Original Article

Correlation Analysis of Socio-Economic Status and Psychological Distress with Framingham Score in Population at Risk of Coronary Heart Disease in Malang, Indonesia

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Abstract

Background: Malnutrition is an important and common public health problem that is frequently not diagnosed earlier among the elderly living in a home, nursing home, or hospital environment. Nurses can prevent the development of malnutrition and loss of functional ability in the elderly by evaluating malnutrition risks.
Objective: This research aimed to determine the relationship between malnutrition risks and functional abilities of the elderly living in a home environment, while revealing malnutrition risks and other affecting factors.
Methods: This research was planned to be descriptive and correlational, with a total of 288 elderly participants (73.8 ± 7.2) (aged >65 years) being included. Three questionnaires were administered to gather data on demographic characteristics, malnutrition risks and functional abilities.
Result: Upon examination of Mini Nutritional Assessment scores, 47.2% of the participants were found to have malnutrition risks, while 15.6% were identified as malnourished. Age range and education status were found to have an effect on malnutrition risk, whereas gender, socioeconomic status, and loneliness did not. A statistically significant difference was determined between malnutrition risk and functional ability ($X^2 = 143.265$; $p < 0.01$). Additionally, a statistically significant correlation was determined between Mini Nutritional Assessment and Bartel Index scores ($r = 0.613$; $p = 0.000$). Through stepwise multiple linear regression analysis, we determined that having children, cerebrovascular diseases, depression or dementia (including Alzheimer's disease), health problems related to the digestive system, lack of appetite, body mass index, mid-upper arm and calf circumference, and Bartel Index scores significantly affected the Mini Nutritional Assessment scores ($R^2 = 0.781$; $p < 0.01$).
Conclusion: This research revealed that a statistically significant positive correlation exists between malnutrition risks and functional abilities of the elderly living in a home environment, and that improvement in functional ability independence reduces such risks.

Keywords: Home care, Aged, Aged 80 and over, Malnutrition, Risk, Daily life activities.

Introduction

Coronary Heart Disease (CHD) is one of the leading causes of death in cardiovascular disease. CHD is the leading cause of death from CVD in the United States, with a total percentage of 43.8% or more than 360,000 people died from CHD (Benjamin *et al.*, 2018). Based on the results of the 2016 Survey Registration System (SRS) survey in Indonesia, CHD became the second leading cause of death at all ages after

cerebrovascular disease, which was 13.3% (Usman *et al.*, 2019). Mortality due to CHD is expected to continue to increase in developing countries (Sanchis-gomar *et al.*, 2016). This indicates that effective primary prevention is needed throughout the world.

The Framingham Score is a rating system that is often used to predict the incidence of cardiovascular disease in the next ten years (Sayin *et al.*, 2014). This tool is also recommended for use by the National Cholesterol Education Program (Adult Treatment Panel III) and has been validated by many studies (Borhanuddin *et al.*, 2018; Nakhaie *et al.*, 2018). Framingham risk scores were assessed based on CHD risk factors, namely age, sex, total cholesterol and HDL levels, systolic blood pressure, smoking status, and treatment of hypertension (Sayin *et al.*, 2014).

Socio-economic status is one of the psychosocial risk factors that is thought to be related to CHD events. Socioeconomic status is related to a person's education, employment, and income status (Psaltopoulou *et al.*, 2017; Wiernik *et al.*, 2018; Rosengren *et al.*, 2019). Several studies have shown a relationship between socioeconomic status and CHD risk. Someone with low education and income is more at risk of developing cardiovascular disease (Ren *et al.*, 2016; Zhang *et al.*, 2017). In addition, activities that do not move much at work are associated with an increased risk of CHD events (Kivimäki *et al.*, 2015; Ma *et al.*, 2017).

Another psychosocial factor that is suspected to be a risk factor for CHD is psychological distress. Psychological distress problems such as stress, anxiety, and depression have a negative impact on cardiovascular health (Cohen, Edmondson and Kronish, 2015; McLachlan and Gale, 2018). High levels of psychological distress, such as depression and anxiety, are significantly related to poor health behavior patterns and low socioeconomic status (McLachlan and Gale, 2018). Poor health behaviors such as smoking, consuming alcohol, lack of physical activity, and lack of fruit and vegetable intake can increase the risk of cardiovascular disease 2 to 3 times (Eriksen *et al.*, 2015). However, the exact mechanism related to psychological distress as a risk factor for CHD still needs to be investigated.

Many studies have discussed the relationship between socioeconomic status and psychological distress with CHD, but some studies are still contradictory. In addition, the relationship mechanism related to socioeconomic status, psychological distress, and Framingham scores still need to be investigated. Thus, this study aims to analyze the direct relationship of socioeconomic status with Framingham scores in CHD risk populations and analyze the indirect relationship of socioeconomic status with Framingham scores through psychological distress in CHD risk populations.

Methodology

This study used an observational analytic and a cross-sectional design. The study was conducted in the Malang, Indonesia in December 2019 to January 2020.

Sampling Criteria: Sampling used total sampling in the community who take a joint health examination at the Kedungkandang Community Health Center, Malang. The determination of the sample was based on inclusion criteria, namely, people who have five or more risk factors for CHD. These CHD risk factors include age, history of hypertension, smoking, history of diabetes mellitus, history of high cholesterol, family history of heart disease, excess body weight, lack of exercise, food consumption excessive fat, and less consumption of fruit and vegetables. Communities who were willing to become respondents were proven by signing on the informed consent sheet.

Data collection: There were three instruments used, namely a questionnaire to assess socioeconomic status, a questionnaire to assess psychological distress, and an instrument to assess the Framingham score. The socioeconomic status questionnaire was based on three indicators. Educational indicators were classified into Bachelor and Diploma, high school and junior high school, elementary school and no school. Job indicators were classified according to Occupational Physical Activity (OPA) based on Metabolic Equivalent of Task (METs), namely hard work, moderate work, light work, and sedentary. Income indicators were classified as being higher than Rp. 2.800.000 and less than Rp. 2.800.000 . There were three categories of socioeconomic status, namely, low socioeconomic status (score 1-3), moderate socioeconomic status (score 4-6), and high socioeconomic status (score 7-9).

The psychological distress questionnaire was prepared based on the Depression Anxiety Stress Scale (DASS 42) instrument, which includes measurements for anxiety, stress, and depression

items. This standardized questionnaire contains 42 questions with 14 points each for each item. The scale of severity was always, often, sometimes, and never. There were five categories of psychological distress, namely normal psychological distress (score 0-25), mild psychological distress (score 26-50), moderate psychological distress (score 51-75), high psychological distress (score 76-100), and very high psychological distress (score 101-126). Framingham score assessment was done by entering data related to CHD risk factors into the Framingham score special calculator application. Risk factors taken into account were age, sex, smoking, total cholesterol, HDL cholesterol, systolic blood pressure, and hypertension treatment. The results of the calculation of the Framingham score were divided into three categories, namely the low-risk category (score ≤ 10%), the moderate risk category (score 10% - 20%), and the high-risk category (score ≥ 20%).Based on the results of the validity test, it was known that the loading factor value on all variables was higher than 0.6, and overall indicators produce a higher loading factor compared to cross-loading on other variables. In addition, based on the reliability test results, it was known that the composite reliability value was higher than 0.7, and the Cronbach's Alpha value was higher than 0.6. Thus, all indicators that measure socioeconomic variables, psychological distress, and Framingham scores were validated and reliable.

Data Analysis: Analysis of the data in this study using the Partial Least Square (PLS) Warp used the WarpPLS program. The problem-solving model using Warp Partial Least Square (PLS) aimed to answer hypotheses related to the direct relationship of socioeconomic status to the Framingham score and the indirect relationship of socioeconomic status to the Framingham score through psychological distress.

Ethical Clearance: This research was approved by The Medical Research Ethics Commission of the Faculty of Medicine, Universitas Brawijaya, based on the Ethical Clearance Certificate No. 242 / EC / KEPK / 09/2019.

Results

The number of participants in this study was 73 respondents. Table 1 shows the characteristics of the socioeconomic status of the participants who participated in this study. Most respondents had moderate socioeconomic status (65.8%). Determination of the level of socioeconomic status was obtained from three indicators: education, employment, and income. Most of the participants had a high school or junior high school education (50.7%), had light work (57.5%), and had an income less than Rp. 2.800.000 (57.5%).

Table 2 shows the characteristics of the participants based on the level of psychological distress experienced. Most participants had psychological distress in the normal category (56.2%). Determination of the level of psychological distress was obtained from three indicators, namely: anxiety, stress, and depression. Most participants had anxiety in the normal category (41.1%), had stress in the normal category (78.1%), and had depression in the normal category (83.6%).

Table 3 shows the characteristics of the participants based on the Framingham score. Most respondents had low Framingham scores (75.3%). Determination of the Framingham score was obtained from seven indicators, namely: age, sex, smoking, total cholesterol, HDL cholesterol, systolic blood pressure, and hypertension treatment.

PLS analysis was used to answer hypotheses related to the direct relationship and the indirect relationship. Testing the direct effect hypothesis was used to answer the hypothesis related to the direct relationship of socioeconomic status with the Framingham score. The effect of socioeconomic status on the Framingham score produces a path coefficient of 0.334 with a p-value of <0.001. The test results indicate that the value of the p-value <level of significance (alpha = 5%). This means that there was a significant influence of socioeconomic status on the Framingham score (Table 4).

Hypothesis testing indirect effect was done to answer the hypothesis related to the indirect relationship of socioeconomic status with Framingham scores through psychological distress. The effect of socioeconomic status on the Framingham score through psychological distress produces a path coefficient of 0.033 with a t-statistics value of 2.304. The test results show that the value of t-statistics> t-table (1.96). This means that there is a significant influence of socioeconomic status on the Framingham score through psychological distress (Table 4).

Table 1: Characteristics of Respondents Based on Socio-Economic Status

Socio-Economic Status (SES)	Frequency	Percentage (%)
SES Low	17	23.3
SES Moderate	48	65.8
SES High	8	11.0
Total	73	100.0
Socio-Economic Status (SES) Indicator	**Frequency**	**Percentage (%)**
1. Education		
- Elementary or not school	30	41.1
- High school or middle school	37	50.7
- Bachelor or Diploma	6	8.2
2. Occupation		
- Sedentary (<1.5 METs)	8	11.0
- Light work (1.6 – 3.0 METs)	42	57.5
- Moderate work (3.1 – 4.5 METs)	23	31.5
- Hard work (>4.5 METs)	0	0
3. Income		
- Less than Rp 2.800.000	42	57.5
- More than Rp 2.800.000	31	42.5

Table 2: Characteristics of Respondents Based on Psychological Distress Level

Category	Interval	Frequency	Percentage (%)
Normal	0-25	41	56.2
Mild	26-50	24	32.9
Moderate	51-75	8	11.0
High	76-100	0	0
Very high	101-126	0	0
Total		73	100.0
Psychological Distress Indicator	**Interval**	**Frequency**	**Percentage (%)**
1. Anxiety			
- Normal	0-7	30	41.1
- Mild	8-9	12	16.4
- Moderate	10-14	16	21.9
- High	15-19	8	11.0
- Very high	>20	7	9.6
2. Stress			
- Normal	0-14	57	78.1
- Mild	15-18	8	11.0
- Moderate	19-25	7	9.6
- High	26-33	1	1.4
- Very high	>34	0	0
3. Depression			
- Normal	0-9	61	83.6
- Mild	10-13	5	6.8
- Moderate	14-20	5	6.8
- High	21-27	2	2.7
- Very high	>28	0	0

Table 3: Characteristics of Respondents Based on Framingham Score

Framingham Risk Score	Frequency	Percentage (%)
High	1	1.4
Moderate	17	23.3
Low	55	75.3
Total	73	100.0

Framingham Risk Indicator	N	Frequency (%)	Med	Min	Max	Mean	SD
1. Sex							
- Male	35	47.9	-	-	-	-	-
- Female	38	52.1	-	-	-	-	-
2. Smoking Status							
- Smoker	15	20.5	-	-	-	-	-
- Non-smoker	58	79.5	-	-	-	-	-
3. Treatment of Hypertension							
- Treated Hypertension	15	20.5	-	-	-	-	-
- Untreated hypertension	58	79.5	-	-	-	-	-
4. Age	-	-	-	-	-	57.58	10.157
5. Systolic Blood Pressure (mmHg)	-	-	-	-	-	136.68	24.011
6. Total Cholesterol (mg/dL)	-	-	191	117	304	-	-
7. **HDL (mg/dL)**	-	-	50	24	102	-	-

Table 4: Hypothesis Testing for Direct Effects and Indirect Effect

Exsogen	Intervening	Endogen	Direct Coefficients	Indirect Coefficients
Socio-Economic Status	-	Framingham Score	0.334*	-
Socio-Economic Status	Pscyhological Distress	Framingham Score	-	0.033*

Note : * (Significant)

Table 5: Goodness of Fit Model

Endogen	R-squared	Q-squared
Pscyhological Distress	0.079	0.076
Framingham Score	0.135	0.166

Table 6: Dominant Effect on Endogenous Variables

Exogen	Intervening	Endogen	Total Coefficients
Social Economic Status	Psychological Distress	Framingham Score	0.367
Pscyhological Distress	-	Framingham Score	-0.117

The Goodness of Fit Model was used to determine the contribution of exogenous variables to endogenous variables (Table 5). The R-square psychological distress was 0.079 or 7.9%. This can indicate that the contribution of socioeconomic status to psychological distress by 7.9%, while the remaining 92.1% is contributed by other factors not discussed in this study. Then the Q-square psychological distress variable is 0.076. This shows that socioeconomic status has a low predictive power of psychological distress. Meanwhile, Framingham's R-square score is 0.135 or 13.5%. This indicates that the contribution of socioeconomic status and psychological distress to the Framingham score of 13.5%, while the remaining 86.5% is contributed by other factors not discussed in this study. Then the Q-square Framingham score variable is 0.166. This shows that socioeconomic status and psychological distress have moderate predictive power on the Framingham score.

Exogenous variables that have a dominant effect on endogenous variables can be identified through the greatest total effect without regard for positive or negative coefficient signs (Table 6). The analysis results inform the variables that have the greatest total effect on the Framingham score are socioeconomic status with a total effect of 0.367. Thus the socioeconomic status is the variable that has the most dominant influence on the Framingham score.

Discussion

Direct Relationship of Socio-Economic Status with Framingham Score in Population at Risk of CHD

The influence of socioeconomic status on the Framingham score shows that there is a positive and significant influence between socioeconomic status on the Framingham score. This shows that if the socioeconomic status is getting higher, it tends to reduce the Framingham score. The Framingham score shows the risk of CHD in the next ten years. The results of this study are in line with previous research, which shows that low socioeconomic status is associated with poor health and an increase in CHD (Psaltopoulou *et al.*, 2017; Pitman and Armstrong, 2019; Redondo-Bravo *et al.*, 2020).

Socioeconomic status can cause CHD through behavioral and biological mechanisms. Unhealthy behavioral patterns, such as poor diet and physical inactivity, can cause major risk factors for cardiovascular disease such as obesity, diabetes, and hypertension (Psaltopoulou *et al.*, 2017; Benjamin *et al.*, 2018; Birck *et al.*, 2019). Based on a survey conducted by ABS (Australian Bureau of Statistics) in 2014-2015, it was shown that in groups of people with low socioeconomic status tend to have health risk factors such as daily smoking, less active activities, obesity, high blood pressure, and consume alcohol. The existence of several possible risk factors that cause in this group 1.7 times risk for suffering from heart disease, stroke, or other vascular diseases (ABS, 2015).

Low socioeconomic status is also associated with the presence of biological responses in the body, such as increased systolic and diastolic blood pressure, interleukin plasma (IL-6), fibrinogen, C-reactive protein, and salivary cortisol (Steptoe *et al.*, 2018). Research conducted by Kollia et al. (2016) showed that individuals with low socioeconomic status were negatively associated with diabetes mellitus, obesity, and physical activity. Thus, biological mechanisms in the body tend to show metabolic dysregulation such as hyperlipidemia, hypertension, chronic inflammation, and dyslipidemia, which is also indicated by the high thickness of the carotid intima-media (Bergström *et al.*, 2015; Nakade *et al.*, 2015; Thompson *et al.*, 2018).

The description of socioeconomic status can be seen based on three indicators, namely education, employment, and income (Psaltopoulou *et al.*, 2017; Wiernik *et al.*, 2018; Rosengren *et al.*, 2019). Several studies have shown that individuals with low education are associated with a less prosperous life, poor health management, and more difficult health access (Rosengren *et al.*, 2019). Difficult access to health can lead to low levels of care and preventative behaviors (Nakade *et al.*, 2015). Unhealthy behaviors such as smoking, unhealthy eating patterns, physical activity, and lack of sleep are associated with risk factors for increasing CHD (Wiernik *et al.*, 2018; Redondo-Bravo *et al.*, 2020).

Research conducted by Browne et al. (2017) shows that work is associated with CHD risk. Work with low physical activity and high sedentary times is associated with poorer health outcomes (Smith *et al.*, 2016; Ma *et al.*, 2017). In addition, individuals who are unemployed or have retired more often experience CHD (Méjean *et al.*, 2013). Low physical activity in

the workplace and sedentary behavior can be associated with risk factors for metabolic syndrome. Criteria for metabolic syndrome, including abdominal obesity, high triglycerides, low HDL cholesterol, increased blood pressure, and fasting blood glucose, are risk factors for CHD (Browne *et al.*, 2017).

Research conducted by Rosengren et al. (2019) shows that income is associated with the risk of cardiovascular disease. High-income individuals report better drug use and higher activity compared to lower-income individuals (Birck *et al.*, 2019; St-pierre *et al.*, 2019). Meanwhile, people with lower incomes tend to experience more difficult health access and access (Birck *et al.*, 2019). Low access to health causes lower levels of care and disease prevention (Nakade *et al.*, 2015; Rosengren *et al.*, 2019).

Indirect Relationship of Socio-Economic Status with Framingham Scores through Psychological Distress in Populations at Risk of CHD

The path coefficient test results show that there is a positive and significant influence between socioeconomic status and Framingham scores through psychological distress. This means that the higher the psychological distress caused by the lower socioeconomic status, it tends to increase the Framingham score. A low Framingham score indicates a low CHD risk, while a high Framingham score indicates a high CHD risk.

Based on the results of the analysis in Table 4 shows that the value of the direct relationship coefficient is 0.334. Meanwhile, the value of the indirect relationship coefficient is 0.033. This shows that psychological distress influenced by socioeconomic status has a role in increasing Framingham's score.

The results of this study are in line with Cho et al. (2019) and Wiernik et al. (2018) who shows that a person who has low socioeconomic status and psychological distress, is more prone to cardiovascular disease than those who have high socioeconomic status and without psychological problems. This is also supported by Moran et al. (2018), who show that there is a relationship between socioeconomic status, psychological distress, and CHD.

Several studies have shown that psychological distress is significantly associated with an increase in cardiovascular disease (Ndrepepa, 2017; Mclachlan and Gale, 2018). The mechanism of psychological distress causes CHD can be mediated by behavioral and biological pathways (Ndrepepa, 2017; Kubzansky *et al.*, 2018). High psychological distress is significantly associated with high BMI and poor health behaviors, such as unhealthy diets, lack of consumption of fruits and vegetables, lack of exercise, and smoking behavior (Mclachlan and Gale, 2018; Dag *et al.*, 2019; St-pierre *et al.*, 2019). Perceived stress can also be associated with other CHD risk factors, such as hypertension and diabetes behavior (Moran, Ommerborn and Blackshear, 2018). Psychological distress can stimulate the sympathetic nervous system and the HPA axis, which causes an increase in catecholamine and cortisol levels. If this condition occurs for a long time, there can be an increase in blood pressure, lipid profile, inflammatory response, endothelial dysfunction, and increased platelets (Ndrepepa, 2017; Wirtz and von Känel, 2017).

The results showed that the contribution of socioeconomic status to psychological distress was 7.9% and socioeconomic status had a low predictive power of psychological distress. Psychological distress can be influenced by other factors such as age, sex, history of illness, and history of past events (Castañeda *et al.*, 2016; Reid, Patel and Wolfe, 2018; Tanji *et al.*, 2018). This might explain why socioeconomic status has a small contribution to psychological distress. In addition, the contribution of socioeconomic status and psychological distress to the Framingham score was 13.5%. Socioeconomic status and psychological distress have moderate predictive power on the Framingham score. Socio-economic status and psychological distress are psychosocial factors that are associated with CHD risk. However, there are other major risk factors such as age, gender, diabetes, hypertension, hypercholesterolemia, lack of physical activity, obesity, smoking, family history, and other psychosocial factors (Magnoni *et al.*, 2015; Zengin *et al.*, 2015; Norton, 2017). This indicates that there are other factors that contribute to the risk of CHD. The results of this study may also be related to the existence of extreme values that can affect the results of the research analysis.

The results of the study showed that socioeconomic status was the variable that had the most dominant effect on the Framingham score. Socio-economic status can affect the Framingham score through behavioral and biological mechanisms. In addition,

socioeconomic status can also affect the risk of CHD through psychological mechanisms. Psychological mechanisms occur if the socioeconomic status experienced can cause psychological distress. Thus, three mechanisms can cause socioeconomic status to influence CHD risk, namely behavioral, psychological, and biological mechanisms. This might be the cause of the socioeconomic status having the most dominant effect on the Framingham score.

The results of this study provide very important input related to socioeconomic status and psychological distress that can increase the risk of CHD. Based on testing the direct effect hypothesis, it can be seen that socioeconomic status has a significant influence on the Framingham score. Likewise, by testing the indirect effect hypothesis, it can be seen that socioeconomic status has a significant influence on the Framingham score through psychological distress. This results can explain that in addition to the main risk factors, other risk factors can support the occurrence of CHD. It can be used as evidence for health care professionals to develop health promotion, prevention and treatment in patients with cardiovascular disease, especially Coronary Heart Disease.

The limitation of this study is that the research conducted is social, making it difficult to control the homogeneity of the participants' characteristics. Future studies are needed with a larger sample and other psychosocial factors related to CHD risk.

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References

ABS (Australian Bureau of Statistics) (2015) *National Health Survey: first results, 2014–2015*. Canberra. doi: 4364.0.55.001.

Benjamin, E. J. *et al.* and On behalf of the American Heart Association Council on Epidemiology and Prevention Statistics Committee and Stroke Statistics Subcommittee (2018) 'Heart Disease and Stroke Statistics — 2018 Update A Report From the American Heart Association', *Circulation*, 137(12), E67–E492. doi: 10.1161/CIR.0000000000000558.

Bergström,G, Redfors B, Angerås O, Dworeck K, Shao Y, Haraldsson I, Petursson P, Milicic D, Wedel H, Albertsson P, Råmunddal T, Rosengren A, Omerovic E. (2015) 'Low socioeconomic status of a patient ' s residential area is associated with worse prognosis after acute myocardial infarction in Sweden, *International Journal of Cardiology*. Elsevier Ireland Ltd, 182, pp. 141–147.

Birck, M. G. Goulart, A. C., Lotufo, P. A. and Bensenor, I. M. (2019) 'Secondary prevention of coronary heart disease : a cross-sectional analysis on the Brazilian Longitudinal Study of Adult Health (ELSA-Brasil)', *Sao Paulo Med J*, 137(3), pp. 223–233.

Borhanuddin, B. Nawi A.M., Shah S.S., Abdullah N., Zakaria S.Z.S, Kamaruddin M. A., Velu K.S., Ismail N., Abdullah M.S., Kamat S. A., Awang A., Hamid M. A, and Jamal R.(2018) '10-Year Cardiovascular Disease Risk Estimation Based on Lipid Profile-Based and BMI-Based Framingham Risk Scores across Multiple Sociodemographic Characteristics : The Malaysian Cohort Project', *Hindawi : The Scientific World Journal*, 1–9.

Browne, R. A. V. *et al.* (2017) 'Sedentary Occupation Workers Who Meet the Physical Activity Recommendations Have a Reduced Risk for Metabolic Syndrome', *American College of Occupational and Environmental Medicine*, XX(X), 1–5. doi: 10.1097/JOM.0000000000001104.

Castañeda, S. F. Buelna C., Espinoza Giacinto R., Gallo L.C., Sotres-Alvarez D., GonzalezP., Fortmann A. L., Wassertheil-Smoller S., GellmanM.D., Giachello A. L., Talavera G.A. (2016) 'Cardiovascular disease risk factors and psychological distress among Hispanics / Latinos : The Hispanic Community Health Study / Study of Latinos (HCHS / SOL)', *Preventive Medicine*. Elsevier B.V., 87, 144–150.

Cho, Y. Tae Ho Lim T.H., Kang H., Lee Y., Lee H., Kim H. (2019) 'Socioeconomic status and depression as combined risk factors for acute myocardial infarction and stroke : A population-based study of 2 . 7 million Korean adults', *Journal of Psychosomatic Research*. Elsevier, (January), pp. 1–10. doi: 10.1016/j.jpsychores.2019.01.016.

Cohen, B. E., Edmondson, D. and Kronish, I. M. (2015) 'State of the Art Review : Depression , Stress , Anxiety , and Cardiovascular Disease', *American Journal of Hypertension*, 28(11), pp. 1295–1302. doi: 10.1093/ajh/hpv047.

Dag, Y. N. Mehlig K., Rosengren A., Lissner L., Rosvall M (2019) 'Negative emotional states and negative life events: Consequences for cardiovascular health in a general population', *Journal of Psychosomatic Research*. Elsevier Inc. doi: 10.1016/j.jpsychores.2019.109888.

Eriksen, A., Tillin T., O'Connor L., Brage S., Hughes A., Mayet ., McKeigue,P., Whincup P., Chaturvedi N., Forouhi N. G., (2015) 'The Impact of Health Behaviours on Incident Cardiovascular Disease in Europeans and South

Asians – A Prospective Analysis in the UK SABRE Study', *PLoS ONE*, 10(3), pp. 1–15. doi: 10.1371/journal.pone.0117364.

Kivimäki, M., Jokela M., Nyberg S.T., Singh-Manoux A., Fransson E., I., Alfredsson L., Bjorner J. B., Borritz M., Burr H., Casini A.,Clays E., De Bacquer D., Dragano N., Erbel R., Geuskens G.A., Hamer M., Hooftman W. E., Houtman I.L., Jöckel K-H., Kittel F., Knutsson A., Koskenvuo M., Lunau T., Madsen I.E.H. Nielsen M.L., Nordin M,. Oksanen T., Pejtersen J. H., Pentti J., Rugulies R., Salo P., Shipley M.J., Siegrist J., Steptoe A., Suominen S.B., Theorell T., Vahtera J., Westerholm P. J. M., Westerlund H., O'Reilly D., Kumari M.,Batty G. D., Ferrie J. E.,Virtanen M.,(2015) 'Long working hours and risk of coronary heart disease and stroke: A systematic review and meta-analysis of published and unpublished data for 603 838 individuals', *The Lancet*, 386(10005), pp. 1739–1746.

Kollia, N. Panagiotakos D. B., Georgousopoulou E., Chrysohoou C., Tousoulis D., Stefanadis C., Papageorgiou C., Pitsavos C. (2016) 'Exploring the association between low socioeconomic status and cardiovascular disease risk in healthy Greeks , in the years of fi nancial crisis (2002 – 2012): The ATTICA study', *International Journal of Cardiology*. Elsevier Ireland Ltd, 223, 758–763.

Kubzansky, L. D. *et al.* Jeff C Huffman J.C., Boehm J.K., Hernandez R., Eric S Kim R. S., Koga H.K., Feig E.H., Lloyd-Jones D.M., Seligman M. E. P., Labarthe D. R., (2018) 'Positive Psychological Well-Being and Cardiovascular Disease', *Journal of The American College of Cardiology*, 72(12), 1382–1396.

Ma, Y., Ying-Jun Wang Y-J., Chen B.R., Shi H-J., Wang H., Khurwolah M.R., Li Y-F., Xie Z-Y.,Yang Y., Wang L-S . (2017) 'Study on association of working hours and occupational physical activity with the occurrence of coronary heart disease in a Chinese population', *PLoS ONE*, pp. 1–14. doi: 10.1371/journal.pone.0185598.

Magnoni, M. Daniele Andreini D., Gorini M., et al, (2015) 'Coronary atherosclerosis in outlier subjects at the opposite extremes of traditional risk factors : Rationale and preliminary results of the Coronary Atherosclerosis in outlier subjects : Protective and novel Individual Risk factors Evaluation (CAPIRE) study', *American Heart Journal*. Elsevier Inc., 173, pp. 18–26.

Mclachlan, K. J. J. and Gale, C. R. (2018) 'The effects of psychological distress and its interaction with socioeconomic position on risk of developing four chronic diseases', *Journal of Psychosomatic Research*. Elsevier, 1–7. doi: 10.1016/j.jpsychores.2018.04.004.

McLachlan, K. J. J. and Gale, C. R. (2018) 'The effects of psychological distress and its interaction with socioeconomic position on risk of developing four chronic diseases', *Journal of Psychosomatic Research*. Elsevier, 109 (April), 79–85.

Méjean, C., Droomers M., van der Schouw Y.T. Sluijs I., Czernichow S., Grobbee D. E., Bueno-de-MesquitaH., Beulens J.W.J. (2013) 'The contribution of diet and lifestyle to socioeconomic inequalities in cardiovascular morbidity and mortality, *International Journal of Cardiology*. Elsevier Ireland Ltd, 168(6), 5190–5195.

Moran, E., Ommerborn, J. and Blackshear, T. (2018) 'Financial Stress and Risk of Coronary Heart Disease in the Jackson Heart Study', *American Journal of Preventive Medicine*. Elsevier Inc., 56(2), pp. 224–231.

Nakade, M. Daisuke Takagi D., Suzuki K., Jun AidaJ., Ojim T., Kondo K., Hirai H., Kondo N., (2015) 'Influence of socioeconomic status on the association between body mass index and cause-speci fi c mortality among older Japanese adults : The AGES Cohort Study', *Preventive Medicine*. Elsevier Inc., 77, 112–118.

Nakhaie, M. R. Behrooz Ebrahimzadeh KoorB.E., Omid Salehi S.E., Karimpour F. (2018) 'Prediction of cardiovascular disease risk using framingham risk score among office workers, Iran, 2017', *Saudi J Kidney Dis Transpl*, 29, 608–614.

Ndrepepa, G. (2017) 'Psychological distress and mortality in stable coronary heart disease : persistence of high distress means increased risk', *Heart*, 0(0), pp. 26–28. doi: 10.1136/heartjnl-2017-311610.

Norton, C. (2017) 'Acute coronary syndrome : assessment and management', *Nursing Standard*, 31(29), pp. 61–71.

Pitman, R. K. and Armstrong, K. A. (2019) 'Stress-Associated Neurobiological Pathway Linking Socioeconomic Disparities to Cardiovascular Disease', *Journal of the American College of Cardiology*, 73(25), 1–13.

Psaltopoulou, T. Hatzis G.. Papageorgiou N., Androulakis E., Briasoulis A., Tousoulis D. (2017) 'Socioeconomic status and risk factors for cardiovascular disease: impact of dietary mediators', *Hellenic Journal of Cardiology*. Elsevier B.V. doi: 10.1016/j.hjc.2017.01.022.

Redondo-Bravo, L. *et al.* (2020) 'Does Socioeconomic Status Influence the Risk of Subclinical Atherosclerosis?', *Journal of the American College of Cardiology*, 74(4),1–10.

Reid, S. W., Patel, P. C. and Wolfe, M. T. (2018) 'The struggle is real : self-employment and short-term psychological distress', *Journal of Business Venturing Insights*. Elsevier Inc., 9(April), pp. 128–136. doi: 10.1016/j.jbvi.2018.04.002.

Ren J., Guo X. L., Z. L. LU, Zhang J. Y., Tang J. L., Chen X., . Gao C. C, Xu C. X.& Xu A. Q. (2016) 'Ideal cardiovascular health status and its association with socioeconomic factors in Chinese adults in Shandong , China', *BMC Public Health*, 16(942), pp. 1–7. doi: 10.1186/s12889-016-3632-6.

Rosengren, A. *et al.* (2019) 'Socioeconomic status and risk of cardiovascular disease in the Prospective Urban Rural Epidemiologic (PURE) study', *Lancet*, pp. 1–13. doi: 10.1016/S2214-109X(19)30045-2.

Sanchis-Gomar, F.Quilis C. P.,Leischik R., Lucia A. (2016) 'Epidemiology of coronary heart disease and acute coronary syndrome', *Annals of Translational Medicine*, 4(13), 1–12.

Sayin *et al.* (2014) 'Framingham risk score and severity of coronary artery disease', *Herz*, 39(5), 638–543.

Smith, L. Smith L., McCourt O., Sawyer A., Ucci M., A Marmot A., Wardle J., Fisher A.. (2016) 'A review of occupational physical activity and sedentary behaviour correlates', *Occupational Medicine*, 66, 185–192.

St-pierre, M. *et al.* (2019) 'SSM - Population Health Relationships between psychological distress and health behaviors among Canadian adults : Di ff erences based on gender , income , education , immigrant status , and ethnicity', *SSM - Population Health*. Elsevier, 7(2019), 1–12.

Steptoe, A., Hiltl T-J.,Dowd J.B., Hammer M. (2018) 'Socioeconomic status and central adiposity as determinants of stress-related bi- ological responses relevant to cardiovascular disease risk', *Brain Behavior and Immunity*. Elsevier Inc. doi: 10.1016/j.bbi.2018.11.019.

Tanji, F., Tomata Y., Zhang S., Otsuka T., Tsuji I.(2018) 'Psychological distress and completed suicide in Japan : A comparison of the impact of moderate and severe psychological distress', *Preventive Medicine*. Elsevier, 116, pp. 99–103. doi: 10.1016/j.ypmed.2018.09.007.

Thompson, J. F, Rachel L. Severson R.L. & Rosecrance J.C. (2018) 'Occupational physical activity in brewery and office workers', *Journal of Occupational and Environmental Hygiene*. Taylor & Francis, 15(9), 686–699.

Usman, Y. *et al.* (2019) 'Indonesia ' s Sample Registration System in 2018 : A work in progress', *Journal of Population and Social Studies*, 27(1),. 39–52.

Wiernik, E., Meneton P., Empana J-F, Siemiatycki J., Hoerte N., Vulser H., Nabi H., Limosin F., Czernichow S., Goldberg M., Ozguler A., Zins M., Lemogne C. (2018) 'Cardiovascular risk goes up as your mood goes down : Interaction of depression and socioeconomic status in determination of cardiovascular risk in the CONSTANCES cohort ☆', *International Journal of Cardiology*. Elsevier B.V., 262, 99–105.

Wirtz, P. H. and von Känel, R. (2017) 'Psychological Stress, Inflammation, and Coronary Heart Disease', *Current Cardiology Reports*. Current Cardiology Reports, 19(11), 1–10.

Zengin, E., Bickel C., B. Schnabel R., Zeller T.,Karl-J. Lackner KJ., Hans-J. Rupprecht H-J., Blankenberg S., Westermann D., Christoph Sinning for the AtheroGene–Study Investigators (2015) 'Risk Factors of Coronary Artery Disease in Secondary Prevention — Results from the Athero Gene — Study', *PLoS ONE*, . 1–14. doi: 10.1371/journal.pone.0131434.

Zhang, F. L. Xing Y-Q., Wu Y-H, Liu, H-Y., Luo y., Sun M-S., Guo Z-N & Yang Y., (2017) 'The prevalence, awareness, treatment, and control of dyslipidemia in northeast China: a population-based cross-sectional survey', *Lipids in Health and Disease*. Lipids in Health and Disease, 16(1), 1–14.