2019

A Risk Reduction Education Intervention for Cardiovascular Risk Factors Among College Students

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A Risk Reduction Education Intervention for Cardiovascular Risk Factors Among College Students

Submitted in Partial Fulfillment of the Requirements for the Degree of Doctor of Nursing Practice

at the University of Kentucky

By

Suzanne White

Morehead, KY

2019

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A**cknowledgements**

I would like to express my deep appreciation to my advisor, Dr. Karen Butler, for her support, encouragement and enthusiasm while completing this research project. Her willingness to give of her time and expertise is very much appreciated. I would also like to thank my former advisor, Dr. Nora Warshawsky, for her constructive suggestions during the early planning and development of this research project. A special recognition to committee member, Dr. Martha Biddle, and clinical mentor, Dr. Shannon Smith-Stephens for offering helpful ideas and comments to improve my research project planning. I would like to express my gratitude to the DNP faculty and staff, particularly Kathy Collins and Whitney Kurtz-Ogilvie, for their valuable input in preparation of this final DNP project. Much appreciation to Morehead State University (MSU) for promoting this research project on our beloved campus for our beloved students. Thank you to Dr. Nathania Bush, Dr. Kim Clevenger, and Dr. Lynn Parsons for believing in my dream. Thank you to Dr. Jeannie Justice for her assistance with data analysis and technical support during the evaluation phase of this research project. I wish to tell Annie and Christy a heartfelt “Thank You” for your care and love throughout this journey. Finally, thank you to the Almighty for this amazing opportunity.

Dedication

This work is dedicated to the memory of my parents and stepfather. Words cannot adequately convey how much each of you are still with me. My father loved me unconditionally, my mother was my first inspiration, and my stepfather couldn't wait to tell his friends I was a doctor. Till we meet again. For my brothers, Keith and Tim, who helped me become the strong woman I am today. For my kids, Jessika, Daniel, and Chloe for loving me at my absolute worst and inspiring me to be my absolute best. For my Husband, my Rock, for being everything I love, admire, and respect. This would never have been possible without you by my side always sharing your strength and laughter. How I love you.

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ABSTRACT

BACKGROUND: Cardiovascular disease is the leading cause of death for both men and women in the U.S. Although cardiovascular disease is often associated with middle aged and older adults, modifiable CVD risk factors are also present in young adults.

PURPOSE: The purpose of this pilot study was to determine whether a cardiovascular risk reduction educational intervention delivered via Facebook is feasible and effective for modifying risk factor reduction such as decreased body mass index and increased fruit/vegetable consumption among college students.

METHODS: This study involved the use of pre-test and post-test surveys modified from the Behavioral Risk Factor Surveillance System to determine intervention effectiveness. A once weekly cardiovascular risk reduction education memes, video clip, or text related to body mass index and/or fruit/vegetable consumption was posted publicly on the private Facebook page. In addition, the treatment group received a once weekly private message that had an additional cardiovascular risk reduction education meme, video clip, or text related to body mass index and/or fruit/vegetable consumption.

RESULTS: Fourteen students participated in the study. The average body mass indexes were 23.02/23.07 pre-test/post-test for the intervention group and 25.97/25.61 pre-test/post-test for the control group. The average daily number of servings of fruits/vegetables was 3.14 both pre-test/post-test for the intervention group and 3.43/3.58 pre-test/post-test for the control group. There were no significant differences observed between the intervention group and the control group with regards to changes in BMI or fruit/vegetable consumption amounts from pre-test to post-test.

CONCLUSION: While the pilot study design was feasible, the results were not statistically significant. The small sample size and short study period affected the ability of results to represent the overall targeted population**.** Future research might include modification to recruitment strategies to target larger sample sizes.

A Risk Reduction Education Intervention for Cardiovascular Risk Factors Among College Students

Background and Significance

Every year in the United States, more than 26 million adults (approximately 11 percent) are diagnosed with cardiovascular disease (CVD; CDC, 2015). The scope of the problem is significant; CVD is the leading cause of death for both men and women, accounting for more than 17.3 million deaths per year (CDC, 2015). About half of all adults in the U.S., and more than half of young adults, have at least one risk factor for CVD (CDC, 2015; Arts, Fernandez, & Lofgren, 2014). About 550,000 people in the U.S. have a first-time myocardial infarction each year and of these about 116,000 die (CDC, 2015). Additionally, there is a growing economic burden associated with CVD (AHA, 2017). According to a 2017 report from the American Heart Association (AHA), the cost of CVD in the U.S. was $555 billion in 2016 and is predicted to climb to $1.1 trillion by 2035 (AHA, 2017). In 2010, CVD accounted for 15% of all hospitalizations in Kentucky, at a cost of over $3.2 billion (Kentucky Cabinet for Health and Family Services, 2010). Kentucky is ranked 8th in the country for highest death rates from CVD (AHA, 2017). If the problem is not addressed the cost will continue to rise and the number of CVD related deaths will increase.

Because some risk factors for CVD are modifiable, such as physical activity, nutrition, and weight, prevention can help reduce the mortality rates from CVD. Although CVD is often associated with middle aged and older adults, modifiable CVD risk factors are also present in young adults. More than 50% of young adults aged 18-24 have at least one identifiable risk factor for CVD and almost 25% have atherosclerotic lesions (Arts et al., 2014). CVD risk is likely underestimated in young adults despite the prevalence of multiple cardiovascular (CV) risk

factors. About 19% of young adults have hypertension (Nguyen et al., 2011), more than 12% of young adults over age 20 have elevated cholesterol levels (CDC, 2019), 23% of college freshmen are overweight or obese (Pope, Hansen, & Harvey, 2017), 24% of college students report physical inactivity (Calestine, Bopp, Bopp, & Papaliaa, 2017), and 59% report food insecurity, which can lead to poor diet (Patton-Lopez, Lopez-Daniel, Lopez-Cevallos, Cancel-Tirado, & Vasquez, 2014). For example, when examining the weight trajectory of college students over four years, Pope, et al. (2017) found the percentage of overweight or obese students increased from 23% to 41% from the beginning of freshman year through the end of senior year.

Additionally, according to the National College Health Assessment survey, only 4.2% of college students report eating the recommended two servings of fruit and three servings of vegetables per day (American College Health Association, 2018). Young adults may not have a high degree of health literacy about these risk factors, despite their prevalence. For instance, Holland, Carthron, Duren-Winfield, & Lawrence (2014) found that prior to participation in a CV risk reduction (CVRR) education intervention, many college students lacked knowledge about family and personal CV risks and may not have fully understood the benefits associated with heart healthy behaviors. Because risk factor profiles of this age group can predict long-term CVD risk, it is critical to improve efforts to reduce modifiable risk factors associated with CVD development among college age students. Cardiovascular risk reduction (CVRR) education interventions have been found to be effective at reducing modifiable risk factors in this population (Brown, O'Connor, & Saviano, 2014; Holland et al., 2014; Imes, Lewis, Austin, & Dougherty, 2015; Magoc, Tomaka, & Bridges-Arzaga, 2011; Melnyk, Panza, Zaleski &Taylor, 2015); Moore, Werch, & Bian, 2012; Napolitano, Hayes, Bennet, Ives, & Foster, 2013; Sutliffe & Carnot, 2011).

CVRR education interventions among college students have focused on reduction of modifiable CV risks, specifically physical activity (Holland et al, 2014; Magoc, Tomaka, & Bridges-Arzaga, 2011; Moore, Werch, & Bian, 2012), nutrition (Brown, O'Connor, & Saviano, 2014; Sutliffe & Carnot, 2011), or weight loss (Napolitano, Hayes, Bennett, Ives & Foster, 2013), and show significant improvement in areas of body mass index (BMI) reduction or fruit and vegetable consumption (Brown et al, 2014; Magoc et al, 2011; Sutliffe & Carnot, 2011).

CVRR education interventions have also focused on increasing personal modifiable CV risk awareness with regard to family history, and include family assessment (Holland et al., 2014; Imes et al., 2015; Melnyk et al., 2015. Of the studies targeting family history and family assessment, all three provided individual measurements of BMI, blood pressure, and cholesterol levels, provided CVRR education, and gave personalized feedback to participants (Holland et al., 2014; Imes et al., 2015; Melnyk et al., 2015). All the researchers reported decreased modifiable CV risk among participants following CVRR education (Holland et al., 2014; Imes et al., 2015; Melnyk et al., 2015).

To further study the issue of CV risk among college age students, a CVRR educational intervention was developed and implemented at Morehead State University (MSU). The purpose was to determine whether a CVRR educational intervention delivered via Facebook is feasible and effective for modifying risk factor reduction such as decreased BMI and increased fruit and vegetable consumption among college students. The target population for this project was first time freshmen enrolled at MSU, living on campus, and between the ages of 18-24 years.

Theoretical/Conceptual Framework/Process Improvement Model

Two models provided the theoretical framework for this study. The Logic model guided the processes of design and planning and implementation and evaluation (see Table 1, W.K.

Kellogg Foundation, 2004) and the Iowa Model of Evidence Based Practice steered the exploration of current CVRR intervention practices and influenced the review of current literature. The Iowa Model of Evidence Based Practice is a practice model with the key purpose of steering clinicians in the use of evidence to improve health care outcomes and has been used in multiple academic and clinical settings (Gawlinski & Rytledge, 2008). This model involves the unusual concept of using "triggers" to explore potential evidence-based practice changes and can precede an evidence-based study (Gawlinski & Rytledge, 2008). Problem-focused and knowledge-focused triggers lead staff members to further examine current health care practices and whether patient care can be improved using evidence-based findings (Rycroft-Malone & Bucknall, 2011, p. 137). When applying the model to the CVRR education intervention plan, the principal investigator (PI) assumed the role of staff members in response to the problem-focused trigger of lack of educational interventions or programs on CVRR for college students. The intent was to review the literature for current findings related to CVRR education interventions among college students and assess whether CV risk factor modification, including decreased BMI and increased fruit and vegetable consumption, could be increased by delivering CV risk education via social media, specifically Facebook. Elevated BMI's associated with obesity increase the risk of CVD compared with normal BMI. Decreased fruit and vegetable consumption is associated with the development of chronic diseases including CVD. The remaining steps of the model are to identify the evidence-based findings that support the change in practice, plan the change, implement the change and monitor the process (Appendix A).

Review of Literature

A review of current literature was conducted to examine the effectiveness of interventions aimed at reducing modifiable risk factors of CVD among college students. The

question that guided the review was, “In college students aged 18-24, how effective are CVRR education interventions delivered via social media, as compared to those delivered via other methods, at reducing modifiable risk factors for CVD?”

A comprehensive literature review was completed utilizing CINAHL, MEDLINE, PubMed, and PsycINFO databases. Duplicate publications were removed from the search. Search terms included: college students, cardiovascular, modifiable, risk factors, health promotion, education, electronic, social media, and intervention. This initial search yielded 50 articles. A manual search for literature using reference lists from retrieved studies resulted in three more studies, for a total of 53 articles from the years 2010 through 2019. The search was narrowed to incorporate the following inclusion criteria: (1) primary research and (2) participants at least 18 years old, and (3) publication in English. Studies were excluded if they were conducted outside the U.S. Ten studies met eligibility criteria for this review.

Nine of ten studies indicate increased knowledge of modifiable CV risk factors following a CVRR education intervention (Brown et al., 2014; Holland et al., 2014; Imes et al., 2015); Magoc et al., 20111; Melnyk et al., 2015; Moore et al., 2012; Napolitano et al., 2013; Sutliffe & Carnot, 2011; Webber et al., 2016). One study focused on a different medical issue but also examined whether educational interventions delivered via social media are effective at increasing knowledge (Wanzer, Foster, Servoss & LaBelle, 2014). Study results indicated that participants receiving education about testicular cancer scored higher on the post-test than those not receiving the education intervention (Wanzer et al., 2014).

An increasingly popular method of CVRR education among college students is to utilize computer-based or smart phone application technology. Methods included computer-based multiple health behavior interventions (Moore et al., 2012) and theory based physical activity

learning modules located on a specific website (Magoc et al., 2011). Other studies implemented interventions via the Mobile MyPlate app, Facebook, Facebook Plus, and virtual learning environments and learning management systems. The Mobile MyPlate app allowed users to track food and exercise on iPhone, iPad, and Apple Watch (Brown et al., 2014). Facebook served as the portal for educational podcasts for all participants while Facebook Plus was used to deliver daily text messages on effective self-monitoring of food and physical activity to the intervention group (Napolitano et al., 2013). The virtual learning environment and learning management system delivered modifiable CVRR education as biweekly messages (Webber et al., 2016). Although it focused on educating college students about testicular cancer rather than cardiovascular risk, a study by Wanzer, et al, (2014) examined an educational intervention delivered via Twitter.

Some researchers found that technology-based delivery made repetitive messaging easier to accomplish (Brown et al., 2014; Napolitano et al., 2013; Webber et al., 2016) and resulted in decreased BMI (Napolitano et al., 2013; Webber et al., 2016) and increased consumption of fruit and vegetables (Brown et al., 2014). Completion of computer-based information sessions (Moore et al., 2012) and Web based learning modules (Magoc et al., 2012) resulted in increased physical activity among college students. Results of studies that delivered education via social media (Napolitano et al., 2013; Wanzer et al., 2014) indicated that post-test scores were higher (Wanzer et al., 2014) and weight loss was greater in the participants assigned to the Facebook Plus with text messaging group as compared to than those who were assigned to the Facebook only group (Napolitano et al., 2013).

The evidence suggests college students are a receptive audience for a CVRR education intervention delivered through use of technology-based or electronic resources including social

media. These methods are preferred by college students for various reasons including presentation of information (Magoc et al, 2011; Moore et al, 2012), interactive capabilities, the ability to remain anonymous (Magoc et al, 2011; Moore et al, 2012; Webber et al, 2016), and twenty-four-hour availability (Brown et al, 2014; Napolitano et al, 2013: Wanzer et al, 2014; Webber et al, 2016). Results from other studies indicate rapidly increasing levels of participation in social media technologies by young people of all demographic ranges (Lenhart, Ling, Campbell, & Purcell, 2010; Lenhart, Purcell, Smith & Zickuhr, 2010). However, research addressing delivery of CVRR education via social media is extremely limited. Only one study used Facebook for delivery of CVRR education (Napolitano et al., 2013).

The lack of relevant research suggests initial hypothesis testing of the idea that social media could result in CVD risk reduction in college students is warranted. The few existing studies do demonstrate potential decreases in risks after completion of such interventions (Appendix B).

Setting

The setting for this pilot study was Morehead State University (MSU) located in the foothills of the Daniel Boone National Forest in Rowan County, Kentucky. The university is a public, co-educational school comprised of males and females of varying ages and ethnicities (https://www.moreheadstate.edu/About, 2019). The target population for this project was first time freshmen enrolled at MSU, living on campus, and between the ages of 18-24 years.

Project Design and Methods

This pilot study was a prospective, pre-test/post-test design. It was experimental and quantitative.

Description of Evidence-Based Intervention

The study utilized Facebook, to deliver a CVRR educational intervention aimed at modifying risk factors such as BMI and fruit and vegetable consumption. The PI developed the 12-week intervention that included careful review and selection of age appropriate CVRR education to be shared on a private Facebook group page.. The PI managed the implementation and evaluation of the project, collected and reviewed data, and managed the Facebook group page for a convenience sample of college freshmen. Once weekly CVRR education memes, video clips, or texts related to changing (decreasing) BMI and/or increasing fruit and vegetable consumption were posted on the private Facebook page. In addition, the treatment group received a once weekly private message that had an additional CVRR education meme, video clip, or text related to changing (decreasing) BMI and/or increasing fruit and vegetable consumption. The intervention was delivered over a 12-week period. The purpose of the project was to determine whether a CVRR educational intervention delivered via Facebook is feasible and effective for modifying risk factor reduction such as decreased BMI and increased fruit and vegetable consumption among college students.

Procedure

For recruiting purposes, study information was distributed to First Year Seminar (FYS) 101 faculty and staff and members of the University's Faculty Senate who shared information and recruiting posters with freshmen students. The PI partnered with campus and student organizations and posters were displayed on campus. Interested students emailed the PI, and 23 of those were deemed eligible and assigned a number 1-23. These numbers were randomly assigned to treatment and control groups through the Quick Calcs application on a website called Graph Pad, available at http://www.graphpad.com.

This study was approved by the University of Kentucky and Morehead State University Investigational Review Boards to ensure the safety of human subjects. Because the research presented no more than minimal risk to the participants and involved no procedures for which written consent is normally required, a cover letter was completed in place of informed consent. Research data were obtained by self-report via online pre-test and post-test surveys located on Google documents, to gather information about participants' BMI and fruit and vegetable consumption. The data collected through self-report surveys were deleted upon completion of the study.

Sample

The convenience sample was selected from eligible study volunteers responding to study information and recruiting efforts. Inclusion criteria for study were: 1) student age of at least 18 years and no more than 24 years of age at the time of the fall semester and 2) freshman status. Recruitment targeted freshmen students living on campus; therefore, distance learning students were excluded from participation. Each fall semester, approximately 1,000 new students enroll at MSU. However, many of these students are online or distance learning students. Others are transfer students who do not have freshman status. Therefore, it was expected that 50 students meeting the inclusion criteria would be obtained during the first month of the semester as part of a representative sample. Only 23 students meeting the inclusion criteria entered the study, 20 completed the pre-test survey and 14 completed the post-test survey. Students were assigned a number 1-23. These numbers were randomly assigned to either group A (treatment) or group B (control) through the Quick Calcs application on a website called Graph Pad, available at http://www.graphpad.com.

Measures and Instruments

Outcomes to be measured included comparison of BMI and fruit and vegetable consumption with those who received additional education via private messages as compared to those who received public posting only education. The BMI was defined as body mass divided by the square of the body height and is universally expressed in units of kg/m2 and calculated by Excel. Fruit and vegetable consumption was defined as the number of servings of fruits and vegetables per day. Height, weight, and number of servings of fruits and vegetables were self-reported on the pre-test and post-test surveys. Information was provided to all participants on BMI calculation and what constitutes a serving size of fruits and vegetables. The independent variable in the study is the risk reduction education intervention. The dependent variables include the change in BMI and fruit and vegetable consumption.

Demographic information such as age, gender, and ethnicity was collected as part of the pre-test surveys (Appendix C). Pre-test and post-test surveys inquired about current height and weight and asked the following questions modified from the Behavioral Risk Factor Surveillance System (BRFSS) (2017): How often do you eat fruit? How often do you drink fruit juices/smoothies? How often do you eat salad vegetables (lettuce, tomato, cucumber, etc.) /other raw vegetables? How often do you eat cooked vegetables? Response options were 0 servings per day, 1 serving per day, 2 servings per day and 3 or more servings per day (See Appendix D).

The BRFSS is reviewed often and in 2013 was found to be reliable and to have high overall levels of validity when compared to other surveys asking comparable questions (Pierannunzi, Shaohua, & Balluz, 2013). The modified surveys were evaluated for face validity and content validity. Face validity was determined by evaluating the questions in the survey as compared to what was being measured (BMI and fruit and vegetable consumption). Content

validity was assessed for readability, clarity and comprehensiveness when determining which questions should be included in the final surveys.

Implementation and Data Analysis

Participants were invited via email to join the private Facebook group along with information to complete a pre-test survey on Google Forms. Participant completion of the pre-test survey allowed for automated data collection and connection to an Excel spreadsheet that was populated with the survey responses. In August and September of 2018, pre-test surveys were completed by self-report from participants to determine BMI and fruit and vegetable consumption. Over a period of twelve weeks, ten CVRR education memes, video clips or texts related to BMI and/or fruit and vegetable consumption were posted publicly on the private Facebook page (Appendix E). In addition, the treatment group received ten additional CVRR education memes, video clips, or texts related to BMI and/or fruit and vegetable consumption via private messaging (Appendix F). There were no posts or private messages for two of the twelve weeks due to participants' fall and Thanksgiving breaks.

ln December 2018 post-test survey information was completed by 14 participants to determine whether a modification in BMI and fruit and vegetable consumption had occurred. Using the Data Analysis ToolKit program add-on in Excel, a paired sample t-test was completed to determine whether there was a change between the two time points, specifically whether BMI and number of fruits and vegetables per day changed within the group of students receiving the intervention. An alpha level of .05 was used to determine statistical significance.

Results

Of the 23 eligible students that requested to join the Facebook page, 20 students completed the pre-test questionnaire and 14 completed the post-test questionnaire for a response

rate of 60.8% and a completion rate of 70%. In this study, 12 participants self-reported ethnicity as White (85.71%), one as Hispanic (7.14%), and one as Mixed Race (7.14%). The average BMI of the intervention group was 22.7 at time of pre-test and 22.8 at time of post-test. The average BMI of the control group was 25.9 at time of pre-test and 25.4 at time of post-test. The average daily number of servings of fruits and vegetables of the intervention group was 3.14 at both pre-test and post-test times. The average daily number of fruits and vegetables of the control group was 3.4 at time of pre-test and 3.5 at time of post-test. BMI and fruit and vegetable consumption did not change after the intervention in either group. There were no significant changes in BMI within the group of participants receiving the intervention nor the participants not receiving the intervention (Table 2 and Table 3). There were no significant changes in number of servings of fruits and vegetables consumed within the group of participants receiving the intervention compared to those in the control group. (Table 2 and Table 3).

Discussion

Although the conduct of the study proved to be feasible, data analyses indicated that results of this study were not statistically significant at the p=0.05 level when comparing BMI measurements of participants. While there were no changes in BMI and fruit and vegetable consumption in this study, other researchers have reported that decreased BMI (Napolitano et al., 2013; Webber et al., 2016) and increased consumption of fruit and vegetables (Brown et al., 2014; Webber et al., 2016) occur following CVRR education interventions. This study did not include the additional components of repetitive text messaging (Brown et al., 2014; Napolitano et al., 2013) and personalized feedback as previous studies have included (Napolitano et al., 2013; Webber et al., 2016). A previous study by Brown et al. (2014), designed to evaluate the effectiveness of repetitive nutrition-related text messages on college students' nutrition

knowledge and fruit and vegetable consumption, suggests that daily text messages may be an effective way to increase nutrition knowledge and promote positive diet-related behaviors in college students (Brown et al., 2014). Similarly, Webber et al., (2016) found that following an intervention using biweekly messaging, participants increased their vegetable consumption.

All participants in this pilot study received CVRR education related to modifiable risk factors via social media, specifically Facebook, which is frequently used by and incorporated into the lives of college students. While the results were not statistically significant regarding change in BMI and fruit and vegetable consumption in this study, other study results that delivered education via social media (Napolitano et al., 2013; Wanzer et al., 2014) suggest this method of delivery is effective among this population.

Implications for Practice, Education, Policy, and Future Research

Implications for practice include creation of strategies that encourage reduction of modifiable CVD risk factors, particularly those using repetitive messaging through social media, specifically Facebook. Napolitano et al. (2013) found that Facebook and text messaging are effective in delivering an education intervention. From an educational perspective, inclusion of CV risk factor reduction could be incorporated into nursing didactic content at both the undergraduate and graduate levels. Policy modifications or changes might include those regulations affecting CV education beginning in elementary, middle, high school and college health and wellness courses along with school incorporated tactics relating to physical activity and food options. Future evidence-based studies should consider assessing stages of learning/change in addition to providing CVRR education interventions.

Replication studies would provide an increase in accurate estimates than a single study. Future research might include modification to the recruitment strategies and consideration of additional onsite recruitment locations as an effort to increase the number of participants.

Limitations

This pilot study had a small sample size in comparison to most other studies reviewed. For future studies a larger sample size would be desirable. Despite instructions to only use their school assigned email addresses, some participants completed the post-test survey using a personal email address which impacted the number of post-test survey data that could be included in the statistical analyses. Limited interaction among participants in the study prevented a sense of community. According to Schein (2010, page 325), individuals learn through imitating a role model and forming a psychological identification with that person. Student peer learners could serve as mentors and provide encouragement and support to participants. CVRR information shared via Facebook in this study was generalizable to most college students. Including campus specific information regarding health and wellness centers, recreational opportunities, and dining options would create a sense of personalization to the intervention. A final limitation is the lack of follow up with participants. While the literature supports interventions delivered within a timeframe of one semester or less, follow up data could be collected to determine changes that might happen after the CVRR education intervention is completed (Webber et al., 2016). Additionally, a follow up component could determine if more than twelve weeks are necessary to modify CV risk factors among college students.

Conclusion

The purpose of this pilot study was to determine whether a CVRR educational intervention delivered via Facebook is feasible and effective for modifying risk factor reduction

such as decreased BMI and increased fruit and vegetable consumption among college students. While this study had a small sample size the risk of CVD in college students is documented in the literature and the need for intervention exists. The CVRR information shared via Facebook in this study was generalizable to most college students. Evidence-based messaging related to CVRR is readily available in the scientific literature and the use of social media to reach this population is shown to be effective. This type of intervention is straightforward and easy to administer and measure. The addition of repetitive text messaging and personalized feedback in future studies may be a more effective way to increase CVRR knowledge and promote risk reduction behaviors in college students. Future research might also include modification to the recruitment strategies and consideration of additional onsite recruitment locations as an effort to increase the number of participants.

Not only is future health a concern, there are significant economic issues associated with CV disease. If left untreated the cost will continue to climb and number of CV related deaths will continue to increase. CVRR efforts in college students can decrease this cost and improve future health. Despite the paucity of literature specific to CVRR education interventions for college students, the existing studies do demonstrate potential decreases in risks after completion of such interventions. Hence, it was feasible to develop and implement a social media based CVRR education intervention for college students at MSU.

Table 1. Logic Model

RESOURCES	ACTIVITIES	OUTPUTS	OUTCOMES	IMPACT
Dedicated staff to oversee study Support of university to offer CVRR education intervention Cardiovascular risk identification and reduction education information to be shared with college students	Design and implement funding strategy if necessary Create an evaluation plan Design and implement PR campaign	# of students educated on cardiovascular risk reduction benefits during project # of students choosing to identify risk factors and having health healthy behaviors # of college students with decreased risk of cardiovascular disease	20% decrease in BMI through self-report of completed questionnaire 20% increase fruits and vegetable consumption through self-report of completed questionnaire	100% of participating students educated on cardiovascular risk reduction

Table 2. Pre-test and Post-test BMI and Number of Servings of Fruits and Vegetables-Intervention Group

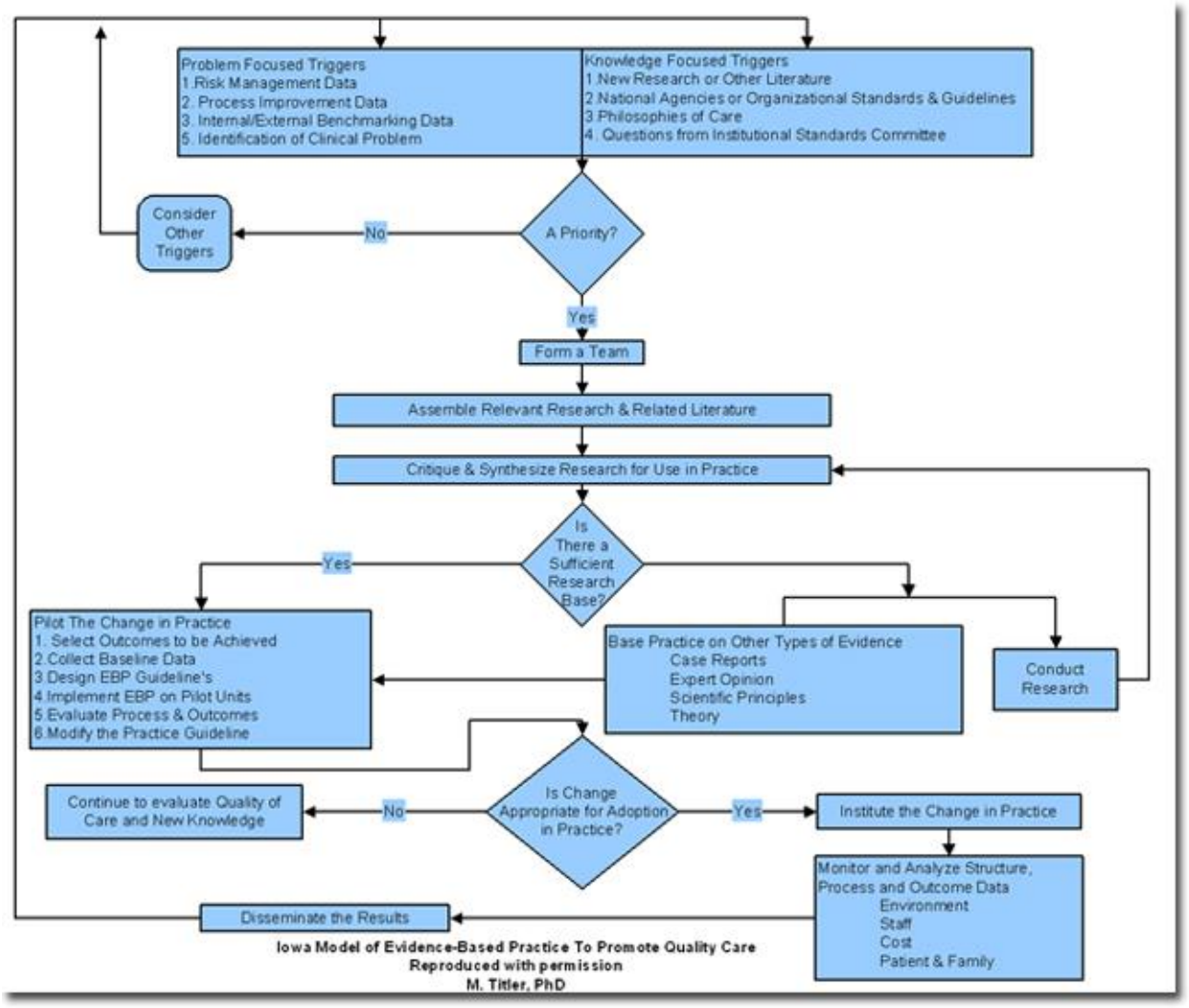
	Pre-test *Mean* (SD)	Post-test *Mean* (SD)	*p*
BMI	22.7 (2.7)	22.8 (2.9)	0.78
Number of servings of fruits and vegetables	3.1 (0.8)	3.1 (1)	0.77

Table 3. Pre-test and Post-test BMI and Number of Servings of Fruits and Vegetables-Control Group

	Pre-test *Mean* (SD)	Post-test *Mean* (SD)	*p*
BMI	25.9 (9.3)	25.46 (9.1)	0.48
Number of fruits and vegetables	3.4 (2.4)	3.5 (0.9)	0.44

Appendix A

Iowa Model of Evidence Based Practice



Appendix B

Annotative Bibliography & Evidence Grading System

Author/Year/ Journal/Title/Reference information	Type of Literature/Design	Sample	Purpose of Article	Findings	Implications	Evidence Level	Evidence Grade
Population-Specific Studies							
Sutliffe, J.T. & Carnot, M.J. (2011) Cardiovascular Risk Reduction among College Students. Family and Consumer Sciences Research Journal.	Descriptive, one-group pre-test and post-test	N=78 college students that completed required health assessments Mean age=22.9+-6.5 years Female=66.7% Freshman/sophomore=59%, Junior=33.7%, Senior=7.7%	Purpose: To determine whether an introductory nutrition course could assist in reducing cardiovascular disease (CVD) risk in college students	PRE-TEST 43.6% of students had health assessment findings that were not within the normal limits 43.9% had elevated BP readings POST-TEST 70.1% low CVD risk levels	Evidence from this study indicates that student risk can decrease after taking an introductory nutrition course. This is suggestive that similar CV education programs could also result in decreased report of risk factors.	Level 3	Grade B evidence
Holland, C., Carthron, D.L., Duren-Winfield, V., & Lawrence, W. (2014). An Experiential Cardiovascular Health Education	Mixed method study designed	Twenty students completed study Eighty percent of the	Purpose: To pilot test a culturally specific and developmentally appropriate	84% reported participating in physical activity often	This evidence suggests that there was a heightened awareness of hypertension,	Level 3	Grade B due to very small sample size

Program for African American College Students. ABNF Journal.	Quasi-experimental design with pre-test and post-test assessment data Content analyses was used to assess the qualitative data findings.	participants 18 or 19 years old 20% between 20 and 24 Fourteen (70%) were female Six (30%) were male. A convenience sampling method used. Inclusion criteria: African American males and females who were healthy freshmen students age 18 to 25, attending a historically black college or university (HBCU) in southeastern North Carolina	curriculum for African American college students that included self and family assessment to increase awareness of risk of cardiovascular disease.	within past 7 days Pre and post knowledge were noted in hypertension (p=0.041), cholesterol (0.0005) diabetes (p=0.043) and obesity (0.002)	cholesterol levels, diabetes, and obesity among African American college students. This is important because assessment measures were specific to CV risk factors among this population and lends strength to the idea that CV risk reduction education programs should include culture and diversity as important consideration.		
Moore, M. J., Werch, C. E., & Bian, H. (2012). Pilot of a Computer-based Brief Multiple-Health Behavior Intervention for	Random assignment, pre-test, post-test assessment, two groups.	N= 200 college students attending a midsized	Purpose: To examine the immediate outcomes and	Results showed the intervention group reported significantly	Findings suggest the use of a fitness goal image as proposed by BIM	Level 3	Grade B

College Students. Journal of American College Health.		southern university Ages 18-21 Intervention (N=102) Control (N=98) Female (51%) and male (49%) Mean age of 19.44 (SD=1.06)	feasibility of a unique computer-based version of a brief multiple behavior education intervention for college students	less intention then the control group to drink alcohol and smoke cigarettes in the next 6 months. Intervention participants were also significantly less likely than control participants to view them-selves as similar to the typical young person who drinks a lot of alcohol and were less willing to be seen by friends as someone who drinks a lot of alcohol.	can efficiently link multiple health behaviors. Computer-based programs are appealing to young people. This information could be modified to fir that of a CVRR education program.		
Imes, C. C., Lewis, F. M., Austin, M. A. and Dougherty, C. M. (2015), My Family Medical History and Me: Feasibility Results of a Cardiovascular Risk Reduction Intervention. Public Health Nursing.	Descriptive, one-group pre-test and post-test	N= 15 Mostly female (n = 13, 86.7%) Mostly Caucasian (n = 10, 66.7%)	Purpose: To evaluate the feasibility and acceptability of a behaviorally focused education intervention designed to increase	Seven (47%) participants reported that receiving the results of their own fasting lipid levels had the greatest impact on their	Evidence suggest that the Intervention was both feasible and acceptable in a small sample of 18–25-year old with a family history of cardiovascular	Level 3	Grade B evidence with respect to the fact that the sample was mostly female

		Some college education (n = 11, 73.3%) Ages 18–25.	perceived cardiovascular disease and coronary heart disease risk in young adults with a family history.	perceived CVD risk. All participants spoke of lifestyle changes to decrease their long-term CVD risk. Most intended to exercise more and eat a healthier diet (n = 12, 80%). Two (13.3%) intended to eat a healthier diet. One participant (6.6%), who was a vegetarian, planned to increase her exercise. Participants wanted to know what foods to avoid or eat to lower cholesterol (n = 4), what exercises were best to decrease CVD risk (n = 2), more	disease or cardiovascular risk factors. This is of importance when addressing the issue of CV risk factor identification and reduction measures.		

				detailed information on how saturated fats contributed to cholesterol levels (n = 1), and how dietary sodium influenced blood pressure (n = 1)			
Melnyk, J. A., G. Panza, A. Zaleski, and B. Taylor. 2015. Awareness and Knowledge of Cardiovascular Risk through Blood Pressure and Testing in College Freshmen. American Journal of Health Education.	Descriptive, one group Pre-Test /Post-Test	N= 25 Subjects were recruited through "freshman experience" courses offered at 3 major universities in the fall of 2012.	Purpose: To determine effectiveness of an individualized blood pressure, cholesterol, and CVD education intervention on college freshmen.	Data provides preliminary evidence that a short-personalized feedback and general health education program can be a cost-effective way to initially improve CVD knowledge and potentially reduce CVD risk across the life span.	Study is unique in that an intervention was employed using personalized BP and blood cholesterol values to provide personalized feedback with a follow-up visit to determine the interventions impact on students' CVD knowledge This study provides significant insight into how an intervention for college freshman that identifies specific risk factors (BP and	Level 3	Grade B

					blood lipids) and improves their knowledge of CVD can be successful in a short period of time. This suggests that education programs could positively impact healthy lifestyle behaviors among college students.		
Wanzer, M. B., Foster, S. C., Servoss, T., & LaBelle, S. (2014). Educating Young Men About Testicular Cancer: Support for a Comprehensive Testicular Cancer Campaign. Journal of Health Communication.	Pre-test/post-test and a post-test-only pre-experimental design	Total= 272 Experimental group N= 220 Caucasian =187 African American=12 Hispanic=3 Native American = 13 Freshman (n=24), sophomore (n=64), junior (n=72), senior (n=52), and	Purpose: To increase awareness among college-age men about testicular cancer and to encourage the behavior change of conducting testicular self-exams.	Students receiving education materials and events and media messages scored significantly higher on post-test surveys as compared to those who did not receive the intervention.	The evidence from this study supports the idea of subject related events and media messages to reinforce the educational component of a program. This is important to consider among the college students' generational habits regarding multimedia exposure.	Level 5	Grade B

		graduate (n=2) represented Control group N= 52 Caucasian =43, African American= 4, Hispanic American=1, Native American= 4 Freshman (n=9), sophomore (n=16), junior (n=11), senior (n=14), and graduate (n=2)					
Magoc, D., Tomaka, J., & Bridges-Arzaga, A. (2011). Using the Web to Increase Physical Activity in College Students. American Journal of Health Behavior.	Descriptive, pre-test, post-test design	N= 117 Part- or full-time currently enrolled male and female students 18-40 years of age from a large southwestern university with a large Hispanic enrollment	Purpose: To evaluate the effectiveness of a theoretically based and Web-delivered intervention using common course technology for increasing physical activity	Participants reported levels of physical acti vity and social cognitive theory (SCT) constructs at baseline and after 6 weeks of the intervention. Intervention participants	The evidence suggests that Web-based interventions can successfully incre ase physical activi ty among college students. The study found strong support that a theory-	Level 3	Grade B

			in a college student sample	reported increased days of moderate and vigorous physical activit y, but few changes in SCT constructs.	based, online intervention could successfully increase physical activity. This is encouraging when considering an education program for cardiovascular risk reduction in this age group.		
Brown, O.N, O' Connor, L.E & Saviano., 2014 Mobile MyPlate: a pilot study using text messaging to provide nutrition education and promote better dietary choices in college students. Journal of American College Health**.**	Descriptive, Pre-test, post-test design	150 college students aged 18-24	Purpose: To evaluate the acceptance and effectiveness of repetitive nutrition-related text messages on college students' nutrition knowledge and fruit and vegetable consumption.	Results: greater MyPlate food group recognition (p <.05) compared with control and a trend toward improved knowledge of dietary guidelines. The intervention group findings indicated increased fruit consumption (p <.05) and a trend toward elevated vegetable consumption was determined.	Texting repeated messages is an acceptable and effective way to increase nutrition knowledge and promote positive diet-related behaviors in college students.	Level 3	Grade B

				No gender differences in intervention effectiveness exist.			
Webber, P., Marsh, W, Jung, L, Gardiner, M., James, J., & Mc Mullan, P (2016.) Effectiveness of early identification and electronic interventions for teens with risk factors for the development of heart disease and diabetes. Journal of American Association of Nurse Practitioners.	Descriptive, Pre-test and post-test, one group design	Teens (*n* = 170) were recruited from one urban and one rural high school in the mid-Atlantic in 2014.	Serum risk factors for the development of heart disease and diabetes are not routinely evaluated in teens. The intent of this study was to determine the prevalence of these risk factors in teens and evaluate the effectiveness of a two-part electronic education program (recurring electronic lifestyle education program [REEP]) on reducing risks.	One or more serum and/or physical risk factors were found in the majority of students with low vitamin D and elevated body mass index (BMI) being the most common. Correlations existed between elevated BMI and elevated diastolic blood pressure, low vitamin D, and low high-density lipoprotein. All but one risk factor (BMI) improved at 12 weeks.	The majority of teens had one or more physical and/or serum risk factors. Using multiple electronic methods to deliver healthy lifestyle recommendations helps lower these risks. Also, Blackboard, an electronic learning platform, was found to be an effective data management and communication center.	Level 3	Grade B
Napolitano, M.A., Hayes, S., G.G., Ives, A/K & Foster, G.D. (2013). Using Facebook and text messaging to deliver a weight loss	Pre-test. Post-test design	Students (N = 52) were randomly assigned to one	Participants were 20.47 ± 2.19 years old, 86.45 ± 17.11 kg, with	The primary outcome was weight loss after 8 weeks	Results indicate the potential for an innovative weight loss	Level 3	Grade B

program to college students. Obesity.		of the three arms: Facebook (n = 17); Facebook Plus text messaging and personalized feedback (n = 18); Waiting List control (n = 17), with assessments at 4 weeks and 8 weeks (post-treatment).	a body mass index of 31.36 ± 5.3 kg/m(2) . Participants were primarily female (86.5%), and the sample was racially diverse (57.7% Caucasian, 30.8% African American, 5.8% Hispanic, and 5.7% other races).	(post-treatment); 96.0% of the participants completed this assessment. At 8 weeks, the Facebook Plus group had significantly greater weight loss (-2.4 ± 2.5 kg) than the Facebook (-0.63 ± 2.4 kg) and Waiting List (-0.24 ± 2.6 kg) (both Ps < 0.05). Weight change at 8 weeks was not significantly different between the Facebook and Waiting List groups.	intervention that uses technology platforms (Facebook and text messaging) that are frequently used and already integrated into the cultural life of college students.		

Appendix C

Cardiovascular Risk Reduction Pre-Test Survey

1. What is your biological gender?
    a. Male
    b. Female

2. Are you a college freshman?
    a. Yes
    b. No

3. What is your age in years?
    a. Under 18
    b. 18
    c. 19
    d. 20
    e. 21
    f. 22
    g. 23
    h. 24
    i. 25 and older

4. What is your ethnicity?

    a. White
    b. Black
    c. Hispanic
    d. Indian
    e. Native American
    f. Middle Eastern
    g. Mixed Race
    h. Asian
    i. Other

5. How often do you eat fruit?
    a) 0 servings per DAY
    b) 1 serving per DAY
    c) 2 servings per DAY
    d) 3 or more servings per DAY

6. How often do you drink fruit juices/smoothies?
    a. 0 glasses per DAY
    b. 1 glass per DAY
    c. 2 glasses per DAY
    d. 3 or more glasses per DAY

7. How often do you eat salad vegetables (lettuce, tomato, cucumber, etc.) /other raw vegetables?
    a. 0 servings per DAY
    b. 1 serving per DAY
    c. 2 servings per DAY
    d. 3 or more servings per DAY

8. How often do you eat cooked vegetables?
    a. 0 servings per DAY
    a. 1 serving per DAY
    b. 2 servings per DAY
    d. 3 or more servings per DAY

9. What is your current height in inches?
10. What is your current weight in pounds?

Appendix D

Cardiovascular Risk Reduction Post-Test Survey

1. How often do you eat fruit?
    a) 0 servings per DAY
    b) 1 serving per DAY
    c) 2 servings per DAY
    d) 3 or more servings per DAY

2. How often do you drink fruit juices/smoothies?
    a) 0 glasses per DAY
    b) 1 glass per DAY
    c) 2 glasses per DAY
    d) 3 or more glasses per DAY

3. How often do you eat salad vegetables (lettuce, tomato, cucumber, etc.) /other raw vegetables?
    a) 0 servings per DAY
    b) 1 serving per DAY
    c) 2 servings per DAY
    d) 3 or more servings per DAY

4. How often do you eat cooked vegetables?
    a) 0 servings per DAY
    b) 1 serving per DAY
    c) 2 servings per DAY
    d) 3 or more servings per DAY

5. What is your current height in inches?
6. What is your current weight in pounds?

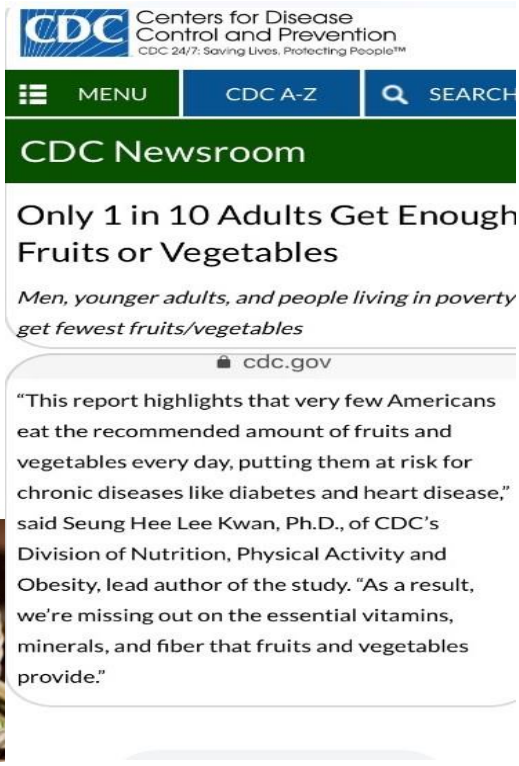
Appendix E

Screenshots of CVRR Education Public Posts on Facebook

Did you know?

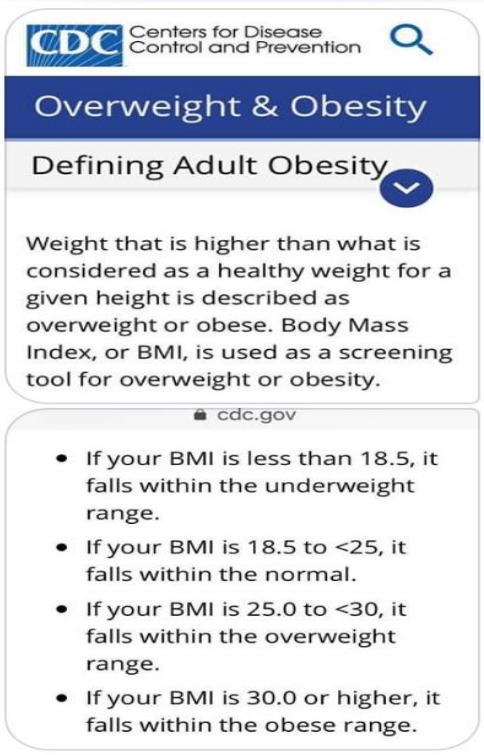
According to the National College Health Assessment survey, only 4.2% of college students report eating the recommended two servings of fruit and three servings of vegetables per day. Some are getting less than one serving per day! (American College Health Association, 2018).

At least nine different families of fruits and vegetables exist, each with potentially hundreds of different plant compounds that are beneficial to health. Eat a variety of types and colors of produce in order to give your body the mix of nutrients it needs. https://www.hsph.harvard.edu/nutritionsource/what-should-you-eat/vegetables-and-fruits/



Appendix F

Screenshots of CVRR Education Private Messages on Facebook



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