



Coronary heart disease and depressive symptoms in south Asian American adolescents

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Abstract

Recent studies show a trend toward increasing depression in the adolescent population, but this phenomenon has not been thoroughly studied in the relatively recent immigration population group of South Asians. There is also a trend for increased onset of developing heart disease in the adolescent population. This study attempted to find a hypothesized positive correlation between depressive symptom rates in South Asian adolescents and their projected future susceptibility to developing coronary heart disease (CHD). Specifically, the study attempted to answer the question: How are South Asian adolescents' risk factors for coronary heart disease correlated with clinical symptoms of depression within a suburban setting? It was found that depressive symptoms and the onset of CHD had a strong correlation within a suburb of the Houston metro area for adolescents of all ethnicities including those of South Asian descendents. When compared with other ethnicities, the correlation for South Asian American adolescents was stronger, but not statistically significant.

Keywords: correlational, mixed-methods, phq-9, suburban, south asian adolescents, depressive symptoms, coronary heart disease, suburb

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Introduction

Per the Office of Population Affairs, 11% of 12-17-year-olds had at least one major depressive episode in the twelve months prior to the study (1). The same survey conducted in 2016 showed a non-significant increase to 13% (1). In conjunction with the levels of depressive symptoms, cardiac deaths following hospitalization over 5 years have also increased by 5% (2). This indicates that the prevalence of depression and anxiety may be correlated with the number of cardiac deaths. Cardiac diseases are now considered one of the top causes of death in the nation (3). Certain ethnicities, such as South Asians, seem to be more genetically predisposed to developing heart disease (4). More specifically, they may have a higher risk of developing Coronary Heart Disease (CHD), the narrowing or blocking of the coronary arteries (4). However, by adhering to a healthy lifestyle during the adolescence years, their risk factors for subsequently developing CHD can be mitigated (5). In fact, addressing the issue of depression itself can reduce the “psychological burden” on adolescents and allow for better cardiac functioning early in life, thereby possibly preventing the future detrimental consequences of CHD (2). With increased research regarding the relationship between depression and cardiac disease in South Asian adolescents, it may be possible to conduct studies that assign causation and to design treatment and prevention methods to aid this population.

Depression and Anxiety Among Adolescents and South Asians

Depression is defined as a persistent feeling of sadness and loss of interest (6). According to the Diagnostic and Statistical Manual of Mental Disorders - 5th edition, or the DSM-5 (7), experiencing five or more symptoms during the same two-week period (with a mandatory inclusion of a depressed mood or loss of interest or pleasure), is considered a clinical manifestation of Major Depressive Disorder (DSM-5). In contemporary society, the increased emphasis on schoolwork, extracurricular activities, and peer pressure may lead students in a high school setting to have a greater chance of experiencing these symptoms of anxiety and depression, which are speculated to lead to a subsequent risk of cardiac disease (8). Accordingly, chronic stressors lead to a higher probability for disease and possible death, especially if individuals are biologically predisposed (e.g. due to ethnicity) to have lower tolerance in handling stress when physiology, behavior, and environment is measured (9, 10). Antidepressants modulate the underlying neurotransmitter imbalances and improve the symptoms of anhedonia. These drugs however do not appear to influence subsequent development of cardiac disease. According to a case-control study of 5623 patients, it was found that patients who were prescribed antidepressants (tricyclic) were almost three times as likely to develop coronary heart disease in the future (11). Although antidepressant use can reduce the symptoms of heart disease, it may paradoxically cause side effects which may increase the risk of developing

heart disease in the future (11). This, in turn, suggests that in addition to antidepressants, lifestyle changes may also be necessary in order to reduce the risk of subsequent CHD.

Coronary Heart Disease and Risk Factors in South Asians

The most common cause of CHD is atherosclerosis, the buildup of cholesterol and plaque on the inner walls of the arteries (5). South Asians appear to be at a higher risk to develop atherosclerosis. This has been attributed in part due to their sedentary lifestyle and higher smoking rates, factors which can be altered from childhood by creating a more proactive lifestyle (12). The mean clotting time, considered to be a biomarker for the risk of developing CHD, was significantly greater for South Asians when compared to Caucasians (13). This could be attributed to a difference in cultural norms (14), with a greater sedentary lifestyle found in the South Asian population. It is known that lifestyle can affect epigenetic mechanisms of gene expression as well as biochemical pathways, which are capable of being inherited. Therefore, even though South Asian communities in the USA have adopted healthier lifestyles (15), their CHD risk has not significantly decreased, probably as a result of this epigenetic connection already present (15). In addition to the physiological risk factors such as increased lipoprotein, cholesterol, and smoking, psychological risk factors that can also lead to CHD (9). These factors include transient depression, chronic stressors, environmental conditions, and anxiety (16). Sangaland and Gee (6) administered

an expanded version of the World Health Organization Composite International Interview to South Asian Americans. They found that 4.6% of South Asian American respondents could be diagnosed with major depressive disorder. This proportion was significantly greater than that for other ethnicities. They concluded that there was an intergenerational strain that continued to be expressed among the Asian American population that could lead to not only psychological effects, but also physiological effects, thereby predisposing to depressive symptoms. More research is needed, in order to establish whether a cultural connection exists with risk factors within a group of adolescents belonging to a particular ethnicity.

Risks for South Asian Adolescents

Despite the significant increase in stress levels, anxiety, and depression in adolescents, specifically in high school students, there have been no systematic studies to determine if these increased psychological stressors translate into long term physiological effects, which differ across ethnicities. As seen in a cross-sectional study which suggested that South Asian adolescents were at a higher risk for developing CHD, these different risk factors (nature and nurture) are taken into account (17). However, a link has not been established between the South Asian adolescents' depression and the subsequent risk of developing CHD. Although some studies have hypothesized a correlation as a result of many trials, the adolescent population has not specifically been studied (2). Studies were limited to emigrant South Asian pockets in the UK and not geographically spread out to a

larger number of nations such as the United States (18).

This study was performed to determine if South Asian adolescents' risk factors for CHD were correlated with clinical symptoms of depression in a suburban high school. This paper hypothesizes a positive correlation between the severity of depressive symptoms in South Asian adolescents and their susceptibility to subsequently developing CHD.

Methods and Procedures

Methods

A mixed methods approach was used that included a correlational study and a comparative study. A survey and a questionnaire was administered to an American-born South Asian adolescent population located in a suburban high school in the Houston metro area in order to determine if there was a correlation between depressive symptoms and risk for CHD within this population. The questionnaire was designed to correlate the magnitude of response scores on the depressive symptoms to that for subsequent CHD risk. A correlational method determines if a relationship exists between two or more variables, however, causation is not determined. The comparative study used the results of the correlational method to compare the South Asian American population to other ethnicities, in order to determine if a statistically significant difference existed between the two.

Statistical analysis

A single tailed t-test was performed. Results were considered statistically significant at an α of < 0.05 . 85% confidence intervals were used.

Procedures

The study was carried out in three phases. The first phases included a survey that allowed stratification into the groups of individuals (first-generation American-born South Asian adolescents and adolescents from all other ethnicities). The second phase included a modified version of the Patient-Health Questionnaire 9 to measure depressive symptoms. This questionnaire has been used in studies such as *Depressive symptoms, health-related quality of life, and cardiac event-free survival in patients with heart failure: a mediation analysis* (19). The third phase included a predictability test for CHD that was adapted from *Comparison of Case Fatality in South Asian And White Patients After Acute Myocardial Infarction: Observational Study* as well as *Cardiovascular Diseases in Nonwestern Societies* (20). IRB approval was obtained for all the phases of the study.

The first phase was a survey through Google forms that stratified the groups into first generation American born South Asians, and other ethnicities. The link and QR code to this form was posted in a large suburban high school in the Houston metro area, specifically in English classrooms, as it is a required course for all high school students. There was a waiting period for 1-2 weeks to gain a large enough sample size to utilize for phase 2. The contact information of the participants was

collected, but anonymity was ensured. Please reference Appendix A to view the entirety of the online survey as well as the appropriate consent forms for this phase.

According to the Demographic Statistical Atlas of the United States, 61.4% of the population is white, 29.1% is Hispanic, 7.3% is black, 1.5% is Asian, and 0.6% is mixed races in suburban high schools in the Houston metro area (21). Based on these percentages, a ratio was used to determine the appropriate number of individuals needed in each stratified group so as to adequately power the study. Then, a sample population was chosen that was representative of the overall population. Only the South Asian population was used for the correlational portion of the method, however the other stratified group that included the other ethnicities, was used in the comparative portion of the method.

The second phase of the method, the Patient-Health Questionnaire 9, was administered to the subjects in a closed classroom and completed within 10 minutes. The same Patient-Health Questionnaire 9 was administered to the other ethnicities the next day at the same time. Please reference Appendix B to view the entirety of the modified Patient Health Questionnaire-9 as well as the appropriate consent forms for this phase.

The students were not required to divulge their name or identity on the test that they were taking. However, their contact information, to be destroyed later, was collected. After the results of the second phase were analyzed, those with depressive

symptoms were contacted again for inclusion into the third phase in the study, which would measure the risk of developing CHD. They were encouraged to ask their parents and guardians about their familial health history such as unprecedented strokes or heart attacks as well as information about their own medical statistics such as cholesterol and diabetes markers. The test for phase 3 was administered to these students in the same classroom. The group of other ethnicities that were stratified in Phase 1 and Phase 2 took the same test under the same conditions. Some questions on the test were dropped to ensure student confidentiality. Figure 3 depicts an example of two included questions in this test (18). Please reference Appendix C to view the entirety of the modified WHO Steps Instrument Test as well as the appropriate consent forms for this phase.

This mixed methods approach that occurred in three phases was beneficial in answering the research question as it allowed for statistical analysis of the correlation between depressive symptoms and the risk for CHD as well as the comparison between this correlation in South Asian adolescents and other ethnicities. According to the responses from the survey, the questionnaire, and the test, the results of South Asian adolescents were compared with those of other ethnicities. Since the population percentages of suburban high schools in the Houston metro area were used, the percentage ratio of South Asians to other ethnicities as well as all ethnicities overall were representative of this population as well with regard to correlation

between depressive symptoms and CHD. In order to find an appropriate sample size, a statistical power analysis was performed in order to find the minimum sample size necessary to obtain valid conclusions.

Results

Phase 1 and Phase 2 Results

Upon completion of the three phases of the study, the results of each of the phases were examined in order to draw a correlation among a sample population of South Asian adolescents. To reach a valid conclusion, the mean percentage and the 85% confidence interval for the context of individuals that possessed symptoms of a depressive disorder and a 85% confidence interval for South Asian adolescents within the same population that possessed a depressive disorder were determined. These intervals were chosen in order to ensure that a small enough range was sampled where predictability could be achieved, yet allowing for a relatively high confidence in the interval itself as well. Modified PHQ-9 scores of 1-4 signified minimal depressive symptoms, 5-9 signified mild depressive symptoms, 10-14 signified moderate depressive symptoms, 15-19 signified moderately severe depressive symptoms, and 20-27 signified severe depressive symptoms. Specific questions on the questionnaire needed to have specific responses in order for the participant to possess depressive disorder symptoms and to be included in the severity scale. 28.95% of all individuals sampled and 27.27% of South Asians displayed symptoms for a depressive disorder respectively.

Phase 2 and Phase 3 Results

Phase 3 resulted in a directly proportional relationship when the scores of the WHO STEPS Instrument were correlated with the scores of the PHQ-9 through a linear regression model and by finding the corresponding r values. The South Asian population group was at non-significantly higher risk for developing CHD than that for other ethnicities, thus confirming that the data could be evaluated to draw significant conclusions. The WHO STEPS Instrument outcomes were quantified by assigning a number value for each qualitative result of the respondent. There were seven different categories (1=extremely low risk, 2=very low risk, 3=low risk, 4=moderate risk, 5=high risk, 6=very high risk, 7=extremely high risk) in order to maximize the overall effect and to reduce the bias that would arise from assigning only five categories. The participants gender, their diet, physical activity, awareness, underlying conditions, and previous history were recorded and accounted for along with their previous PHQ-9 scores from Phase 2 in order to calculate their risk of onset of CHD.

Table 1 below displays the scores of depressive symptoms and the scores of the onset of CHD for the population of South Asian adolescents and the overall general student population. These have been reported as the adjusted mean (with standard deviation) using the sample size, n, that was observed at the end of all phases.

Table 1: Phase 2 and Phase 3 Data Combined Summary

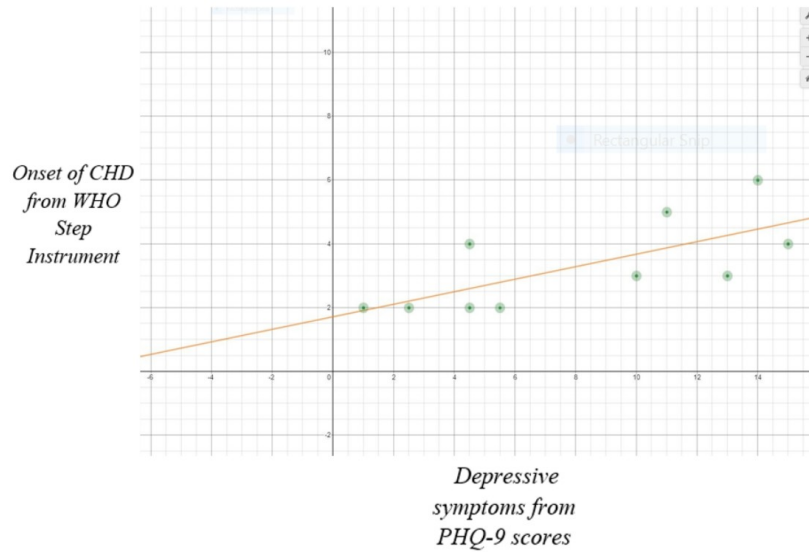
	PHQ-9 Scores	Onset of CHD risk
All ethnicities (n=10)	6.667 $\pm$ 7.420	3.300 $\pm$ 1.418
South Asian American (n=6)	6.300 $\pm$ 6.783	3.83 $\pm$ 1.60

To ensure that an appropriate sample size was utilized, a statistical power test was conducted. Using the CHD onset and depressive symptoms means, the approximated sample size was 100. However, because this study is focused on a suburb within the greater Houston area, a sample size of 12 with a sigma of 0.5 was considered sufficient to power the test as the focus was on a small area.

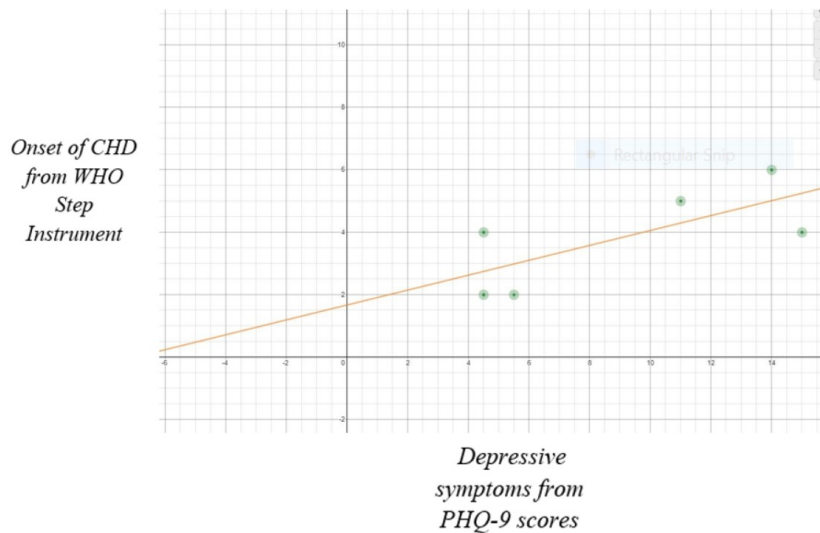
A linear regression model was applied to the final sample data from Phase 3 in order to determine

whether there was a correlation between depressive symptoms and the onset of CHD. The r value is considered an indicator of a linear relationship between the two measured factors. The following graphs display the linear correlation among the two studied factors. Graphs 1 and 2 show that that is a linear regression model can adequately describe the correlation between depressive symptoms and the onset of CHD for the South Asian as well as the other ethnicities samples. The r values for Graphs 1 and 2 are 0.7093 and 0.7236 respectively.

Graph 1: All Ethnicities Depressive Symptoms vs CHD Risk



Graph 2: South Asian American Adolescents Depressive Symptoms vs CHD Risk



In order to determine if there was a statistically significant difference between South Asian American adolescents and other ethnicities in terms of the correlation of the onset of CHD and depressive symptoms, a one tail t test was performed. The means from the data of the South Asian American adolescents and the data from the other ethnicities were used as the two-sample means. Given that the sample was random, independence was assumed,

hence a one tailed t-test could be performed with assumed normality. The first set is all ethnicities. The second set is South Asian American adolescents. The data for the means and standard deviation are shown in Table 1. The null hypothesis was that both means are equal; i.e. there is no significant difference between either the severity of depressive symptoms or the onset of CHD for both groups (South Asian Americans and All ethnicities). The alternative

hypothesis stated that the mean of the South Asian American adolescent population is significantly greater than the mean of data for all ethnicities. The results (Table 2) indicate that there is not significant

evidence to claim that South Asian American adolescents have a higher CHD onset risk and depressive symptoms than other ethnicities.

Table 2: Results of the one-tailed t-test ($\alpha=0.05$)

	PHQ-9 scores	Onset of CHD risk
t-statistic for independent t-test	0.099	0.69
degrees of freedom	16	16
critical value for a one-tailed t-test	1.746	1.746
p-value	NA	0.25
Reject null hypothesis?	no	no

Discussion

The discussion and analysis of the results of this study involving adolescents at a suburban high school in the Houston metro area can be split into four categories: the frequency of depressive symptoms in South Asians, the frequency of depressive symptoms in other ethnicities, the correlation between depressive symptoms and the onset of CHD in South Asians, and the correlation between depressive symptoms and the onset of CHD in other ethnicities. The analysis was organized this manner in order to sequentially address the various aspects and the considered components of this study.

Frequency of Depressive Symptoms in Other Ethnicities

28.95% of all the ethnicities sampled had symptoms for major depressive disorder or symptoms for other depressive disorder. Out of the 38 individuals sampled, 11 were seen to possess

depressive symptoms with a Patient-Health Questionnaire Score ranging from 9 through 19. A 85% confidence interval was applied to this data in order to be certain that the population mean lies within the derived range. The mean of this data was 7.921 (No Depressive Disorder Symptoms). The standard deviation of this data was 4.493. With this information, the researcher is 85% confident that the true proportion of adolescents in a suburban high school in the Houston metro area with symptoms for a depressive disorder is between 18.36% and 39.53%. For the 11 individuals that possessed symptoms of a depressive disorder, the strength of the symptoms was also measured on a modified scale provided by the World Health Organization. Out of the 11, 2 were seen to possess symptoms of mild depression, 5 were seen to possess symptoms of moderate depression, and 4 were seen to possess symptoms of moderately severe depression. For reference, there are five categories of depression severity that are

determined by the scores of the PHQ-9: Minimal Depression, Mild Depression, Moderate Depression, Moderately Severe Depression, and Severe Depression. Because the PHQ-9 was modified in this study, the categories were also modified to compensate for the adjustments. This means that a great portion of those that possessed depressive symptoms, also possessed a higher category of depressive symptoms as well. Further studies can delve into whether a higher category of depressive symptoms is correlated to higher rates and more severe onset of CHD.

Frequency of Depressive Symptoms in South Asian American adolescents

Essentially, 27.27% of South Asians displayed symptoms for major depressive disorder or symptoms for other depressive disorder. In order to have a more precise prediction of the true proportion of this data, a 85% confidence interval was performed instead. The mean of the data for South Asians was 7.5. The standard deviation of this data was 3.776. By constructing a 85% confidence interval for this mean data, the researcher is 85% confident that the true proportion of South Asian adolescents in a large suburban high school in the Houston metro area with symptoms for a depressive disorder is between 13.65% and 40.94%. Although the percentage of South Asians experiencing depressive symptoms is less than the percentage of other ethnicities experiencing depressive symptoms (28.95%), the difference between the proportions is not statistically significant enough to state that South Asians are

more or less likely than other ethnicities to possess depressive symptoms.

Correlation Between Depressive Symptoms and the Onset of CHD in Other Ethnicities

The mean of the onset of CHD for all ethnicities was 3.3 (between Low and Moderate). The standard deviation of the onset of CHD for all ethnicities was 1.418. The correlation coefficient, or the r value, for all ethnicities, including South Asians, was 0.7093, which means that 70.93% of the variation in the onset of CHD could be explained by the relative magnitude of the depressive symptoms. The correlation coefficient in a linear model can determine the strength and the direction of the relationship between two variables. There was a moderately strong correlation among individuals exhibiting depressive characteristics and their onset of CHD. By providing this overall relationship, it was possible to create a comparison between the rates of South Asian-American adolescents with the rates of all ethnicities.

Correlation Between Depressive Symptoms and the Onset of CHD in South Asians

The mean of the onset of CHD for South Asians was 3.83 (closer to Moderate). The standard deviation of the onset of CHD for South Asians was 1.60. When the correlation between the onset of CHD and these depressive symptoms was analyzed, the r value for the South Asian adolescent population was 0.7236 (Graph 2); i.e. 72.36% of the variation in the onset of CHD could be explained by the relative magnitude of the depressive symptoms.

The correlation between depressive symptoms and the onset of CHD in the South Asian adolescent sample (0.7236) was (non-significantly) greater than that in the all-ethnicities sample (0.7093). This may be due to differences in dietary habits, physical exercise, and familial medical history. that were involved in the study. Finally, it must be considered that this sample is not representative of all first-generation South-Asian Americans because it focuses on one suburban high school, which is considered to be relatively wealthy compared to the majority of the United States.

Limitations

The sample size was small as the responses only 16 individuals were measured by the end of Phase 3. Using the CHD means of the two groups and a common standard deviation of 1.5, a minimum sample size of 100 respondents is required for 80% statistical power (the probability of correctly rejecting the null hypothesis). (22) . However, it must be considered that this study was of an exploratory nature and was only applied to the population of a suburb within the greater Houston area. Thus, the statistical analyses may be considered to be adequate in the context of this limited population.

Another limitation of this study was the inability to control for the availability of participants. The test was administered to three participants at a different time and location than that for the other participants. Although there were no major environmental changes between the two settings, it is plausible to consider that there may be minor differences as a result of this difference in atmosphere. The three students participated in another classroom where there was an ongoing class whereas the majority of the participants were assessed in an empty classroom with solely those

Regarding the procedures portion of the study, both cultural aspects and questionnaire/test conditions were controlled for effectively. However, one limitation of this study was the inability to control for a wide variety of factors including at home conditions, the underlying reasons for depression, dietary habits, etc. Further, the third phase of the method included sensitive questions regarding the health history of the participants and/or their ancestors and may not have elicited completely truthful responses.

Conclusions

The severity of depressive symptoms was correlated with the subsequent onset of developing CHD for South Asian American adolescents. There was no significant difference between South Asian American adolescents and other ethnicities either for the severity of depressive symptoms or for the subsequent risk of CHD. It can be concluded that it is vital to maintain physical health and social stability, not only for South Asian American adolescents but also for adolescents of other ethnicities. Depressed individuals in both these groups are equally likely to develop CHD if they do not consider the implications of their diet, physical activity, and health history from a young age.

Although Frasure-Smith and Lesperance (2) reached the same conclusion, they did not specifically study the population group of first-generation South Asian-American adolescents.

Since the statistical power of this study is less than that acceptable, more data on this population subgroup is needed in order to determine if the correlation can be applied on a broader scale with added perspective. Since the South Asian-American adolescent population has not been studied in terms of the correlation between the onset of CHD and depressive symptoms, researchers who are attempting to find anomalies within South Asian culture and generational change can utilize this study to focus on the adolescent group. Their conclusions can then take into account the significance of the correlation between CHD risk and depressive symptoms. Another plausible application of this study would be to establish a causal connection between CHD and depressive symptoms. Although this study found correlation, with mentioned limitations, it can be utilized by future studies in order to determine if depressive symptoms cause CHD or vice versa. This can be attributed to the idea that with strong enough experimental evidence and mechanism(s), causation can, in fact, be inferred from correlation. Thus, by placing this study in a broader academic context, it is possible to expand the scope of research of studying depression and CHD in specific sub-populations.

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APPENDIX A: METHODS AND PROCEDURES - PHASE 1

Consent Form

Consent Form Online Survey - Phase 1

You are being invited to participate in a research study titled “Depression and Predicted Risk of CHD”.

- This study is being done by a student as a requirement of the College Board Capstone – AP Research class.
- You were selected to participate in this study because you are an adolescent attending a suburban high school in the Houston metro area.

The purpose of this research study is to find a correlation between the onset of depression/anxiety and their future risk of developing coronary heart disease among South Asian adolescents within this region.

- If you agree to take part in this study, you will be asked to complete an online survey/questionnaire.
- This survey will ask about your age, high school, ethnicity, and contact information and will take you approximately 5 minutes to complete.

PARTICIPATION

- Your participation in this survey is voluntary. You may refuse to take part in the research or exit the survey at any time without penalty. You are free to decline to answer any particular question you do not wish to answer for any reason.

BENEFITS

- You will receive no direct benefits from participating in this research study; however, we hope that your participation in the study may allow for a deeper understanding of the long term impacts of depression on the cardiac system.

RISKS

The possible risks or discomforts of the study are minimal. You may feel a little uncomfortable answering personal survey questions.

CONFIDENTIALITY

- Your survey answers will be sent to <https://forms.gle/tDwK8vS7sovQKheT6> where data will be stored in an electronic format. Your responses will remain anonymous. No one will be able to identify you or your answers, and no one will know whether or not you participated in the study.

At the end of the survey you will be asked to continue to participate in the remaining phases of the study in person. If you provide contact information such as your phone number or email

address, your survey responses may no longer be anonymous to the researcher. However, no names or identifying information would be included in any publications or presentations based on these data, and your responses to this survey will remain confidential.

CONTACT

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ELECTRONIC CONSENT

Please select your choice below. You may print or save a copy of this consent form for your records.

Clicking on the “Agree” button indicates that

- You have read the above information

You voluntarily agree to participate

Online Survey**Depression/CHD in SA Adolescents (Phase 1 - Online Survey)**

The purpose of this study is to find a correlation between depression/anxiety and the future risk of developing coronary heart disease within the South Asian adolescent population within suburban high schools in the Houston metro area.

What is your phone number? (short answer) *not required, but preferred

What is your email? (short answer) *not required, but preferred

What is your ethnicity? (multiple choice)

- American Indian or Alaska Native
- East Asian
- South Asian
- Central Asian
- Middle Eastern
- Black or African American
- Hispanic or Latino
- Native Hawaiian or Other Pacific Islander
- White - Other:

Which generation were the first immigrants to settle in the United States of America within your family? (multiple choice)

- Great-great grandparents
- Great-Grandparents
- Grandparents
- Parents
- I was born in another country - migrated to U.S. before 5yrs. of age - I was born in another country - migrated to U.S. after 5yrs. of age
- Other:

What is your age? (multiple choice)

- 13
- 14
- 15
- 16

- 17
- 18
- 19
- Other:

What grade level are you in? (multiple choice)

- Freshman
- Sophomore
- Junior
- Senior
- Other:

APPENDIX B: METHODS AND PROCEDURES - PHASE 2**Consent Form****Consent Form
Questionnaire - Phase 2**

You are being invited to participate in a research study titled:

Informed Consent: “Depression and Predicted Risk of CHD”

- This study is being done by a student as a requirement of the College Board Capstone – AP Research class.
- You were selected to participate in this study because you have fit the criteria of a South Asian adolescent with an education in suburban high schools in the Houston metro area according to the results of the Phase 1 online survey.

PURPOSE OF STUDY:

- You are invited to take part in a research study. Before you decide to participate in this study, it is important that you understand why the research is being done and what it will involve. Please read the following information carefully. Please ask the researcher if there is anything that is not clear or if you need more information.
- The purpose of this study is to utilize a correlational and comparative study in order to find a possible relationship among depression and coronary heart disease among the South Asian adolescent population through a questionnaire and a test as part of a three phase study.

STUDY PROCEDURES:

The purpose of this research study is to find a correlation between the onset of depression/anxiety and their future risk of developing coronary heart disease among South Asian adolescents within large suburban high school in the Houston metro region through a correlational and comparative study.

- If you agree to take part in this study, you will be asked to complete a questionnaire, titled the *Patient-Health Questionnaire-9*, which serves to measure depression levels.
- This questionnaire will ask about you sleep schedule, the level of interest you have doing certain activities, your personality time, your own perception of your mental health, as well as your day-to-day habits.
- The process will take you approximately 10 minutes to complete. After three days, the results of the questionnaire will be evaluated and an appropriate population will be

selected to participate in the third phase of the study which will include a test that will evaluate your rate of developing heart disease in the future.

RISKS:

- Some of the survey questions ask about your day-to-day activities and possible depressive symptoms and may be distressing to you as you think about your experiences.

BENEFITS:

There will be no direct benefit to you for your participation in this study, however the results of the study will allow for the establishment of a correlation between CHD and depression within a South Asian adolescent population which can propel increased in-depth research.

CONFIDENTIALITY:

- For the purposes of this research study, your comments will not be anonymous. Every effort will be made by the researcher to preserve your confidentiality including the following:
- Assigning code names/numbers for participants that will be used on all research notes and documents
- Summarizing and anonymizing notes, interview transcriptions, and any other identifying participant information in an electronic digest
- Destroying all confidential data/documents, including audio tapes, at the culmination of this project

COMPENSATION:

- No compensation will be given for participation in this study.

CONTACT INFORMATION:

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VOLUNTARY PARTICIPATION:

Your participation in this study is voluntary. It is up to you to decide whether or not to take part in this study. If you decide to take part in this study, you will be asked to sign a consent form. After you sign the consent form, you are still free to withdraw at any time and without giving a reason. Withdrawing from this study will not affect the relationship you have, if any, with the researcher. If you withdraw from the study before data collection is completed, your data will be returned to you or destroyed.

CONSENT:

I have read and I understand the provided information and have had the opportunity to ask questions. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving a reason and without cost. I understand that I will be given a copy of this consent form. I voluntarily agree to take part in this study.

Participant's signature _____ Date _____

Investigator's signature _____ Date _____

Modified PHQ-9 Questionnaire**Depression/CHD in SA Adolescents (Phase 2 - Questionnaire)**

The purpose of this study is to find a correlation between depression/anxiety and the future risk of developing coronary heart disease within the South Asian adolescent population within a suburban high school in the Houston metro area.

Over the last two weeks, how often have you been bothered by any of the following problems?

Little interest or pleasure in doing things

- Not at all (0)
- Several Days (1)
- More than half the days (2)
- Nearly every day (3)

Feeling down, depressed, or hopeless

- Not at all (0)
- Several Days (1)
- More than half the days (2)
- Nearly every day (3)

Trouble falling or staying asleep, or sleeping too much

- Not at all (0)
- Several Days (1)
- More than half the days (2) - Nearly every day (3)

Feeling tired or having little energy

- Not at all (0)
- Several Days (1)
- More than half the days (2)
- Nearly every day (3)

Poor appetite or overeating

- Not at all (0)
- Several Days (1)
- More than half the days (2)
- Nearly every day (3)

Feeling bad about yourself – or that you are a failure or have let yourself or your family down

- Not at all (0)
- Several Days (1)
- More than half the days (2)
- Nearly every day (3)

Trouble concentrating on things, such as reading the newspaper or watching television

- Not at all (0)
- Several Days (1)
- More than half the days (2)

- Nearly every day (3)

Moving or speaking so slowly that other people have noticed. Or the opposite – being so fidgety or restless that you have been moving around a lot more than usual

- Not at all (0)
- Several Days (1)
- More than half the days (2)
- Nearly every day (3)

If you checked off any problems (not 0), how *difficult* have these problems made it for you to do your work, take care of things at home, or get along with other people?

- Not difficult at all
- Somewhat Difficult
- Very Difficult
- Extremely Difficult

APPENDIX C: METHODS AND PROCEDURES - PHASE 3**Consent Form****Consent Form
Predictive Test - Phase 3**

You are being invited to participate in a research study titled:

Informed Consent: “Depression and Predicted Risk of CHD”

- This study is being done by a student as a requirement of the College Board Capstone – AP Research class.
- You were selected to participate in this study because you have fit the criteria of a South Asian adolescent with an education in a suburban high school in the Houston metro area according to the results of the Phase 1 online survey.

PURPOSE OF STUDY:

- You are invited to take part in a research study. Before you decide to participate in this study, it is important that you understand why the research is being done and what it will involve. Please read the following information carefully. Please ask the researcher if there is anything that is not clear or if you need more information.
- The purpose of this study is to utilize a correlational and comparative study in order to find a possible relationship among depression and coronary heart disease among the South Asian adolescent population through a questionnaire and a test as part of a three phase study.

STUDY PROCEDURES:

The purpose of this research study is to find a correlation between the onset of depression/anxiety and their future risk of developing coronary heart disease among South Asian adolescents within a suburban high school in the Houston metro area through a correlational and comparative study.

- If you agree to take part in this study, you will be asked to complete a predictive test, titled the *WHO STEPS Instrument Test*, which serves to measure depression levels.
- This test will ask about food habits, diets, exercise, regular activity, family history, cholesterol, blood pressure, heart rate, and basic medical information
- The process will take you approximately 30 minutes to complete. This will be the last phase of the study and participants will not have to be called back again

RISKS:

- Some of the questions ask about your day-to-day activities and possible depressive symptoms and may be distressing to you as you think about your experiences.

BENEFITS:

There will be no direct benefit to you for your participation in this study, however the results of the study will allow for the establishment of a correlation between CHD and depression within a South

Asian adolescent population which can be utilized in order to come to conclusions

CONFIDENTIALITY:

- For the purposes of this research study, your comments will not be anonymous. Every effort will be made by the researcher to preserve your confidentiality including the following:
- Assigning code names/numbers for participants that will be used on all research notes and documents
- Summarizing and anonymizing notes, interview transcriptions, and any other identifying participant information in an electronic digest
- Destroying all confidential data/documents, including audio tapes, at the culmination of this project

COMPENSATION:

- No compensation will be given for participation in this study.

CONTACT INFORMATION:

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VOLUNTARY PARTICIPATION:

Your participation in this study is voluntary. It is up to you to decide whether or not to take part in this study. If you decide to take part in this study, you will be asked to sign a consent form. After you sign the consent form, you are still free to withdraw at any time and without giving a reason. Withdrawing from this study will not affect the relationship you have, if any, with the researcher. If you withdraw from the study before data collection is completed, your data will be returned to you or destroyed.

CONSENT:

I have read and I understand the provided information and have had the opportunity to ask questions. I understand that my participation is voluntary and that I am free to withdraw at any

time, without giving a reason and without cost. I understand that I will be given a copy of this consent form. I voluntarily agree to take part in this study.

Participant's signature _____ Date _____

Investigator's signature _____ Date _____

Modified WHO Steps Instrument Test

Depression/CHD in SA Adolescents (Phase 3 – Modified Predictive WHO Steps Instrument Test) The purpose of this study is to find a correlation between depression/anxiety and the future risk of developing coronary heart disease within the South Asian adolescent population within a suburban high school in the Houston metro area.

Please answer the following questions to the best of your ability. Leave questions blank if you do not know the answer, if you feel uncomfortable answering, or if you are not at liberty to state an accurate answer.

Survey Information		
Consent, Interview Language and Name	Response	Code
Consent has been read and obtained	Yes 1 No 2 If NO, END	I5
Interview Language <i>[Insert Language]</i>	English 1 <i>[Add others]</i> 2 <i>[Add others]</i> 3 <i>[Add others]</i> 4	I6
Time of interview (24 hour clock)	: hrs mins	I7
Additional Information that may be helpful		
Contact phone number where possible		I10
Step 1 Demographic Information		
CORE: Demographic Information		
Question	Response	Code
Sex (<i>Record Male / Female as observed</i>)	Male 1 Female 2	C1
What is your date of birth? <i>Don't Know 77 77 7777</i>	/ / dd mm year <i>If Known, Go to C4</i>	C2

How old are you?	Years	C3
In total, how many years have you spent at school and in full-time study (excluding pre-school)?	Years	C4

Step 1 Behavioural Measurements

CORE: Diet

The next questions ask about the fruits and vegetables that you usually eat. I have a nutrition card here that shows you some examples of local fruits and vegetables. Each picture represents the size of a serving. As you answer these questions please think of a typical week in the last year.

Question	Response	Code
In a typical week, on how many days do you eat fruit ?	Number of days <i>If Zero days, go to D3</i> Don't Know 77	D1
How many servings of fruit do you eat on one of those days? (<i>USE SHOWCARD</i>)	Number of servings Don't Know 77	D2
In a typical week, on how many days do you eat vegetables ? (<i>USE SHOWCARD</i>)	Number of days <i>If Zero days, go to D5</i> Don't Know 77	D3
How many servings of vegetables do you eat on one of those days? (<i>USE SHOWCARD</i>)	Number of servings Don't know 77	D4

Dietary salt

With the next questions, we would like to learn more about salt in your diet. Dietary salt includes ordinary table salt, unrefined salt such as sea salt, iodized salt, salty stock cubes and powders, and salty sauces such as soy sauce or fish sauce (see showcard). The following questions are on adding salt to the food right before you eat it, on how food is prepared in your home, on eating processed foods that are high in salt such as [*insert country specific examples*], and questions on controlling your salt intake. Please answer the questions even if you consider yourself to eat a diet low in salt.

How often do you add salt or a salty sauce such as soy sauce to your food right before you eat it or as you are eating it? (<i>SELECT ONLY ONE</i>)	Always 1 Often 2 Sometimes 3 Rarely 4 Never 5 Don't know 77	D5
How often is salt, salty seasoning or a salty sauce added in cooking or preparing foods in your household?	Always 1 Often 2 Sometimes 3 Rarely 4 Never 5 Don't know 77	D6
	Always 1 Often 2	D7

How often do you eat processed food high in salt ? By processed food high in salt, I mean foods that have been altered from their natural state, such as packaged salty snacks, canned salty food including pickles and preserves, salty food prepared at a fast food	Sometimes	3	
	Rarely	4	
	Never	5	
	Don't know	77	
How much salt or salty sauce do you think you consume?	Far too much	1	D8
	Too much	2	
	Just the right amount	3	
	Too little	4	
	Far too little	5	
	Don't know	77	

EXPANDED: Diet				
Question		Response		Code
How important to you is lowering the salt in your diet?		Very important	1	D9
		Somewhat important	2	
		Not at all important	3	
		Don't know	77	
Do you think that too much salt or salty sauce in your diet could cause a health problem ?		Yes	1	D10
		No	2	
		Don't know	77	
		Do you do any of the following on a regular basis to control your salt intake ? (RECORD FOR EACH)		
Limit consumption of processed foods	Yes	1	D11a	
	No	2		
Look at the salt or sodium content on food labels	Yes	1	D11b	
	No	2		
Buy low salt/sodium alternatives	Yes	1	D11c	
	No	2		
Use spices other than salt when cooking	Yes	1	D11d	
	No	2		
Avoid eating foods prepared outside of a home	Yes	1	D11e	
	No	2		
Do other things specifically to control your salt intake	Yes	1	D11f	
	No	2		
Other (please specify)			D11other	

CORE: Physical Activity
Next I am going to ask you about the time you spend doing different types of physical activity in a typical week. Please answer these questions even if you do not consider yourself to be a physically active person.

Think first about the time you spend doing work. Think of work as the things that you have to do such as paid or unpaid work, study/training, household chores, harvesting food/crops, fishing or hunting for food, seeking employment. <i>[Insert other examples if needed]</i>. In answering the following questions 'vigorous-intensity activities' are activities that require hard physical effort and cause large increases in breathing or heart rate, 'moderate-intensity activities' are activities that require moderate physical effort and cause small increases in breathing or heart rate.		
Question	Response	Code
Work		
Does your work involve vigorous-intensity activity that causes large increases in breathing or heart rate like <i>[carrying or lifting heavy loads, digging or construction]</i>	Yes 1 No 2 <i>If No, go to P 4</i>	P1
In a typical week, on how many days do you do vigorous-intensity activities as part of	Number of days	P2
How much time do you spend doing vigorous-intensity activities at work on a typical day?	Hours : minutes : hrs mins	P3 (a-b)
Does your work involve moderate-intensity activity, that causes small increases in breathing or heart rate such as brisk walking <i>[or carrying light loads]</i> for at least 10	Yes 1 No 2 <i>If No, go to P 7</i>	P4
In a typical week, on how many days do you do moderate-intensity activities as part of	Number of days	P5
How much time do you spend doing moderate-intensity activities at work on a typical day?	Hours : minutes : hrs mins	P6 (a-b)
Travel to and from places		
The next questions exclude the physical activities at work that you have already mentioned. Now I would like to ask you about the usual way you travel to and from places. For example to work, for shopping, to market, to place of worship. <i>[Insert other examples if needed]</i>		
Do you walk or use a bicycle (<i>pedal cycle</i>) for at least 10 minutes continuously to get to and from places?	Yes 1 No 2 <i>If No, go to P 10</i>	P7
In a typical week, on how many days do you walk or bicycle for at least 10 minutes	Number of days	P8
How much time do you spend walking or bicycling for travel on a typical day?	Hours : minutes : hrs mins	P9 (a-b)

CORE: Physical Activity, Continued		
Question	Response	Code
Recreational activities		
The next questions exclude the work and transport activities that you have already mentioned. Now I would like to ask you about sports, fitness and recreational activities (leisure), <i>[Insert relevant terms]</i> .		
Do you do any vigorous-intensity sports, fitness or recreational (<i>leisure</i>) activities that cause large increases in breathing or heart rate like <i>[running or football]</i> for at least 10	Yes 1 No 2 <i>If No, go to P 13</i>	P10
In a typical week, on how many days do you do vigorous-intensity sports, fitness or recreational (<i>leisure</i>) activities?	Number of days	P11
How much time do you spend doing vigorous-intensity sports, fitness or recreational activities on a typical day?	Hours : minutes : hrs mins	P12 (a-b)
Do you do any moderate-intensity sports, fitness or recreational (<i>leisure</i>) activities that cause a small increase in breathing or heart rate such as brisk walking, <i>[cycling, swimming, volleyball]</i> for at least 10 minutes	Yes 1 No 2 <i>If No, go to P16</i>	P13
In a typical week, on how many days do you do moderate-intensity sports, fitness or recreational (<i>leisure</i>) activities?	Number of days	P14
How much time do you spend doing moderate-intensity sports, fitness or recreational (<i>leisure</i>) activities on a typical day?	Hours : minutes : hrs mins	P15 (a-b)

EXPANDED: Physical Activity		
Sedentary behaviour		
The following question is about sitting or reclining at work, at home, getting to and from places, or with friends including time spent sitting at a desk, sitting with friends, traveling in car, bus, train, reading, playing cards or watching television, but do not include time spent sleeping. <i>[INSERT EXAMPLES] (USE SHOWCARD)</i>		
How much time do you usually spend sitting or reclining on a typical day?	Hours : minutes : hrs mins	P16 (a-b)

CORE: History of Raised Blood Pressure		
Question	Response	Code
Have you ever had your blood pressure measured by a doctor or other health worker?	Yes 1 No 2 <i>If No, go to H6</i>	H1
Have you ever been told by a doctor or other health worker that you have raised blood	Yes 1 No 2 <i>If No, go to H6</i>	H2a
Were you first told in the past 12 months?	Yes 1 No 2	H2b
In the past two weeks, have you taken any drugs (medication) for raised blood pressure prescribed by a doctor or other health worker?	Yes 1 No 2	H3
Have you ever seen a traditional healer for raised blood pressure or hypertension?	Yes 1 No 2	H4
Are you currently taking any herbal or traditional remedy for your raised blood	Yes 1 No 2	H5

CORE: History of Diabetes		
Have you ever had your blood sugar measured by a doctor or other health worker?	Yes 1 No 2 <i>If No, go to H12</i>	H6
Have you ever been told by a doctor or other health worker that you have raised blood sugar	Yes 1 No 2 <i>If No, go to H12</i>	H7a
Were you first told in the past 12 months?	Yes 1 No 2	H7b
In the past two weeks, have you taken any drugs (medication) for diabetes prescribed by a doctor or other health worker?	Yes 1 No 2	H8
Are you currently taking insulin for diabetes prescribed by a doctor or other health worker?	Yes 1 No 2	H9
Have you ever seen a traditional healer for diabetes or raised blood sugar?	Yes 1 No 2	H10
Are you currently taking any herbal or traditional remedy for your diabetes?	Yes 1 No 2	H11

CORE: History of Raised Total Cholesterol		
Question	Response	Code
Have you ever had your cholesterol (fat levels in your blood) measured by a doctor or other	Yes 1 No 2 <i>If No, go to H17</i>	H12
Have you ever been told by a doctor or other health worker that you have raised cholesterol?	Yes 1 No 2 <i>If No, go to H17</i>	H13a
Were you first told in the past 12 months?	Yes 1 No 2	H13b
In the past two weeks, have you taken any oral treatment (medication) for raised total	Yes 1 No 2	H14
Have you ever seen a traditional healer for raised cholesterol?	Yes 1 No 2	H15
Are you currently taking any herbal or traditional remedy for your raised cholesterol?	Yes 1 No 2	H16

CORE: History of Cardiovascular Diseases		
Have you ever had a heart attack or chest pain from heart disease (angina) or a stroke (cardiovascular accident or incident)?	Yes 1 No 2	H17
Are you currently taking aspirin regularly to prevent or treat heart disease?	Yes 1 No 2	H18
Are you currently taking statins (Lovastatin/Simvastatin/Atorvastatin or any other statin) regularly to prevent or treat heart	Yes 1 No 2	H19

Step 2 Physical Measurements

CORE: Blood Pressure		
Question	Response	Code
Interviewer ID		M1
Device ID for blood pressure		M2
Cuff size used	Small 1 Medium 2 Large 3	M3
Reading 1	Systolic (mmHg)	M4a

	Diastolic (mmHg)	M4b
Reading 2	Systolic (mmHg)	M5a
	Diastolic (mmHg)	M5b
Reading 3	Systolic (mmHg)	M6a
	Diastolic (mmHg)	M6b
During the past two weeks, have you been treated for raised blood pressure with drugs (medication) prescribed by a doctor or other	Yes 1 No 2	M7
CORE: Height and Weight		
Height	in Centimetres (cm)	M11
Weight <i>If too large for scale 666.6</i>	in Kilograms (kg)	M12
CORE: Waist		
Waist circumference	in Centimetres (cm)	M14

Step 3 Biochemical Measurements

CORE: Blood Glucose		
Question	Response	Code
During the past 12 hours have you had anything to eat or drink, other than water?	Yes 1 No 2	B1
Time of day blood specimen taken (24 hour clock)	Hours : minutes : hrs mins	B4

Fasting blood glucose [CHOOSE ACCORDINGLY: MMOL/L OR MG/DL]	mmol/l	B5
	mg/dl	
Today, have you taken insulin or other drugs (medication) that have been prescribed by a doctor or other health worker for raised blood glucose?	Yes 1	B6
	No 2	
CORE: Blood Lipids		
		
Total cholesterol [CHOOSE ACCORDINGLY: MMOL/L OR MG/DL]	mmol/l	B8
	mg/dl	
During the past two weeks, have you been treated for raised cholesterol with drugs (medication) prescribed by a doctor or other health worker?	Yes 1	B9
	No 2	

EXPANDED: Triglycerides and HDL Cholesterol		
Question	Response	Code
Triglycerides [CHOOSE ACCORDINGLY: MMOL/L OR MG/DL]	mmol/l	B16
	mg/dl	
HDL Cholesterol [CHOOSE ACCORDINGLY: MMOL/L OR MG/DL]	mmol/l	B17
	mg/dl	