ECON30310: Economics Research Project 3

Effect of Socio-economic Status (SES) and Lifestyle on Physical and Mental health

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Abstract:

The role of lifestyle in mediating the relationship between socio-economic characteristics and health has been discussed extensively in the epidemiological and economic literatures. In this paper, we develop two simple economic models in which health is determined by individuals' Socioeconomic Status (SES) and lifestyle, which depends on preferences, budget and time constraints and unobservable characteristics. The paper consists of 2 main models, Model 1 deals with Physical health and Model 2 deals with Mental health. The current body of literature indicates a positive relationship between SES and health, suggesting that those with better living conditions have a better physical health. The aim of this research is to prove that SES and lifestyle have a significant impact on both Physical and Mental health and lifestyle mediates the relationship between SES and health. This does not go without debate, as there is also confounding research that has found that SES and lifestyle have no significant impact on mental health. Using comprehensive data from The Irish Longitudinal study on Ageing (TILDA) dataset, I generated two models. I ran logistic regression analysis to provide evidence to support my hypotheses. The results show that SES has a significant impact on both Physical and Mental health. The results also show that lifestyle mediates the relationship between SES and health (Physical and Mental).

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1. Introduction

The relationship between socioeconomic status (SES)and health has been studied over a number of years now. During the 1960s, scholars generally believed that with the advancement of medical technology and economic development, health inequality would be reduced, especially in developed countries (Lutfey, K., & Freese, J. et al.,2005). However, in the 1980s, Black found that health inequality in Britain has increased instead of diminishing (British Medical Jour nal,1990). Studies carried out in US and European countries have also confirmed that SES has a profound impact on health; however, the mechanism used behind this phenomenon has been questionable. There are two different perspectives proposed by the scholars: social causation theory and health selective theory. The Social Causation Theory suggests that the difference in SES is the key reason behind health inequalities whereas, the Health Selective Theory implies that people with good health leads to a higher SES. Fuchs (1986) on the other hand has argued that the strong correlation between SES and health may be due to differences in the time preferences of individuals, which affects investments in both education and health (Galama, Titus J, van Kippersluis, Hans, The Economic Journal, 2018).

Lifestyle is also a key factor that is related to the influence of SES on health. In other words, lifestyle choices that individuals make help them maintain and improve their health. Furthermore, lifestyles could be passed down across generations. A study of mother-child pairs proposed that if a mother of an infant (0–3 years old child) has a healthy lifestyle, the child is 27% more likely to be healthy and adopt the same lifestyle (Ponthiere, G. 2011). A healthy lifestyle refers to the behavioral patterns through which individuals maintain good health based on certain motivations, abilities, and knowledge about what makes up healthy and pleasurable behaviors (Cockerham, W. et al.,2005). Lifestyle involves two different type of behaviors i.e., health-risk behaviors, such as cigarette smoking and drinking etc. and health-promoting behaviors, such as exercise, social interactions, good health investment e.g., health insurance, GP visits etc. (Wang & Geng, 2019).

An investigation conducted in the United States also showed that risky behaviors such as smoking, poor diet, and physical inactivity are the leading causes of mortality. The study concluded that lifestyle-related behavioral factors account for nearly 40% of deaths (Mokdad AH et al., 2004). It has also been noted that

lifestyle is also associated with psychological health. Generally, people with a healthy lifestyle tend to have better mental/psychological health as compared to the people with unhealthy lifestyles. For example, some studies have reported that risky behavior, such as smoking lead to poor mental health (Rohrer J.E. et al., 2005), on the contrary, health-promoting behavior, such as physical activity, sports, and exercise, are reported to be effective in relieving depression (Lawlor D.A., Hopker S.W, 2001). Furthermore, a recent social survey targeting New Zealand adults revealed that people who adopt a healthier lifestyle tend to have optimal well-being (Prendergast K.B. et al., 2016). Despite lifestyle being closely related to one's health, it is not purely a personal choice. In fact, lifestyle is influenced by a variety of social factors, especially an individual's SES.

This paper aims to undertake an in-depth and critical examination of the relationship between Socioeconomic Status (SES), lifestyle and health (Physical and Psychological) in Irish adults aged 50 and over. Moreover, this paper sets out to understand whether lifestyle does play a part in mediating this relationship. Given there is a wide range of literature available on this topic, this paper will stand out as it will be analyzed using the data from The Irish Longitudinal Study on Ageing (TILDA) dataset, accessed via The Irish Social Science Data Archive (ISSDA), which was released in 2015. The data entirely focuses on the residents of Ireland. In addition to this, this paper will take different variables into account which I have generated myself instead of taking directly from other studies. I will be using several variables that are indicative of SES as well as lifestyle.

This paper will be divided into several sections. The first section covered a brief introduction of the topic. The second section contains a descriptive literature review surrounding this topic. Subsequently, the third section will provide a detailed outline of the empirical methodology and data utilized to examine various relationships in my study. The fourth section will outline the empirical results and a discussion of the various findings of my research. Lastly, the paper will conclude in the fifth section with conclusive remarks on the findings and their significance in the realm of economic analysis. The end of the paper will outline the mathematical appendices. This section contains supplementary material, which may help provide a more comprehensive understanding of the research topic.

2. Literature Review

Several Health economic journals are covering the topic of the relationship between SES and health in different countries. A study that is very closely associated with my research model is the one conducted by Jian Wang and Liuna Geng in 2019. This study examined the effect of SES on respondents' physical and psychological health. Furthermore, it investigated the potential mediating effect lifestyle may have on the relationship between SES and health. Data utilised in this study were obtained from the 2015 Chinese General Social Survey (CGSS). It is a continuous large-scale nationwide survey conducted by the National Survey Research Center of China. The CGSS 2015 covered 478 villages in 28 provinces across mainland China. However, some of the data was missing because of unanswered questions, after cleaning the data (removal of invalid questionnaires) the final sample size was reduced to 986. The sample consisted of 532 males and 454 females. Data included information about the samples' mean age, marital status, educational attainment etc. This study adopted International Socio-Economic Index (ISEI) as the indicator of SES along with several health-promoting behaviours as the indicators of lifestyle. Furthermore, this study not only involves physical health but also psychological health which provides a broader understanding of human health (Wang & Geng, 2019).

The study focuses on the following set of hypotheses:

- H1a: People with higher SES are in better physical health.
- H1b: People with higher SES are in better psychological health.
- H2a: People with a healthier lifestyle are in better physical health.
- H2b: People with a healthier lifestyle are in better psychological health.
- H3a: Lifestyle mediates the relationship between SES and physical health.
- H3b: Lifestyle mediates the relationship between SES and psychological health.

In order to test the hypothesized relationship between the variables, Structural equation modelling (SEM) was used. This index reflects people's socioeconomic status with respect to their occupation, education, and income. (Wang & Geng, 2019).

This study mainly focused on health-promoting behaviours. Lifestyle was measured by a 6-item Likert scale. Respondents were asked whether they do the following often (1) “physical exercise”; (2) “attend cultural events, exhibitions, concerts etc.,”; (3) “socialising with friends”; (4) “listen to music”; (5) “reading books, newspapers etc.” and (6) “learning new things.” The options ranged from 1 (always) to 5 (never). A higher score represented a healthier lifestyle (Wang & Geng, 2019).

Respondents’ self-reported health was used to measure physical health. Self-reported health is still considered a valid indicator of health in various social contexts despite the variance between self-reported health and people’s objective health condition, (Subramanian S.V et al.,2009). Physical health was assessed based on the following two questions: (1) “How would you rate your current physical condition? (1 = poor health to 5 = Excellent health)” and (2) “Do physical health problems affect your work often? (1 = always, 5 = never).” A higher score indicated better physical health (Wang & Geng, 2019).

Similarly, Psychological health was measured by a 5-item Likert scale, with response options ranging from 1 (always) to 5 (never). The following type of questions were asked: (1) “How often do you feel calm/ peaceful?” (2) “How often do you feel happy?” (3) “How often do you feel exhausted?” (4) “How often do you feel mentally tired?” and (5) “How often do you feel like you cannot take it anymore?” A higher score indicated better psychological health (Wang & Geng, 2019).

Covariates included in this analysis were age, gender (male = 1, female = 2), region (urban areas = 1, rural areas = 2), and marital status (married = 1, unmarried = 2). (Wang & Geng, 2019).

The results implied that SES has a significant effect on physical health, i.e., people with higher SES may have better physical health. However, there was no significant impact of SES on psychological health, indicating that people with higher SES do not necessarily have good mental health. Furthermore, there was a significant positive effect of lifestyle on both physical health and psychological health, indicating that people with a healthier lifestyle may be in better physical and psychological health. In addition, lifestyle acted as a mediator for the relationship between SES and physical health. Similarly, the results also indicated a significant indirect effect of SES on psychological health, which was mediated by lifestyle. (Wang & Geng, 2019).

It has been emphasised by many scholars that several factors contribute to the health of people and communities including economic resources, education and level of income, access to health care, and

quality of environment (Eberhardt et al.,2001). Regardless of where they live, people with lower income and lower educational attainment are more likely to report poor health. They are less likely to have health insurance coverage, and less likely to receive preventive health care. Altogether, these variables raise the risk of death across all demographic populations (Pamuk et al., 1998). Many of the ill people associated with poverty, including lower total household income and a higher number of uninsured residents, are magnified in rural areas. (Eberhardt et al.,2001) also stated that people in rural America experience higher rates of chronic disease and health-harming behaviours; they are more likely to indulge in risky behaviours like smoking, more likely to lose teeth, as well as suffer from chronic health conditions. This puts focus on the fact that governments need to provide rural areas with better employment, education and health facilities in order to reduce health inequality.

Despite awareness about single lifestyle-related health risk factors, more research is needed to clarify the relationship between multiple healthy lifestyle factors and variables that may impact peoples' health. Such data may guide both clinical and health policy decision making and therefore, lead to population health improvement. The prevalence and cluster patterns of multiple healthy lifestyle factors among a random sample of teenagers (n =616), adults (n =585), and seniors (n =685) from a large Midwestern health plan was documented by a group of authors (Pronk N.P. et al., 2004). Lifestyle-related health factors were assessed including physical activity, non-smoking, healthy diet, and healthy weight for all the participants; adults and seniors were also asked about their alcohol consumption. The healthy lifestyle factors sum score was categorized into three levels, i.e., 0 to 2, 3, or 4 to 5 healthy lifestyle factors (4 for adolescents). Ordinal logistic regression was used to estimate the odds of meeting each of the above criteria after taking several demographic characteristics and disease states into account. Results showed that only 14.5% of the teenagers, adult and senior health plan members met the recommended guidelines for four common healthy lifestyle factors. Only 10.8% of adults and 12.8% of seniors met all five behaviour-related factors. For teenagers, only being non-depressed was associated with an increased likelihood to stick to multiple healthy lifestyle factors. For adults, being in the 50- to 64-year-old cohort, having a college degree and having no chronic disease were associated with an increased likelihood to be in adherence to multiple healthy lifestyle factors. For seniors, having a college degree was the only variable associated with an increased likelihood of having a healthy lifestyle (Pronk N.P. et al.,2004). This analysis presents a potentially useful summary

measure based on person-centred measures of healthy lifestyle factors. It can help clinicians to derive meaningful information about the factors that lead to a healthy lifestyle. Further, this information can be used by Health systems administrators to influence health policy and resource allocation decisions (Pronk N.P. et al., 2004).

Kenkel (1995) estimated health production functions with the help of several output measures, in order to estimate the effect of lifestyle on adult health. He modelled his variable, current health to be dependent on previous health and the depreciation rate, as well as lifestyle and schooling. However, the empirical specifications were not derived from an explicit structural model. Kenkel (1995) used OLS estimates using cross-sectional US data from the 1985 National Health Interview Survey. He found that excessive weight, smoking, excessive drinking, insufficient or excessive sleep, and stress to be harmful inputs in the health production function. He also found that exercise and moderate alcohol consumption prove to be beneficial for health (Kenkel,1995).

Contoyannis P. and Jones A.M. (2004) proposed a simple model to identify interactions between health-related behaviour and self-reported health, given other observable and unobservable factors. Unobservable heterogeneity might reflect underlying causal factors such as correlations in the direct marginal utilities of health, income, and lifestyle choices. The structural parameters of a health production function were estimated, along with the reduced form parameters for the lifestyle equations using panel data from the Health and Lifestyle Survey (HALS) conducted in the United Kingdom in the years 1984 and 1991. Maximum Simulated Likelihood for a multivariate probit (MVP) model was used with discrete indicators of lifestyle choices and self-assessed health (SAH) to achieve the results. The study found that sleeping well, doing regular exercise, and refraining from smoking in 1984 had dramatic positive effects on the probability of reporting excellent or good SAH in 1991. The null of exogeneity for all the lifestyle variables was rejected at the 5% level (Contoyannis P., and Jones A.M., 2004).

3. Data and Methods

3.1. Data Description

I used The Irish Longitudinal Study on Ageing (TILDA) Wave 3, 2014-2015, version 3.3 to carry out my data analysis. TILDA gathers information about different aspects of economics, health and social circumstances from adults aged 50 years and over resident in Ireland. TILDA aims to provide a complete and accurate picture of the characteristics, needs and contributions of older people in Ireland to inform and support improvements in policy and practice; technology and innovation advancement; tailored education and training through an enhanced ageing research infrastructure; harmonization with leading international research to ensure the adoption of best policy and practice and comparability of results. TILDA plays a crucial role as the foundation on which we can plan appropriate health, medical, social, and economic policies for our older adults.

For this survey, there was a single-cohort longitudinal design implicated which studied about various aspects of Irish adults aged 50 and over. Due to the longitudinal nature of this project, respondents were being interviewed on a number of occasions. In total, there are 4 different occasions i.e., waves available on the Irish Social Science Data Archive (ISSDA), during which they were interviewed. I will be focusing on a single wave (wave 3) to conduct the data analysis in this paper.

Wave 3 of the study was completed between June 2014 and December 2015. It involved 6,566 self-respondents, a response rate of 85%, with 85% of these returning a Social Communication Questionnaire (SCQ). All participants in wave 3 were invited to undergo a health assessment. They could either do a full assessment at a health centre in Dublin or a partial assessment that could be done at their own homes. 81% of the participants underwent a comprehensive health assessment. The various clinical measurements taken at the health centre were repeated from wave 1 with the addition of some new function and performance tests. The data contained some missing observations. In order to carry out my data analysis, I cleaned the data by removing the variables that I did not require and omitting the missing observations. As a result, my final sample contained 5087 observations. All the data was accessed through the Irish Social Science Data Archive (ISSDA).

3.2. Variables Description

As outlined in my introduction, the intention of this paper is to analyze the effect of socioeconomic status (SES) on physical and psychological health. And most importantly, the contribution of lifestyle in mediating this effect. I wanted to carry out a logistic (logit) regression so, I chose the suitable variables from the TILDA dataset. Some of the variables needed to be converted into binary variables.

The dependent variable which I will be using in the first model of my regression analysis is 'Health'. This variable refers to an Individual's physical health. This is a categorical variable ranging from 1(Excellent) to 5(Poor) physical health. The variable was obtained by asking the respondents the following: "Would you say your health is, a) Excellent b) Very Good c) Good d) Fair e) Poor". In order to carry out my regression analysis, I generated a new variable named 'Healthy'. I generated this variable by combining the first 3 categories i.e., respondents who reported their health to be excellent, very good and good, these represented good health. The other 2 categories i.e., Fair and Poor represented bad physical health. This is a binary variable holding a value of 1 for a person who is physically healthy and 0 for a person who is unhealthy.

The independent variable which I have chosen to examine the relationship between gender and health, is the respondent's sex who has filled out the survey. In order to test which gender has a better health, I generated a binary variable named 'Female' which held a value 1 if the respondent was a female and 0 if the respondent was a male. This variable tells whether females have a better health as compared to males or not. Out of the 5087 respondents 2335 (45.90%) were male and 2752 (54.10%) were female.

A very important indicator of one's socio-economic background, is the annual household income. One could argue that households with higher income are more privileged and can afford better diet, education, healthcare etc. So, household income effects individual's health. I used the variable 'Household_Income' to account for the net income. This was a categorical variable divided into 11 categories altogether (Less than 10,000, 10,000-20,000, 20,000-30,000 up until 100,000+). I omitted the first category i.e., Less than 10,000. I compared the health of people in the other ten categories to the health of the people in this category.

Another important factor that determines health is education. More educated people know how to improve their health, make better health investment, maintain a healthy diet and they are less likely to indulge into health-harming activities e.g., smoking. I used a categorical variable named 'education' to account for respondent's educational attainment. Respondents were asked to select the "Highest education achieved". The variable was divided into 3 categories:

1) None/Primary 2) Secondary 3) Third level/Higher.

I omitted the first category i.e., None/Primary education in my regression. I compared the health of people with a secondary education or higher education to the health of people with None/Primary education.

The control variable for age of the respondent was named 'age'. It ranged from less than 53 (respondents aged between 50-53) to 84+. I generated another variable named 'age2' by squaring the variable 'age'. This variable talks about the effect of increasing age on individual's health.

I also wanted to test the effect of marital status on health so, I used a binary variable named 'Married' which held a value of 1 for married people and 0 for unmarried people. The variable was obtained by asking the respondents the following: "Is the respondent currently married?"

Since lifestyle is a major part of my analysis, I used several control variables which were indicative of lifestyle. These variables included the following:

Employment status: I obtained a variable named 'employ' from TILDA wave 3 (accessed by ISSDA). The respondents were asked the following question: "Is the respondent currently employed/self-employed?" where they had to respond as 'Yes' or 'No'. I renamed the variable as 'Employed' which held a value of 1 for employed people and 0 for unemployed people.

Health Insurance: The respondents were supposed to answer the following question: "Does the respondent has a private medical insurance cover?". It held a value of 1 for people who had a medical insurance covered and 0 otherwise. I named the variable 'Healthinsurance'. 2,940 of the 5087 respondents had health insurance covered (57.79%) whereas the remaining 2147 (42.21%) did not.

Sports club membership: I was intrigued to test whether indulging in sport activities has a significant impact on health. This was another binary variable obtained by asking "Do you participate in any groups such as sports club or social group/club?" The variable held a value of 0 for the respondents who said 'No' and 1 for the respondents who said 'Yes'. I renamed the variable as 'Sportsclubparticipation'. 2,583 out of the

5087 people participated in sports club (50.78%) whereas 2,504 of the people did not (49.22%).

Exercise: I used another variable to account for physical activity. The respondents were asked "Do you exercise regularly?". This was a categorical variable with 8 different categories ranging from 1(Daily) to 8(Never). I generated a new binary variable by combing the first 3 categories i.e., 1) Daily 2) weekly 3) twice a month. This made up 56.77% of the sample (2888 of the 5087 respondents). I put the remaining 5 categories together making up 43.23% of the sample (2199 of the 5087 respondents). The binary variable 'Exercise' held a value 1 for individuals who exercise regularly and 0 for the ones that do not exercise regularly.

Home Activity: The respondents were asked "How often do you work in the garden or at home?". The responses ranged from 1(Daily) to 8(Never). I generated a new binary variable 'Homeactivity' with a value 1 for people who did gardening or housework regularly and 0 for the people who did not do housework regularly.

Smoking: I used a binary variable named 'Smoker'. This was obtained by asking the respondents "Are you currently a smoker?". It held the value 1 for people who said 'Yes 'and 0 for the people who said 'No'.

GP visit: The respondents were asked: "In the last 12 months, how many times did you visit a GP?". There were 3 response categories 1) None 2) Single visit 3) 2+ visits. I combined the categories 2 and 3. I generated a variable named 'GPvisit'. This variable tells whether the respondent has visited a GP in the last 12 months or not.

Longterm disability: I named the variable 'Longetrm_disability'. This variable helps us understand whether a longterm disability has a significant effect on individual's health. The respondents were asked: "Do you have any longterm illness or disability?". The variable held value 0 for 'No' and 1 for 'Yes'.

Chronic pain: I named the variable 'Chronicpain'. This variable holds a value 0 for no pain and 1 for any extent of pain. I used this variable to understand to what extent does chronic pain effect health.

For my second model, my dependent variable is 'Good_Mentalhealth'. This variable was obtained by asking the respondents the following: "Would you say your mental health is, a) Excellent b) Very Good c) Good d) Fair e) Poor". In order to carry out my regression analysis, I generated a new variable named 'Healthy'. I generated this variable by combining the first 3 categories i.e., respondents who reported their

health to be excellent, very good and good, these represented good health. The other 2 categories i.e., Fair and Poor represented bad physical health. This is a binary variable holding a value of 1 for a person who is physically healthy and 0 for a person who is unhealthy. All the other variables used in this model are the same as the first model.

Table 1: Variable description

Variable	Description	Source
Healthy	Respondent's self-reported physical health. Categorical variable converted to Binary.	The Irish Longitudinal study of Ageing (TILDA) – Wave 3
Good_Mentalhealth	Respondent's self-reported Mental health. Categorical variable converted to Binary.	The Irish Longitudinal study of Ageing (TILDA) – Wave 3
Employed	Respondent's current employment status. Binary variable.	The Irish Longitudinal study of Ageing (TILDA) – Wave 3
Household_income	Respondent's current household income. Categorical variable (Incomes ranging from less than 10,000 to 100,000+)	The Irish Longitudinal study of Ageing (TILDA) – Wave 3
Education	Respondent's highest educational attainment. 3 categories (None/Primary. Secondary, Higher)	The Irish Longitudinal study of Ageing (TILDA) – Wave 3
Female	Binary variable for Respondent's Gender.	The Irish Longitudinal study of Ageing (TILDA) – Wave 3
Married	Binary variable for Respondent's marital status.	The Irish Longitudinal study of Ageing (TILDA) – Wave 3
Age	Respondent's age.	The Irish Longitudinal study of Ageing (TILDA) – Wave 3
Age2	Age squared is the square of the variable 'Age'.	The Irish Longitudinal study of Ageing (TILDA) – Wave 3
Smoker	Respondents were asked "Do you currently smoke?". Binary Variable.	The Irish Longitudinal study of Ageing (TILDA) – Wave 3

Exercise	Respondents were asked "How often do you exercise?" This was originally a categorical variable that I converted into a binary variable.	The Irish Longitudinal study of Ageing (TILDA) – Wave 3
Healthinsurance	Respondents were asked "Does the respondent have a private medical insurance cover?" Binary variable.	The Irish Longitudinal study of Ageing (TILDA) – Wave 3
Homeactivity	Respondents were asked "How often do you work at home, in the garden or on car?" This was originally a categorical variable that I converted into a binary variable for my research.	The Irish Longitudinal study of Ageing (TILDA) – Wave 3
Sportsclubparticipation	Respondents were asked "Do you participate in any groups such as sports club or social group/club?" Binary variable.	The Irish Longitudinal study of Ageing (TILDA) – Wave 3
GPvisit	Respondents were asked "In the last 12 months, how many times did you visit a GP?" This was originally a categorical variable that I converted into binary.	The Irish Longitudinal study of Ageing (TILDA) – Wave 3
Longterm_disability	The respondents were asked: "Do you have any longterm illness or disability?" Binary variable.	The Irish Longitudinal study of Ageing (TILDA) – Wave 3
Chronicpain	"Does the respondent suffer from chronic pain?" Binary variable.	The Irish Longitudinal study of Ageing (TILDA) – Wave 3

Source: The Irish Longitudinal study of Ageing (TILDA)

3.3. Model Specification

I have created two different models, which contain 4 logistic regressions in total. These will be outlined and analyzed below along with their respected summary statistics. All the data which is used for the regression models below are the variables that were discussed in Section 3.2. After gaining access to this data, I imported it to STATA in order to perform the regressions. The empirical results of the regressions will be discussed in Section 4 of the paper.

A common model when dealing with categorical and binary variables is the logistic regression (logit). The first model includes 2 logistic regressions. The coefficients of the regression were converted into odds ratios for better interpretation of the results.

The dependent variable, 'Healthy' refers to physical health. It appears on the left-hand side in a regression. There are two main hypotheses in this model H1 and H2:

- H1: SES has a significant effect on one's Physical health.
- H2: Lifestyle mediates the relationship between SES and Physical health.

The equations for both the regression models are given below:

Model 1.1

$$Healthy = \beta0 + \beta1(Age) + \beta2(Age2) + \beta3(Female) + \beta4(Married) + \beta5(Education) + \beta6(Household\_income) + \beta7(Employed) + u$$

Model 1.2

$$Healthy = \beta0 + \beta1(Age) + \beta2(Age2) + \beta3(Female) + \beta4(Married) + \beta5(Education) + \beta6(Household\_income) + \beta7(Employed) + \beta8(Exercise) + \beta9(Smoker) + \beta10(Homeactivity) + \beta11(Sportsclubparticipation) + \beta12(Healthinsurance) + \beta13(GPvisit) + \beta14(Longterm\_disability) + \beta15(Chronicpain) + u$$

The major difference between the two regression models is that Model 1.1 only focuses on the effect of SES on physical health. The variables used in this model only represent SES whereas, Model 1.2 considers 8 additional variables that are representative of lifestyle. By comparing the results (odds ratios) of these 2 models, we can test whether lifestyle mediate the effect of SES on physical health or not.

I generated a second model to test for the effect of SES and lifestyle on Psychological/mental health. The two main hypotheses in this model H3 and H4 are given below:

- H3: SES has a significant effect on one's Psychological health.
- H4: Lifestyle mediates the relationship between SES and Psychological health.

Model 2.1

$$Good\_Mentalhealth = \beta 0 + \beta 1(Age) + \beta 2(Age2) + \beta 3(Female) + \beta 4(Married) + \beta 5(Education) + \beta 6\ (Household\_income) + \beta 7(Employed) + u$$

Model 2.2

$$Good\_Mentalhealth = \beta 0 + \beta 1(Age) + \beta 2(Age2) + \beta 3(Female) + \beta 4(Married) + \beta 5(Education) + \beta 6\ (Household\_income) + \beta 7(Employed) + \beta 8(Exercise) + \beta 9(Smoker) + \beta 10(Homeactivity) + \beta 11(Sportsclubparticipation) + \beta 12(Healthinsurance) + \beta 13(GPvisit) + \beta 14(Longterm\_disability) + \beta 15(Chronicpain) + u$$

3.4. Limitations

In this paper, there are various limitations and drawbacks to the above-mentioned models that may affect the results presented in the section below. The main difficulties I faced were related to the variables, which were available and, in some cases, not available. One of the biggest issues was that all the variables (including the dependent and the independent) were self-reported. This was concerning because we cannot guarantee the accuracy of the reported information. This can have an impact on our findings. Another issue was the availability of some of the variables I wanted to include in my research. I wanted to include Parents' income, health and education in my study as well for a better understanding of whether Parents' SES effect children's' SES once they are old (50 and over). However, there were little or no responses available for these variables. Another variable that I wanted to add to my list of independent variables was 'Alcohol consumption' which would study the following: "In the last 6 months, how often have you had drinks containing alcohol?", however, majority of the observations were missing. Therefore, I could not include the effect of alcohol consumption on one's health. The addition of these variables would have made these models much stronger.

4. Empirical Results

4.1. Model 1: Effect of SES and lifestyle on Physical health

As mentioned above, model 1.1 tests for the effect of SES on physical health irrespective of individual's lifestyle. My three main control variables representative of SES in this model are 'Household_income', 'Education' and 'Employed'. The first two variables are categorical as mentioned in section 3.2. The sample size for this model consists of 5,087 observations. The law of large numbers, states that as sample size increases, its mean converges closer to the average of the whole population. The Pseudo R-Squared for this model is 0.0633 as given in *Table 3*. I used odds ratios for better interpretation of the results. In order to test our hypothesis, we need to determine the significance of our results. In terms of defining whether or not any of the variables above are statistically significant, it is important to note the significance levels for the p-value. For 10% significance level, the p- value must be < 0.1 to be statistically significant. For 5% significance level, the p-value must be < 0.05 to be statistically significant. For 1% significance level, the p-value must be < 0.01 to be statistically significant.

Overall, from this model one can observe that most of the explanatory variables are statistically significant at the 1% level. There are a few control variables that are significant at 10% level. The control variable 'Married' is statistically insignificant. Looking at our control variable for Female, we see that the odds of a female being healthy are 1.15 times that of a male being healthy i.e., females are 15% more likely to be physically healthy than males. We can see that the variable 'Married' for marital status does not have a significant effect on health. The variable 'Age' indicates that with a 1 unit increase in age, health increases by 12%. This result was the opposite of my expectations, as you would expect health to decrease with age, however, one reason for this could be our age range as my study is focused on older people (50-84+). The variable Age2 which is the squared of variable 'Age' has an OR of 0.9992. Adding the square of the variable allows you to model more accurately the effect of age on your dependent variable, if you have a positive effect of age and a negative effect of age-squared that means that as people get older the effect of age is lessoned, whereas a positive effect of age and a positive effect of age squared means that as people

get older the effect is stronger. For instance, the effect of age could be positive up until a certain age and then negative thereafter. This variable tells that relationship between age and health is nonlinear. The odds ratio (OR) for an individual with a secondary school qualification is 1.7135. This means that for a secondary school graduate, the odds of being healthy are 1.71 times as large as the odds for a primary school graduate being healthy. Similarly, for a college graduate (Higher level), the odds of being healthy are 2.06 times as large as the odds for a primary school graduate being healthy. Another way to interpret this is that a secondary school graduate is 71% more likely to be physically healthy as compared to a primary school graduate and a college graduate is 106% more likely to be physically healthy as compared to a primary school graduate. Looking at the income variable 'Household_income', I compared the 10 income categories given in the table above to the income category 'less than 10,000'. The variables have been explained in more detail in section 3.2. All the income levels show significant results except 1 i.e., (90,000-99,000). We can see that the odds of being healthy for a person with household income between '20,000-29,999' are 1.58 times that of a person with household income category 'less than 10,000'. So, a person with household income between '20,000-29,999' is 58% more likely to be healthy as compared to a person with household income 'less than 10,000'. Similarly, the odds of a person with household income between '80,000-89,999', being healthy are 5.76 times that of a person with household income 'less than 10,000'. So, he is 476% more likely to be healthy. We can see the OR for the other income levels in model 1.1. The independent variable for employment status is named 'Employed', it is statistically significant at 1% level. The odds of an employed person being healthy are 2.33 times as large as the odds of an unemployed person being healthy i.e., an employed person is 133% more likely to be healthy as compared to an unemployed person. These results support our first hypothesis, H1 for Model 1, discussed in section 3.3. The logistic regression output is given below:

Model 1.1

Healthy	*Odds Ratio*	*Std. Error*	*z*	*P>z*	*[95% Conf.*	*Interval]*
Age	1.1232*	0.0774	1.69	0.092	0.9813	1.2857
Age2	0.9992*	0.0005	-1.69	0.092	0.9982	1.0001
Female	1.1469*	0.0883	1.78	0.075	0.9862	1.3337
Married	1.0792	0.0962	0.86	0.392	0.9062	1.2853
Education						
Secondary	1.7135***	0.1572	5.87	0.000	1.4315	2.0511
Third/higher	2.0610***	0.2159	6.90	0.000	1.6784	2.5309
Household_income						
10,000-19,999	1.3473**	0.1933	2.08	0.038	1.0171	1.7847
20,000-29,999	1.5772***	0.2394	3.00	0.003	1.1714	2.1237
30,000-39,999	1.6379***	0.2622	3.08	0.002	1.1969	2.2414
40,000-49,999	2.1199***	0.4068	3.92	0.000	1.4554	3.0878
50,000-59,999	2.1902***	0.4793	3.58	0.000	1.4264	3.3632
60,000-69,999	2.1373***	0.5240	3.10	0.002	1.3219	3.4557
70,000-79,999	2.7255***	0.7961	3.43	0.001	1.5375	4.8316
80,000-89,999	5.7632***	3.0653	3.29	0.001	2.0320	16.3456
90,000-99,999	1.8357	0.7919	1.41	0.159	0.7882	4.2755
100,000+	2.3952***	0.7004	2.99	0.003	1.3504	4.2485
Employed	2.3309***	0.2571	7.67	0.000	1.8777	2.8935
Constant	0.0248	0.0588	-1.56	0.119	0.0002	2.6023

Note: Constant estimates baseline odds

** p<0.1, ** p<0.05, *** p<0.01*

In order to test whether lifestyle mediates the effect of SES on health, I generated a second regression model with the addition of several control variables representing lifestyle. Looking at model 1.2 given below, we can notice that the OR for the variables, Education, Household_income and Employed have decreased whereas, the OR for our gender variable 'Female' has increased. Pseudo-R2 for model 1.2 is 0.2623 (see *Table 4*). All of our control variables for lifestyle and SES are statistically significant at either 1% level, 5% level or 10% except for 'Household_income'. The results for income are significant for only 2 income levels i.e., '20,000-29,999' and '80,000-89,999'. We interpret the OR once again. The odds of a person with income category '20,000-29,999', being healthy are 1.38 times the odds of a person with income category 'less than 10,000' being healthy. The odds of a person with income category '80,000-89,999' being healthy are 3.21 times the odds of a person with income category 'less than 10,000' being healthy. In other words, a person with income category '20,000-29,999' is 38% more likely to be healthy as compared to a person with income category 'less than 10,000'. A person with income category '80,000-89,999' is 221% more likely to be healthy as compared to a person with income category 'less than 10,000'. Looking at the variable 'Education', we can conclude that the odds of a secondary school graduate being healthy are 1.35 times as large as the odds for a primary school graduate being healthy. Similarly, for a college graduate (Higher level), the odds of being healthy are 1.38 times as large as the odds for a primary school graduate being healthy. i.e., secondary school graduate is 35% more likely to be physically healthy as compared to a primary school graduate and a college graduate is 38% more likely to be physically healthy as compared to a primary school graduate. Variable 'Employed' shows that an employed person is 71% more likely to be healthy as compared to an unemployed person (OR=1.705). The OR for 'Employed' was 2.33 in model 1.1. The values for all our control variables have dropped significantly in model 1.2 as compared to model 1.1. If we compare these results to model 1.1, we can conclude that the effect of SES on health has decreased upon addition of lifestyle variables i.e., Lifestyle mediates the effect of SES on health. The results support our second hypothesis, H2 for Model 1 (section 3.3).

Model 1.2

Healthy	*Odds Ratio*	*Std. Error*	*z*	*P>z*	*[95% Conf.*	*Interval]*
Age	0.9751	0.078	-0.31	0.753	0.8336	1.1407
Age2	1.0001	0.001	0.20	0.845	0.9990	1.0012
Female	1.2515**	0.110	2.54	0.011	1.0529	1.4875
Married	0.9893	0.101	-0.10	0.917	0.8094	1.2092
Education						
Secondary	1.3465***	0.145	2.77	0.006	1.0910	1.6617
Third/higher	1.3773***	0.173	2.55	0.010	1.0770	1.7613
Household_income						
10,000-19,999	1.2438	0.205	1.32	0.187	0.8998	1.7193
20,000-29,999	1.3794*	0.243	1.83	0.068	0.9770	1.9474
30,000-39,999	1.2170	0.225	1.06	0.288	0.8470	1.7487
40,000-49,999	1.2987	0.286	1.19	0.236	0.8432	2.0002
50,000-59,999	1.2460	0.309	0.89	0.376	0.7659	2.0269
60,000-69,999	1.3803	0.377	1.18	0.238	0.8078	2.3587
70,000-79,999	1.3461	0.439	0.91	0.362	0.7103	2.5511
80,000-89,999	3.2095**	1.809	2.07	0.039	1.0633	9.6881
90,000-99,999	1.0012	0.472	0.00	0.998	0.3978	2.5199
100,000+	1.3346	0.437	0.88	0.378	0.7030	2.5337
Employed	1.7059***	0.208	4.39	0.000	1.3437	2.1658
Exercise	1.7571***	0.178	5.56	0.000	1.4406	2.1433
Smoker	0.8021*	0.099	-1.79	0.073	0.6300	1.0211
Homeactivity	1.2802**	0.129	2.45	0.014	1.0510	1.5593
Sportsclubparticipation	1.6785***	0.153	5.68	0.000	1.4037	2.0071
Healthinsurance	1.4874***	0.149	3.97	0.000	1.2228	1.8093
GPvisit	0.5304***	0.047	-7.21	0.000	0.4464	0.6302
Longterm_disability	0.1774***	0.018	-17.44	0.000	0.1461	0.2155
Chronicpain	0.4200***	0.037	-9.77	0.000	0.3529	0.4998
Constant	18.4259	50.691	1.06	0.290	0.0839	4047.082

Note: Constant estimates baseline odds.

** p<0.1, ** p<0.05, *** p<0.01*

Looking at the control variables representative of lifestyle, we can see that 'Exercise','Homeactivity' and 'Sportsclubparticipation' have a significant positive impact on health. This indicates that people who are physically more active are in better health. 'Healthinsurance' also has a significant positive impact on health. We can conclude that the people who have a health insurance are healthier because they can avail the healthcare services free of cost and therefore, keep their health in check. This would help them to maintain a good health.

The variables 'Smoker', 'GPvisit', 'Chronicpain' and 'Longterm_disability' have significant negative effect on health. Smoking on the contrary has a significant negative impact on health. The variable 'Smoker' says that the odds of a smoker being healthy are 0.80 times the odds of a nonsmoker being healthy. This is very clear as we all are aware of the harmful effects of smoking.

The variable 'GPvisit' indicates that a person who visits a GP at least once a year is likely to be less healthy. A reason for this result can be the fact that sicker people tend to visit their GP more often, so, in this case we can assume that being unhealthy results in GP visits.

I used the variables 'Chronicpain' and 'Longterm_disability' to test whether having a disability or chronic pain effect one's health significantly. The results showed that both these variables do effect physical health significantly.

4.2. Model 2: Effect of SES and lifestyle on Mental health

My second model studies the effect of all the control variables mentioned in section 3.3 on Psychological/Mental health. This model is very similar to model 1.1 except the fact that this time my dependent variable of interest is 'Good_Mentalhealth' instead of 'Healthy'.

Looking at Model 2.1 given below, we can see that once again, most of our control variables are statistically significant at either 10%, 5% or 1% level. Pseudo R2 for this model is 0.0350 (see *Table 5*). We can see from the variable 'Married'; married people are more likely to have a good mental health. However, age and gender do not have a significant effect on mental health. 'Education' has a significant positive effect on mental health. We can also see that as 'Household_income' increases, the likelihood of having a good

mental health also increases. The people with their income in the given 10 categories are more likely to have a better mental health than people with income category 'less than 10,000'. If we compare these values to model 1.1, we can see that the effect of 'Household_income' on mental health is not as large as the effect of 'Household_income' on physical health. Employment also has a significant positive effect on mental health i.e., 'Employed' people are more likely to be in a good mental health. The results support our first hypothesis, H3 for Model 2 (section 3.3).

The logistic regression output can be seen below:

Model 2.1

Good_Mentalhealth	*Odds Ratio*	*Std. Error*	*z*	*P>z*	*[95% Conf.*	*Interval]*
Age	1.0468	0.0556	0.86	0.389	0.9433	1.1617
Age2	0.9998	0.0004	-0.55	0.580	0.9990	1.0005
Female	0.9739	0.0579	-0.44	0.657	0.8667	1.0944
Married	1.1395*	0.0792	1.88	0.060	0.9945	1.3058
Education						
Secondary	1.3648***	0.1037	4.09	0.000	1.1760	1.5840
Third/higher	1.8496***	0.1526	7.45	0.000	1.5734	2.1743
Household_income						
10,000-19,999	1.1187	0.1442	0.87	0.384	0.8689	1.4402
20,000-29,999	1.2720*	0.1683	1.82	0.069	0.9814	1.6486
30,000-39,999	1.3641**	0.1864	2.27	0.023	1.0435	1.7831
40,000-49,999	1.4725***	0.2226	2.56	0.010	1.0949	1.9803
50,000-59,999	1.7432***	0.2861	3.39	0.001	1.2637	2.4046
60,000-69,999	2.0130***	0.3637	3.87	0.000	1.4128	2.8683
70,000-79,999	2.6721***	0.5416	4.85	0.000	1.7960	3.9755
80,000-89,999	3.0923***	0.8226	4.24	0.000	1.8360	5.2085
90,000-99,999	2.2451***	0.6933	2.62	0.009	1.2257	4.1123
100,000+	2.5085***	0.5149	4.48	0.000	1.6777	3.7507
Employed	1.3641***	0.1021	4.15	0.000	1.1780	1.5796
Constant	0.0683	0.1242	-1.48	0.140	0.0019	2.4086
Note: Constant estimates baseline odds						

** p<0.1, ** p<0.05, *** p<0.01*

Model 2.2 tests the combined effect of SES and Lifestyle on Mental health. Majority of the variables are significant at either 10%, 5% or 1% level. However, in this model the control variable 'Married' is no longer significant while it was significant in model 2.1. Pseudo R2 for this model is 0.0749, (see *Table 6*). The effects of all the variables have decreased as compared to Model 2.1. This supports our second hypothesis, H4 for Model 2, this is an evidence that the control variables for lifestyle have mediated the effect of education on Mental health. The variables for 'Education' show that education has a significant positive impact on Mental health. But just like in model 1(Model 1.2 had smaller OR values for all variables as compared to Model 1.1), the OR values for both the education variables have dropped compared to Mode 2.1. 'Household_income' has a significant positive effect on Mental health in half of the income categories. The effect is, however, smaller than that in Model 2.1.

All the control variables for lifestyle are showing significant impact on mental health. For more details look at Model 2.2 given on the next page.

Model 2.2

Good_Mentalhealth	*Odds Ratio*	*Std. Error*	*z*	*P>z*	*[95% Conf.*	*Interval]*
Age	0.9902	0.0549	-0.18	0.859	0.8882	1.1039
Age2	1.0002	0.0004	0.42	0.676	0.9994	1.0010
Female	0.9850	0.0607	-0.24	0.807	0.8729	1.1116
Married	1.0950	0.0788	1.26	0.207	0.9510	1.2608
Education						
Secondary	1.1835**	0.0954	2.09	0.037	1.0105	1.3861
Third/higher	1.5100***	0.1364	4.56	0.000	1.2650	1.8025
Household_income						
10,000-19,999	1.0510	0.1402	0.37	0.709	0.8092	1.3649
20,000-29,999	1.1331	0.1552	0.91	0.362	0.8662	1.4821
30,000-39,999	1.1386	0.1620	0.91	0.361	0.8616	1.5047
40,000-49,999	1.1262	0.1777	0.75	0.451	0.8267	1.5342
50,000-59,999	1.3300*	0.2275	1.67	0.095	0.9512	1.8597
60,000-69,999	1.6010**	0.3001	2.51	0.012	1.1088	2.3116
70,000-79,999	1.9410***	0.4079	3.16	0.002	1.2858	2.9302
80,000-89,999	2.2819***	0.6260	3.01	0.003	1.3328	3.9068
90,000-99,999	1.7365*	0.5516	1.74	0.082	0.9317	3.2366
100,000+	1.8889***	0.4017	2.99	0.003	1.2450	2.8658
Employed	1.1846**	0.0926	2.17	0.030	1.0164	1.3806
Exercise	1.1686**	0.0847	2.15	0.031	1.0139	1.3469
Smoker	0.7663***	0.0713	-2.86	0.004	0.6385	0.9196
Homeactivity	1.1507*	0.0883	1.83	0.067	0.9900	1.3375
Sportsclubparticipation	1.1876***	0.0745	2.74	0.006	1.0502	1.3430
Healthinsurance	1.2076***	0.0850	2.68	0.007	1.0521	1.3862
GPvisit	0.8560**	0.0532	-2.5	0.012	0.7578	0.9668
Longterm_disability	0.5334***	0.0344	-9.74	0.000	0.4701	0.6053
Chronicpain	0.6842***	0.0451	-5.76	0.000	0.6013	0.7785
Constant	0.7964	1.5078	-0.12	0.904	0.0195	32.5674

Note: Constant estimates baseline odds.

** p<0.1, ** p<0.05, *** p<0.01*

4.3. Comparison between Model 1 and Model 2

Given below are the key findings of the 2 models:

- Upon comparing Model 1(1.1 & 1.2) and Model 2(2.1 & 2.2), we can conclude that the magnitude of the effect of all the control variables representative of SES i.e., 'Education', 'Household_income' and 'Employed', on mental health is smaller in Model 1 as compared to Model 2. This means that the impact of SES on physical health is greater than the impact of SES on mental health.
- All the control variables for lifestyle are showing a significant effect on both Physical and Mental health. 'Exercise','Homeactivity' and 'Sportsclubparticipation' have a significant positive impact on both physical and mental health. This indicates that people who are physically more active have a good physical health and they are more likely to have a good mental health. However, comparing the ORs for all these variables in Model 1 and Model 2, we can see that physical activity has a higher impact on physical health than on mental health. Similar is the case with 'Healthinsurance'.
- The negative effect of smoking on Mental health is slightly higher than the negative effect of smoking on physical health i.e., Smoking affects mental health more than physical health. However, the difference is very small.
- 'Chronicpain' and 'Longterm_disability' have negative impact on both physical and mental health. However, my research has found that both 'Chronicpain' and 'Longterm_disability' affect mental health more than they affect physical health. We can assume that having a physical condition that is limiting one's ability to carry out everyday tasks on their own may induce feelings of guilt/stress that eventually may lead to depression/bad mental health.

5. Conclusion

This paper set out to investigate the relationship between SES, Lifestyle and Health (Physical and Mental). Most of the findings of this research support previous literature mentioned in section 2 i.e., SES and lifestyle have a significant impact on health. Health-promoting behavior improves physical and mental health whereas, health-harming behavior decreases health. However, one can say that the results from my data analysis contradict the literature to some extent, particularly the (Wang & Geng, 2019) study as their results showed that there was no significant impact of SES on psychological health, indicating that people with higher SES do not necessarily have good mental health. However, in my study we have found that SES does have a significant impact on Psychological/Mental health. All 4 of our hypotheses (H1, H2, H3 & H4) (Section 3.3) were supported with the help of our models.

Mathematical Appendices

Appendix A. Summary Statistics

Table 2: Summary Statistics for all the variables – Model 1&2

Variable	Observations	Mean	Std. Dev.	Min	Max
*Healthy**	5,087	0.82	0.384	0	1
*Good_Mentalhealth**	5,087	0.56	0.496	0	1
Age	5,087	66.30	8.81	53	84
Age2	5,087	4473.44	1201.42	2809	7056
Female	5,087	0.54	0.498	0	1
Married	5,087	0.65	0.476	0	1
Education					
Primary/none	5,087	0.25	0.433	0	1
Secondary	5,087	0.39	0.489	0	1
Third level/higher	5,087	0.35	0.478	0	1
Household_income					
Less than 10,000	5,087	0.06	0.243	0	1
10,000-19999	5,087	0.23	0.418	0	1
20,000-29,999	5,087	0.21	0.404	0	1
30,000-39,999	5,087	0.17	0.373	0	1
40,000-49,999	5,087	0.10	0.302	0	1
50,000-59,999	5,087	0.08	0.263	0	1
60,000-69,999	5,087	0.05	0.222	0	1
70,000-79,999	5,087	0.04	0.196	0	1
80,000-89,999	5,087	0.02	0.142	0	1
90,000-99,999	5,087	0.01	0.11	0	1
100,000+	5,087	0.04	0.191	0	1
Employed	5,087	0.33	0.471	0	1
Exercise	5,087	0.57	0.495	0	1
Smoker	5,087	0.13	0.333	0	1
Homeactivity	5,087	0.73	0.443	0	1
Sportsclubparticipation	5,087	0.51	0.5	0	1
Healthinsurance	5,087	0.58	0.494	0	1
GPvisit	5,087	0.44	0.496	0	1
Longterm_disability	5,087	0.42	0.494	0	1
Chronicpain	5,087	0.35	0.477	0	1

** Dependent variable*

Appendix B. Regression tables

Table 3: Model 1.1

Number of observations	5,087
LR chi2(17)	303.21
Prob > chi2	0.000
Pseudo R2	0.0633

Table 4: Model 1.2

Number of observations	5,087
LR chi2(25)	1256.89
Prob > chi2	0.000
Pseudo R2	0.2623

Table 5: Model 2.1

Number of observations	5,087
LR chi2(17)	244.2
Prob > chi2	0.000
Pseudo R2	0.0350

Table 6: Model 2.2

Number of observations	5,087
LR chi2(25)	522.74
Prob > chi2	0.000
Pseudo R2	0.0749

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