PUBH 6955: MPH Capstone Course - Colorado School of Public Health
Project Proposal Summary

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Anticipated Graduation Date (MM/YR):___Spring 2017_____

MPH Concentration (or dual degree program): __BIOS/EPID_____

Title of Project: Food Insecurity and Metabolic Syndrome in NHANES 1999-2014

Name and Affiliation of Preceptor:__Dr. Anna Barón – CSPH BIOS FACULTY_____

Name and Affiliation of Academic Advisor: __Elaine Scallan – EPID Sharon Lutz - BIOS__

If you are a preventive medicine resident, check here ____ (PUBH 6600 is waived for you.)

IRB APPROVAL STATUS: IRB is required of all students unless your project is not considered research. Look at the "Determining Human Subjects Decision Tree-Decision Tree" and "Is an Activity Research Involving Human Subjects?" documents on the COMIRB website: http://www.ucdenver.edu/academics/research/AboutUs/comirb/forms/Pages/Dicision-Trees.aspx
 Contact COMIRB to you are unsure if you need to submit

☐ **My project has been approved by an IRB: IRB #**_____

☐ **My project has been submitted to an IRB and is pending approval: IRB #**_____

☐ **My project needs IRB approval but has not been submitted**

X My project does not need IRB approval (e.g., quality assurance, quality improvement, program evaluations, operational activity such as customer service initiatives, disease outbreak investigations, development of organization policies/procedures)

CAPSTIONE ONLINE

Most semesters we offer an online section of the Capstone course. Space is limited and admittance is determined based on need, with priority given to LPH students. If you would like to enroll in the online class, check the box below AND indicate the reason you want to enroll. Note, checking the box does NOT mean you will be enrolled; you will be notified after all proposals are submitted about your assigned section.

If work schedules are a difficulty, you must submit a signed letter by your workplace supervisor on your workplace letterhead stating that you are unable to work at any other time. This letter is due on the same day as the Proposal deadline.

☐ Yes, I would like to enroll in the online section
Reason for request: _____
☐ Workplace letter submitted (required if you indicated a work scheduling difficulty)

Problem to be studied/project topic: (Include purpose, questions, aims, and hypotheses as relevant)

This project will explore the association between food insecurity and metabolic syndrome. Previous research has found an association between food insecurity and hyperlipidemia, hypertension and diabetes[1], increased BMI in young women[2], and poor health outcomes in disabled adults[3]. Recent studies have also reported on individuals who have normal BMI but are metabolically unhealthy[4,5]. This study aims to use the large dataset collected from 1999 to 2014 as part of NHANES to explore the relationship between food insecurity and metabolic syndrome, an early indicator of risk for cardiovascular disease and type II diabetes. The primary hypothesis for this study is that adults with self-reported food insecurity are at a higher risk for metabolic syndrome. The secondary hypothesis is that because food insecure individuals have access to fewer calories and healthy foods, adults with self-reported food insecurity are more likely to have a normal BMI in conjunction with metabolic syndrome and less likely to be overweight/obese without metabolic syndrome.

Methods: (Describe in detail what you are doing and how you are going to do it). As relevant, describe the project/study methodology, population, data source/survey to be used, study design, statistical analyses, grant writing, policy development, resource evaluation, etc.)

This study will use publically available de-identified data from the CDC collected as part of the National Health and Nutrition Examination Study (NHANES). The exposure variable will be food insecurity as measured by the Adult Food Security Category. This information is captured during the Food Security Questionnaire. NHANES uses the 12-month scale of the US Household Food Security Survey Module (FSSM), which consists of 18 items and has a three-stage design. The screening design keeps respondent burden to a minimum as most households are asked only three questions (five in households with children). The US household FSSM was created in 1995 to be included every year in the Community Population Survey administered by the US Census Bureau and is distributed by the USDA[6]. The USDA evaluated the reliability of the questionnaire using both traditional methods such as Spearman-Brown, Rulon's and Cronbach's alpha and novel methods to account for the high proportion of respondents that answer all questions in the negative[7]. All measures gave values greater than .69 indicating good reliability.

Metabolic syndrome will be defined using the harmonization criteria (described in the attached Data Analysis Plan) proposed in the joint interim statement of the International Diabetes Federation Task Force on Epidemiology and Prevention; National Heart, Lung, and Blood Institute; American Heart Association; World Heart Federation; International Atherosclerosis Society; and International Association for the Study of Obesity[8]. The outcome is binary – individuals will be classified as positive/negative for metabolic syndrome. Potential covariates will be gender (male, female), ethnicity (Non-Hispanic Black, Hispanic, Non-Hispanic Other, Non-Hispanic White), age, education, income, alcohol use, smoking status, and physical activity. For a complete list of all variables to be used, including the categorization of all variables please see the detailed data analysis plan. Logistic regression will be used for the primary analysis. Likelihood ratio test will be used to determine if there is a significant association between the exposure (food insecurity) and the outcome (metabolic syndrome). A likelihood ratio test will be used to test the significance of the food insecurity exposure variable with full food security used

as the reference category. Odds ratios for metabolic syndrome in the marginal, low, and very low food security categories compared to the reference full food security category will be calculated. Attributable risk and population attributable risk for food insecurity with respect to metabolic syndrome will also be calculated. All potential covariates will be evaluated for confounding. Potential effect modifiers (if applicable) will be identified a priori using previous research and expert opinion. Covariates that are not confounders or effect modifiers will be considered as precision variables or for face validity.

Only a subset of the sample population was instructed to fast overnight and was examined as part of the morning session and therefore has fasting glucose and insulin measurements. Only this subset of individuals will be included. In the NHANES data sets from 1999-2014, there are 25,474 individuals with glucose measurements. Excluding children, elderly, and pregnant women will reduce this population. In addition, individuals might be missing data on the exposure variable, other components of the outcome variable, or covariate data. However, even conservative estimates indicate that greater than 10,000 individuals should remain for analysis. The CDC recommends using the weights found in the Fasting Subsample 4 year MEC weight (WTSAF4YR) variable in the Plasma Fasting Glucose, Serum C-peptide & Insulin dataset for the years 1999-2002 and the Fasting Subsample 2 year MEC weight (WTSAF2YR) variable in the Plasma Fasting Glucose, Serum C-peptide & Insulin dataset for years 2003-2014. (This is because the 1999-2001 sample was based on the 1990 census while subsequent samples were based on the 2000 census, the 4-year weight corrects this and standardizes the data from 1999-2014.) The weights above account for the probability that an individual was selected for both NHANES and then the morning fasting session. The CDC recommends the following formula when combining weights across survey cycles: if sddsrvyr in (1,2) then SAF16YR = 1/4*WTSAF4YR, if sddsrvyr in (3,4,5,6,7,8) then SAF16YR = 1/8*WTSAF2YR, where sddsrvyr is the survey year variable (1 = 1999-2000, 2 = 2001-2002, 3 = 2003-2004, 4 = 2005-2006, 5 = 2007-2008, 6 = 2009-2010, 7 = 2011-2012, 8 = 2012-2014). In order to ensure that variances are correct the CDC recommends estimating sampling errors using the Taylor Series Linearization method accounting for the stratum (variable SDMVSTRA) and the primary sampling units (variable SDMVPSU)[9]. This will be done in R using the Survey package. The inverse probability weight (IPW) (sampling weights) will be the SAF16YR variable, the sampling strata will be the SDMVSTRA variable and the primary sampling units will be the SDMVPSU variable. All analysis will be performed using R and version controlled using Git. All files except data will be stored in a repository on github.

In 5 sentences, describe the Public Health Impact of your project. (Use 5 sentences, no more, no less.)

In 2010, it was estimated that approximately 50 million Americans were food insecure[10] and heart disease is the leading cause of death in the US[11]. A better understanding of the association between food security and poor cardiovascular and metabolic health can improve the effectiveness of public health interventions. To date, no studies have explored the association between food security and early indicators of poor cardiometabolic health other than BMI, but evidence suggests BMI may be a poor indicator. This may be particularly true of food insecure individuals due to normal BMI caused by caloric restriction. This study will add to the scientific knowledge of how resource scarcity can contribute to poor health.

Works Cited:

1. Seligman HK, Laraia BA, Kushel MB. The Journal of Nutrition. Food Insecurity Is Associated with Chronic Disease among Low-Income NHANES Participants. 2010 Feb; 140(2): 304-310

2. Gooding HC, Walls CE, Richmond TK. Food insecurity and increased BMI in young adult women. Obesity (Silver Spring). 2012 Sep;20(9):1896-901.

3. Brucker DL. The association of food insecurity with health outcomes for adults with disabilities. Disabil Health J. 2016 Dec 19. pii: S1936-6574(16)30181-9.

4. Wildman RP, Muntner P, Reynolds K, McGinn AP, Rajpathak S, Wylie-Rosett J, Sowers MR. The obese without cardiometabolic risk factor clustering and the normal weight with cardiometabolic risk factor clustering: prevalence and correlates of 2 phenotypes among the US population (NHANES 1999-2004). Arch Intern Med. 2008 Aug 11; 168(15):1617-24.

5. Tomiyama AJ, Hunger JM, Nguyen-Cuu J, Wells C. Misclassification of cardiometabolic health when using body mass index categories in NHANES 2005-2012. Int J Obes (Lond). 2016 May;40(5):883-6.

6. Carlson SJ, Andrews MS, Bickel GW. Measuring Food Insecurity and Hunger in the United States: Development of a National Benchmark Measure and Prevalence Estimates. J Nutr. 1999 Feb 1; 129(2):510-516.

7. Hamilton WL, Cook JT, Thompson WW, Buron LF, Frongillo EA, Olson CM, Wehler CA: Household Food Security in the United States in 1995: Technical Report of the Food Security Measurement Project. Report prepared for the USDA, Food Consumer Service, Alexandria, VA. 1997

8. Alberti KG, Eckel RH, Grundy SM, Zimmet PZ, Cleeman JI, Donato KA, Fruchart JC, James WP, Loria CM, Smith SC Jr; International Diabetes Federation Task Force on Epidemiology and Prevention.; Hational Heart, Lung, and Blood Institute.; American Heart Association.; World Heart Federation.; International Atherosclerosis Society.; International Association for the Study of Obesity.. Harmonizing the metabolic syndrome: a joint interim statement of the International Diabetes Federation Task Force on Epidemiology and Prevention; National Heart, Lung, and Blood Institute; American Heart Association; World Heart Federation; International Atherosclerosis Society; and International Association for the Study of Obesity. Circulation. 2009 Oct 20;120(16):1640-5.

9. Johnson CL, Paulose-Ram R, Ogden CL, et al. National Health and Nutrition Examination Survey: Analytic guidelines, 1999–2010. National Center for Health Statistics. Vital Health Stat 2(161). 2013.

10. Coleman-Jensen A, Nord M, Andrews M, Carlson S. Household food security in the United States in 2010. Washington, DC: USDA, Economic Research Report; 2011; No. ERR-125.

11. CDC Leading Causes of Death https://www.cdc.gov/nchs/fastats/leading-causes-of-death.htm Updated: October 7, 2016. Accessed: 01/03/2017.

Anticipated product: (What will be the deliverable(s) resulting from this project? For example, report to an agency, tested intervention materials for dissemination, grant proposal, statistical/epidemiologic summary to inform practice or policy, etc.)

Publishable Paper

Please select the choice that best describes your project:

_____ The primary focus of my project will be creating or delivering a program that has direct benefit to the public/community.

_____ The primary focus of my project will be conducting research, evaluation, or surveillance that will immediately translate to direct benefit to the public/community.

_____ The primary focus of my project will be conducting research, evaluation, or surveillance that will eventually translate to direct benefit to the community/community.

__X___ The primary focus of my project will be conducting research, evaluation, or surveillance that will contribute to the body of scientific knowledge.

Timeline: (What are the important steps for successful completion of your project and when will you complete each of them? Note – a timeline is a detailed listing of each step of your project. For example, when will you prepare your study materials, obtain your data, begin and complete your data analyses, etc.). Include steps you have already completed. **Timelines should be bullet-pointed.**

Note, you must have data/information gathered by approx.. 4 weeks after the semester begins in the summer and approx.. 7 weeks after the semester begins in the fall/spring. Please make sure your timeline denotes that your data will be collected by then.

- Finalization of Data Analysis Plan: 1/27

- Complete code for downloading all data from CDC and download data 2/3

- Finish creating all data analysis datasets (finished all cleaning, merging, weighting etc). 2/17

- Finish all descriptive analysis/tables/graphs: 3/6

- Finish all analysis: 3/17

- Draft of Abstract, Introduction and Methods: 3/27

- Draft of Full Paper: 4/7

- Final Draft of Paper: 4./21

- Review by Faculty Completed: 5/12

Potential problems/limitations: (What potential problems do you anticipate and how will you address them and/or what are your study limitations and how do you expect them to affect the outcome of your study?)

While I have done my best to confirm constancy and availability of all necessary variables across 1999-2014, there may be problems that arise. There may also be issues with missing data that may need to be addressed with multiple imputation or other methods. Some variables changed methods multiple times over the course of NHANES and this will need to be addressed in the limitations.

Competencies brought to the project: (What do you bring to this project, skills gained from the MPH courses you have taken, previous experience, etc?) List <u>5</u> key competencies providing the coded number for each competency along with the competency from the MPH Competency list. Include at least one competency specific to your MPH concentration.

CN-BIOS 3 - Test and interpret models for continuous outcome data (normal linear model), categorical outcome data (logistic and Poisson regression), and time-to-event data (Cox regression).

CN-BIOS 6 - Use computer software for data entry and data base management and for summarizing, analyzing and displaying research results.

CN-BIOS 10 - Use the principles of hypothesis testing and estimation of population parameters to draw inferences from quantitative data and communicate verbally and in writing those inferences and their statistical and scientific interpretation to non-statistical scientists

CN-EPID 7 - Use computer software for data entry, database management, and summarizing, analyzing and displaying data.

CN-EPID 9 - Interpret statistical results in order to make appropriate inferences.

Competencies to be gained through the project: (What specific competencies will you be increasing/gaining through this project)? List <u>5</u> key competencies providing the coded number for each competency along with the competency from the MPH Competency list. Include at least one competency specific to your MPH concentration.

CN-BIOS 9 - Apply scientific and statistical principles and methods to design basic public health and biomedical studies.

CN-BIOS 11 - Address a biomedical, public health or statistical research question with a basic statistical analysis (e.g. linear or logistic regression).

CN-EPID 10 - Evaluate threats to internal validity and when critically evaluating strength of evidence.

CR-CC 8 - Define a public health problem and specify an analytic approach.

CR-CC 3 - Communicate effectively both in writing and orally with policy makers, professionals, and the public.