskin, IRB Coordinator JB

DATE: 3/10/2022

RE: Human Subjects Protocol I.D. – IRB # 22-154

The IRB has completed its review of your student's Level 1 protocol entitled *Blue Zones Honors Thesis Teaching Project*. After review and consideration, the IRB has determined that the research, as described in the protocol form, will be conducted in compliance with Murray State University guidelines for the protection of human participants.

The forms and materials that have been approved for use in this research study are attached to the email containing this letter. These are the forms and materials that must be presented to the subjects. Use of any process or forms other than those approved by the IRB will be considered misconduct in research as stated in the MSU IRB Procedures and Guidelines section 20.3.

Your stated data collection period is from 3/10/2022 to 4/29/2022.

If data collection extends beyond this period, please submit an Amendment to an Approved Protocol form detailing the new data collection period and the reason for the change.

This Level 1 approval is valid until 3/9/2023.

If data collection and analysis extends beyond this date, the research project must be reviewed as a continuation project by the IRB prior to the end of the approval period, 3/9/2023. You must reapply for IRB approval by submitting a Project Update and Closure form (available at murraystate.edu/irb). You must allow ample time for IRB processing and decision prior to your expiration date, or your research must stop until such time that IRB approval is received. If the research project is completed by the end of the approval period, then a Project Update and Closure form must be submitted for IRB review so that your protocol may be closed. It is your responsibility to submit the appropriate paperwork in a timely manner.

The protocol is approved. You may begin data collection now.

Opportunity *afforded*

murraystate.edu