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A Meta-analysis of Effects of Socioeconomic Status on Depression and Substance Use Disorder

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Abstract

Background: Low socioeconomic status (SES) is generally associated with high incidence of depression and substance use disorder. But previous findings on the strength of the association are yet inconsistent.

Objective: This study is a systematic review examining the prospective effects of socioeconomic status (SES) on both depression and substance use disorder incidence.

Method: PubMed was searched to locate relevant studies that published before the start of 2017 in multiple languages. There were 10 studies that met inclusion criteria that contained 30 effect size estimates, with a sample of 5,270,999 people. The moderating effects of different SES components and follow up durations were also examined.

Result: Low SES at baseline was correlated with depression ($r=0.13$, 95%CI 0.08- 0.18, $p<0.001$) and substance use disorder ($r=0.16$, 95%CI 0.08-0.24, $p<0.001$) at follow up. The relationship was consistent for all SES components as predictors, as well as for different follow-up duration.

Conclusion: Individuals with a relatively low socioeconomic status are at higher risks of developing depression and substance use disorder.

Keywords: socioeconomic status, SES, review, meta-analysis, depression, substance, alcohol, drug.

1. Introduction

Socioeconomic status (SES) is defined as a combined measurement of the relative social and economic position of an individual (Dutton et al., 1989). An individual's SES usually is defined by their income, education level, and occupation status. For children and adolescents, their SES often equals to family SES, or parental SES (Gilman et al., 2002).

The surrounding environment has an impact on one's development, especially when it comes to mental status (McLeod et al., 1993; Seidman et al., 1998; Rutter et al., 2003). SES is one of the important reflexes of the surrounding environment of an individual. Previous studies suggest that people with lower SES have higher chance of getting mental disorders (Holzer et al., 1986). There are many characteristics about low SES conditions that influence the individual's mental health conditions. In socioeconomic disadvantaged condition, one is more likely to suffer from community disorganization, such as the lack of sufficient policing, education and job opportunities (Sampson et al., 1989). Low SES neighborhoods are also related to insufficient physical resources, like poor housing, lack of parks, lack of environmental design, and distant markets (Cohen et al., 2003). A low SES environment may lead to increasing crime and delinquency rate by exposing local people to opportunities to commit crimes, or reducing healthy informal social regulations and healthy behaviors (Cohen et al., 2003).

Unipolar major depression is reported to be one of the most common mental health disorders, which ranks within the 10 leading diseases contributing to the global disease burden, measured by disability-adjusted life-years (Lim et al., 2013). According to the survey of Substance Abuse and Mental Health Services Administration (SAMHSA), an estimated 16.1 million adults in the U.S., which accounts for 6.7% of all adult population, had at least one episode of major depression in 2015 (SAMHSA, 2016). The risk factors for depression are various, and previous research has been focused mostly on individual characteristics, such as gender (Pallavi et al., 2013), personality traits (Matsudaira et al., 2006), and personal and family history (Hammen et al., 2005). Environmental factors, such as family and

neighborhood SES have also been theorized to have an effect on depression. According to theories of stress and coping, residents in SES disadvantaged neighborhoods have higher chance of being exposed to stressors or buffering of stress, which consumes the coping resources of an individual, and may lead to maladaptive behaviors in response to stressful stimuli (Meyer et al., 2008), and further influence the risks of getting depression. In families with low SES, individuals are more likely to be exposed to risk factors like a large number of siblings, and parental divorce or remarriage (Fendrich et al., 1990; Mcleod et al., 1991). These risk factors increase the possibility of having family dysfunctions, such as the lack of closeness with parents, and conflicts or violence between family members, and may contribute to the chance of having depressive disorders or symptoms (Greene et al., 2002). However, previous findings of the relationship between SES and depression are inconsistent (Richardson et al., 2015).

Another health risk that is worth noticing for residents in low SES community is the use of substances, such as smoking, and the consumption of alcohol and drugs. In 2015, there were estimated over 19 million adults in U.S. who had a substance use disorder of illicit drugs or alcohol. Such number took up about 8.1% of people in U.S. total population. Additionally, the population in U.S. with illicit drug use problem experienced an upward trend from year 2002 to year 2015 (SAMHSA, 2016). Some previous researches found the evidence that SES disadvantages are related to levels of alcohol use (Casswell et al., 2003), binge drinking (Stimpson et al., 2007), and other alcohol use disorders (Keyes & Hasin, 2008). It has also been found that low SES is related to illegal drug use for both adults (Boardman et al., 2001) and adolescents (Hoffmann et al., 2002). Some findings suggest that the reason behind this phenomenon is that the availability of substances varies for neighborhoods as a function of different SES. The density of substance marketing in SES disadvantaged neighborhoods is significantly higher than the ones in more advantaged SES neighborhoods (Jones-Webb et al., 2008; Romley et al., 2006). Therefore, individuals who live in a low SES area may be put into higher risks of substance misuse, and may develop substance related illnesses.

Empirically speaking, substance use disorder is likely to co-occur with other mental health illnesses. In the year 2015, there were over 8 million people in the U.S. with substance use disorder and another diagnosed mental illness. This number consists of about 42% of the total population with substance use disorder in the U.S. (SAMHSA, 2016). According to previous research, depression is one of the most common mental illnesses which are likely to occur comorbidly with substance use disorder (Davis et al., 2008). The chance that both of these disorders co-occur is especially high among adolescents (Kessler et al., 2005) and in the female population (Waller et al., 2006). In the theory of relative deprivation, it is argued that there is a connection among an individual's SES, depression, and the use of a substance (Wilkinson et al., 1999). The theory suggests that there is a causal effect of SES on substance use, and such effect is intermediated by depression (Baron et al., 1986). However, the studies on the comorbidity of these two disorders among low SES population has been rare. In a study focusing on adolescents, it was proved that depressive symptoms serve as a mechanism in the causal relationship between SES and substance use behaviors, including the use of tobacco and cocaine (Goodman, 2002).

Besides the lack of studies on the relationship among the three factors, the findings of SES on substance use behavior solely have neither been consistent. Various studies on US national adult samples show increased levels of alcohol related problems (Jones-Webb et al., 1997), binge drinking (Stimpson et al., 2007), and illicit drug use (Boardman et al., 2001; Hoffmann et al., 2002) in low SES areas. On contrary, some other studies found higher alcohol use is in higher SES areas (Chuang et al., 2005). There are some findings suggesting that there is no relation between SES and alcohol use at all (Ecob et al., 2000), or a conflicting relationship depending on different measurements of SES (Hoffmann et al., 2002; Schroeder et al., 2001).

One of the reasons for the mixed findings of previous research is that they were derived using different designs, some of them are cross-sectional, and others are longitudinal.

Cross-sectional designs cannot be used to interpret the effect of SES on health outcomes. On the other hand, a longitudinal design is better to suggest the direction of the effect between SES and mental disorders. Therefore, relations across time can be determined. In this study, only longitudinal evidence for such topic was included in order to reduce potential bias and articulate the temporal order of causality.

The aim of this study is to systematically review the topic on the longitudinal associations between SES and depression and substance use disorder, and to provide a critical assessment of the research evidence on this topic.

2. Methods

2.1 Search

A systematic search of the literature was conducted in PubMed (1973-Jan 2017). The search aimed to find all published articles examining the prospective association between mental health (terms which are defined in Diagnostic and Statistical Manual of Mental Disorders (5th edition; DSM-5; American Psychiatric Association, 2013) and International Classification of Diseases (10th revision; ICD-10; World Health Organization, 1992)) and SES. The search string was (socioeconomic* OR ses) AND (“mental health” OR psychopatholog*). Only articles written in English, Dutch, German, French, Spanish and Chinese were included.

2.2 Article inclusion

In the first stage of the search, four reviewers were working in two independent groups, reviewing titles and abstracts of articles. Articles covering different components on SES and mental health (terms which are defined in DSM-V/ ICD-10) were retained for further investigation. In the second stage of the search, four reviewers went through all articles individually and coding of the variables of interest will be conducted. Papers that measured the effect of SES on depression and substance use disorder were included in this study.

The populations that included were free of diagnosed depression, substance use disorder, or any other mental illnesses at baseline. No further restrictions were posed with regard to population.

The inclusion criteria of articles were that the study needed to be: (i) a prospective study; (ii) including measures of socioeconomic status (income, occupation, education and financial crisis) at baseline; (iii) including measures of depression or substance use disorder at follow up; (iv) reported prospective associations of socioeconomic status at baseline and the incidence of depression or substance use disorder at follow up. (v) study sample is free from psychological disorders at baseline.

The exclusion criteria were: (i) studies without a formal diagnosis for predictor or outcome; (ii) studies without reported associations on the putative relation between SES and outcome.

2.3 Data extraction

We extracted methodological details from different studies we retained, including participants' demographic information: mean age in years at baseline, gender distribution at baseline, country in which the study was performed, socioeconomic status at baseline and follow-up; the duration between baseline and follow-up; the assessment of alcohol abuse, diagnosis at baseline and follow-up; the measures of SES (including different categories, like education, occupation, employment status and income), the covariates that were used in statistical analyses, differences in outcome in covariate models (adjusted and unadjusted), whether time-varying covariates were used, the number of exposure categories, the number of outcome categories, whether results are reported were of primary or secondary interest, the analytical strategy that was used, the participation rate, the percentage of withdrawal during follow-up.

2.4 Risk of Bias (Quality) Assessment

The included studies were assessed regarding their methodological quality/ risk of bias using the method proposed by Lieveense et al. (2002). This scale was modified to meet the conditions of the research. The scale (Appendices 1) includes 11 criteria on sample selection, study design, and means of assessment. The overall quality score was calculated by summing one point for each 'yes', minus one point for 'no' and zero point for 'not know'. We applied the following three categories: studies that score more than 9 were categorized as relatively high quality and could not have more than one unsatisfactory item; studies that score between 5 and 8 were considered as relatively medium quality, studies that score 4 or below 4 were grouped as relatively low quality (Seo & Kim, 2012). Quality assessment was performed

independently by two groups of raters. Discrepancies were discussed until an agreement was reached.

2.5 Statistical analysis

For each study, we calculated the correlations and 95% CI between SES and depression and substance use disorder incidence. The correlations were based on the depression/substance use disorder incidence rate of the lowest SES category divided by the depression/substance use disorder incidence rate of the highest SES category. That is to say, we took the higher SES level as the reference group compared to lower SES. We also reversed the data in which higher SES was used as the predictor in order to keep the consistence of the predictor between studies. The significance level of p-value is considered to be 0.05.

The correlations described above were pooled using random effects meta-analysis (CMA, Smith, 2017) in order to reduce the variation between studies. The meta-regression-analyses was explored in order to see whether there were differences in outcome as a function of: how and what SES is measured (education, occupation, income, financial crisis and mixed of the measures above), and follow-up duration. The follow-up duration was categorized into two groups, the studies with the duration shorter than 5 years were coded as short, studies with more than 5 years were coded as long (Richardson et al., 2015).

The between-study heterogeneity was calculated using Cochran's Q (Cochran, 1954). Potential publication bias was assessed by funnel plot and Egger's regression-based test (Egger et al., 2002). In order to test the robustness of the results, we re-conducted the analysis with the removal of all studies with relatively low quality (Lorant et al., 2002).

All calculations were conducted on the natural log-scale using CMA software (Version 3).

3. Results

In the first round of article search, 9642 articles were identified and screened, 605 of which were determined to be potentially relevant. The full text of these 605 articles were assessed for eligibility in the first round, and 391 articles were excluded. In the second round of full text assessment, 214 articles were viewed, resulting in 68 articles that were included. In the third round, the remaining 68 articles were assessed and of these 10 met our in- and exclusion criteria. A flowchart of the article selection and the reasons for exclusion reasons is shown in Figure 1. The characteristics of the included studies are provided in Table 2.

3.1 Study Population

The population of the included studies were heterogeneous with regard to age and location. Four studies looked into the impact of childhood or adolescent SES (Reinherz et al., 1993; Johnson et al., 1999; Poulton et al., 2002; Melchior et al., 2007), while six studies focused on adult populations (Skapinakis et al., 2006; Lofors et al., 2006; Galea et al., 2007; Hollander et al., 2013; van der Pol et al., 2013; Pabayo et al., 2014). Four studies were conducted in the U. S. (Reinherz et al., 1993; Johnson et al., 1999; Galea et al., 2007; Pabayo et al., 2014), two in Sweden (Lofors et al., 2006; Hollander et al., 2013), two in New Zealand (Poulton et al., 2002; Melchior et. al., 2007), one in United Kingdom (Skapinakis et al., 2006), and one in Netherlands (van der Pol et al., 2013). Two articles (Lofors et al., 2006; Hollander et al., 2013) used data from the same Sweden national survey, and they both took education and employment status as SES measures, the outcomes for both of these studies were depression incidence.

3.2 Socioeconomic Measurements

Socioeconomic Status was measured as education (Skapinakis et al., 2006; Lofors et al., 2006; Galea et al., 2007; Hollander et al., 2013; van der Pol et al., 2013; Pabayo et al., 2014), occupational status (Skapinakis et al., 2006; Lofors et al., 2006; Hollander et al., 2013; van

der Pol et al., 2013; Pabayo et al., 2014), income (Galea et al., 2007), and financial crisis (van der Pol et al., 2013; Pabayo et al., 2014). In some studies with baseline children and adolescent samples, parental SES was investigated, which included parental education level (Johnson et al., 1999; Poulton et al., 2002; Melchior et al., 2007), parental occupational status (Johnson et al., 1999; Poulton et al., 2002), and family income (Johnson et al., 1999; Poulton et al., 2002; Melchior et al., 2007).

3.3 Outcome Measurements

The outcome of the studies included diagnosis of depression and/or substance use disorder at follow up. The disorders were assessed by using questionnaires, or semi-structured interviews. Three studies made diagnosis in interviews based on the fourth edition of Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) (Poulton et al., 2002; van der Pol et al., 2013; Pabayo et al., 2014), one study used DSM-III (Galea et al., 2007). Three studies made diagnosis based on International Classification of Diseases 10th revision coding (ICD-10) (Skapinakis et al., 2006; Lofors et al., 2006; Hollander et al., 2013), one study used both ICD-9 and ICD-10 (Lofors et al., 2006). One study used Diagnostic Interview Schedule (DIS) (Melchior et al., 2007; Reinherz et al., 1993), another study used Diagnostic Interview Schedule for Children (DISC-I) (Johnson et al., 1999).

3.4 Quality Assessment

The assessed methodological quality is presented in Table1. The median overall score (out of 11) for included studies was 5.5 and the mean overall score was 4.3. The study quality assessment categorized 4 studies as being of relatively low quality (Galea et al., 2007; Hollander et al., 2013; van der Pol et al., 2013; Pabayo et al., 2014), 5 studies as being of relatively medium quality (Reinherz et al., 1993; Johnson et al., 1999; Skapinakis et al., 2006; Lofors et al., 2006; Melchior et al., 2007;), and 1 studies as being of relatively high quality (Poulton et al., 2002).

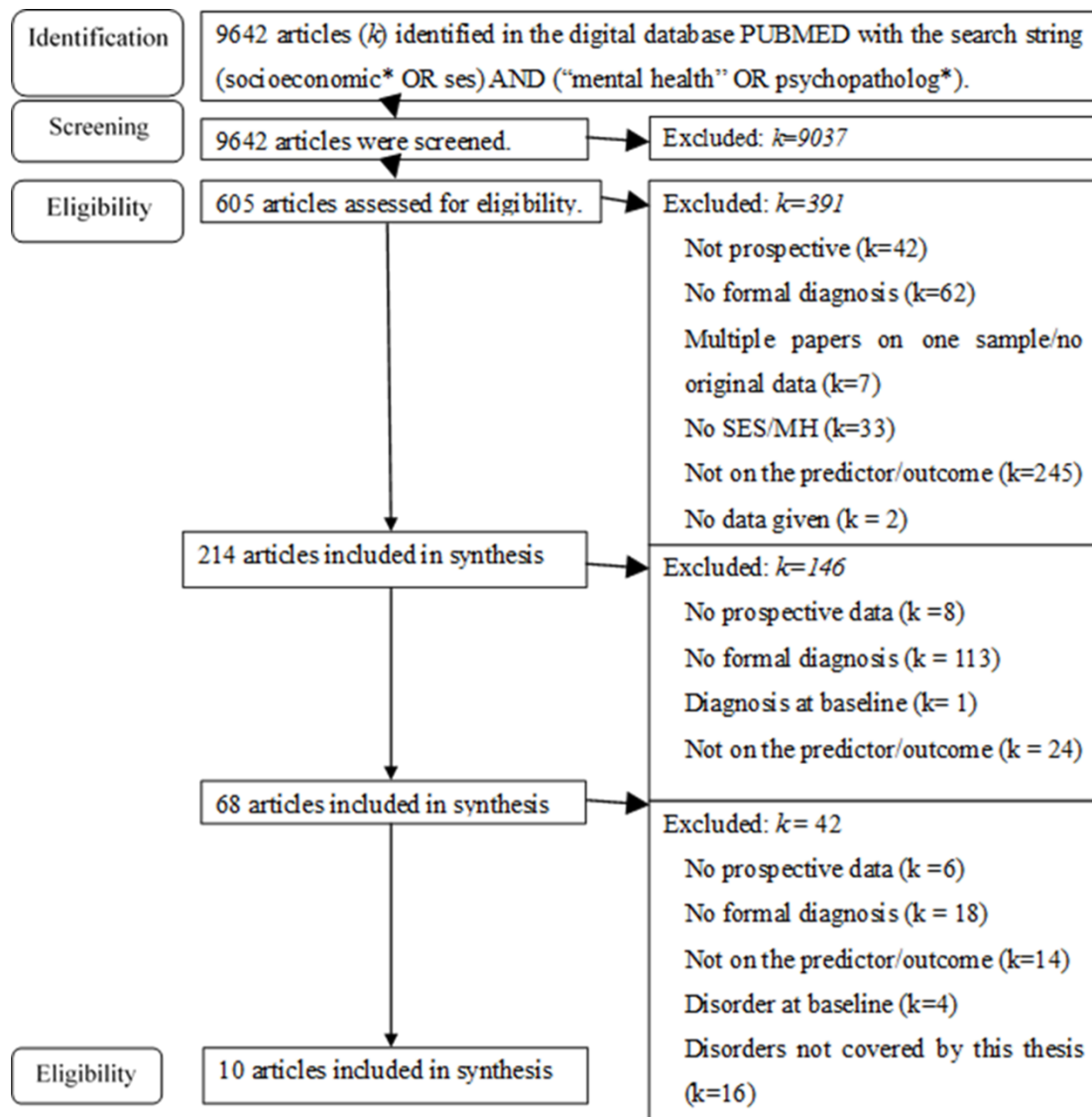


Figure 1. Flowchart on identification, screening and inclusion of eligible publications.

Table 1. Characteristics of the included studies

References	Population	SES components	Duration	Outcome: diagnosis	Mental health measure	Study quality
Reinherz (1993)	385 adolescents in U.S.	Mixed family SES Academic Failure	14 years	Depression	DIS-III-R	7 (Medium)
Johnson (1999)	736 adolescents in U.S.	Parental SES: mix of parental education, occupation, and income.	19 years	Depression Substance use disorder	DISC-I	7 (Medium)
Poulton (2002)	1037 children in New Zealand.	Mixed childhood SES	23 years	Major depression Alcohol dependence Tobacco dependence	DSM-IV	10 (High)
Skapinakis (2006)	2406 adults in U.K.	Socioeconomic position: mix of occupation and education.	18 months	Depression	ICD-10	5 (Medium)
Lofors (2006)	5229025 adults in Sweden	Education Occupation	3 years	Depression	ICD-9 and ICD-10	6 (Medium)
Galea (2007)	1120 adults in U.S.	Education Income	18 months	Depression	DSM-III	1 (Low)
Melchior (2007)	1037 children New Zealand.	Childhood SES: mix of education and income.	32 years	Depression Substance dependence	DIS	5 (Medium)
Hollander (2013)	5229025 adults in Sweden.	Education Occupation	6 years	Depression	ICD-10	-1 (Low)
van der Pol (2013)	600 adults in Netherlands.	Education Occupation Financial Crisis	3 years	Substance dependence	DSM-IV	1 (Low)
Pabayo (2014)	34653 adults in U.S.	Education Occupation Financial Crisis	3 years	Depression	DSM-IV	2 (Low)

3.5 Study Results

Among the 10 studies included in this research, 4 studies found a significant association between SES and depression (Johnson et al., 1999; Poulton et al., 2002; Lofors et al., 2006; Hollander et al., 2013), 4 studies found a significant association between SES and substance use disorder (Johnson et al., 1999; Poulton et al., 2002; Melchior et al., 2007; van der Pol et al., 2013), and 4 studies did not report any significant finding (Reinherz et al., 1993; Skapinakis et al., 2006; Galea et al., 2007; Pabayo et al., 2014). Among the 6 studies with significant findings, 1 study found that low SES is negatively correlated with depression incidents, indicating that low SES individuals had a lower depression incidence (Poulton et al., 2002); The rest of significant findings suggested a positive correlation between low SES and depression or substance use disorder incidence, indicating that individuals with low SES have higher depression/ substance use disorder incidence (Johnson et al., 1999; Poulton et al., 2002; Lofors et al., 2006; Melchior et al., 2007; van der Pol et al., 2013; Hollander et al., 2013).

Most studies have more than one indicators of SES. As a result, for 10 included studies, there are 30 coded correlations, 22 for depression outcome, and 8 for substance use disorder outcome. For the samples with depression outcomes, the average effect size for the random effects model was 0.13 with a 95% confidence interval of 0.08 to 0.18 ($z=4.71$, $p<0.001$). For the samples with substance use disorder, the average effect size for the random effects model was 0.16 with a 95% confidence interval of 0.08 to 0.24 ($z=3.93$, $p<0.001$). There were not any significant differences ($p>0.05$) between the effect sizes for depression and substance use disorder outcome. In a random effects model, the overall Q test of heterogeneity was not significant ($Q=0.364$, $p=0.55>0.05$), indicating that the correlations were homogeneous across the studies.

An analysis on moderators was also conducted to explore how the type of SES and follow up duration moderate the relationships between SES and depression/ substance use disorder. The results are displayed in table 2.

Table 2. Methodological characteristics impacting effects of SES on depression and substance use disorder

Moderator	Mental Disorder	k	Q	Mean ES	Lower limit 95% CI	Upper limit 95% CI	
Type of SES	Depression	22	5.73				
Mixed SES		4		0.04	-0.12	0.20	
Education		9		0.12**	0.06	0.17	
Occupation		6		0.18**	0.13	0.23	
Income		2		0.16*	0.02	0.31	
Financial Crisis		1		0.16**	0.15	0.17	
Type of SES	SUD	8	29.99				
Mixed SES		2		0.18	-0.09	0.43	
Education		2		0.13**	0.08	0.19	
Occupation		2		0.08**	0.02	0.14	
Income		1		0.17**	0.10	0.24	
Financial Crisis		1		0.34**	0.27	0.41	
Duration	Depression	22	0.26				
Short		11		0.11*	0.01	0.21	
Long		11		0.14**	0.09	0.20	
Duration	SUD	8	0.66				
Short		3		0.18*	0.01	0.34	
Long		5		0.15**	0.06	0.25	

Note. SUD=substance use disorder; k=number of effect sizes; ES=effect size; CI=confidence interval for the average value of ES.
 *p<0.05; **p<0.01

We also tested whether there were any significant differences between the effects of different SES components. The results revealed that within the same outcome, each of the comparisons between the five SES indicators (mixed SES, education, occupation, income, and financial crisis) were nonsignificant ($p>0.05$). The same pairwise comparisons were also conducted to test the difference between follow up durations (short and long). The results showed that for both depression and substance use disorder outcome, there was no significant ($p>0.05$) difference between the short and long duration conditions.

Removing 4 studies of relatively low quality (Galea et al., 2007; Hollander et al., 2013; van der Pol et al., 2013; Pabayo et al., 2014) did not change the effects of moderators. After the removal of these 4 articles, all effect sizes remained stable.

Publication bias was assessed among all included studies with funnel plot (figure 2) with pseudo 95% confidence intervals. Funnel plot showed that none of the individual study results was more extreme than expected, which indicated that there was no evidence for publication bias. According to Egger's test, the result also indicated that there was no significant ($t=0.40$, $p=0.69$) publication bias.

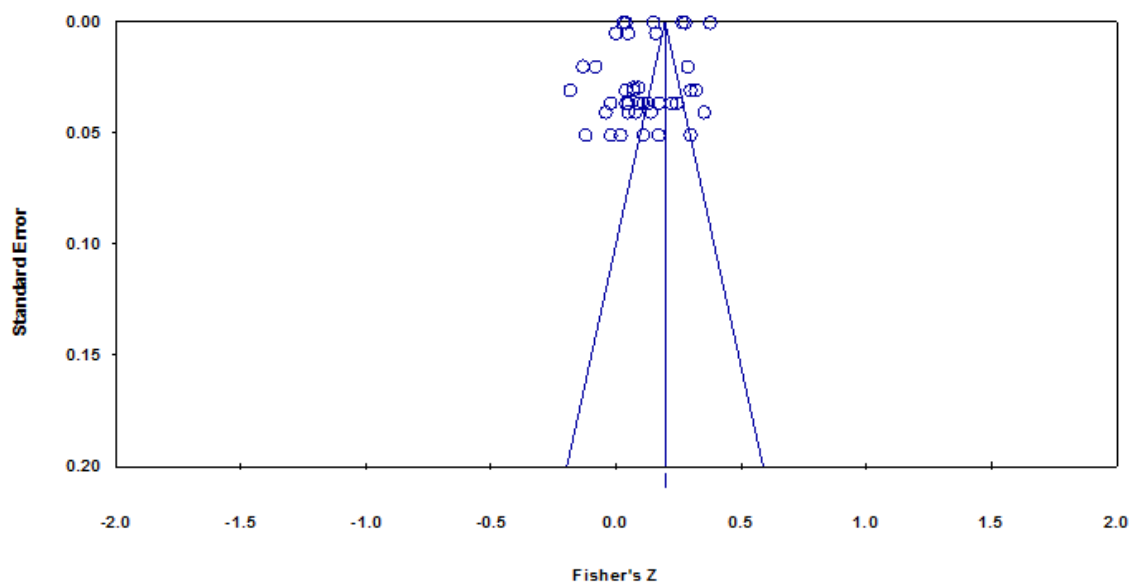


Figure 2. Funnel plot for publication bias.

4. Discussion

The general goals of this research were to (1) determine the relationship between SES and depression or substance use disorder and, (2) explore the impact of different moderators in these associations.

4.1 Main findings

According to the results, there is a weak positive correlation between low SES and the onset of depression. The same relationship also exists between low SES and the onset of substance use disorder. The overall findings indicate that SES is related to people's depression and substance use conditions. For individuals, the lower their SES are, the higher probability of getting diagnosis of depression or substance use disorder.

If SES was measured by income, education and occupation independently, it did not change the relationship between SES and depression, also the relationship between SES and substance use disorder. However, when SES was measured as a variable mixed with multiple measures, including income, education, and occupation, the correlations both between SES and depression, and between SES and substance use disorder, were not significant. It indicates that SES is a better predictor for depression and substance use disorder incidence, when it is measured separately than mixed.

Additionally, when SES is measured by financial crisis, it produced a larger correlation between SES and substance use disorder. The average correlation between SES and substance use disorder was 0.16, when SES was operationalized by financial crisis as an indicator to low SES, the correlation changed to 0.34. However, financial crisis was only measured in a very limited number of studies. So the effect is not strong enough to make a conclusion.

When the length of follow up duration was taken into consideration, it did not change the relationship between SES and depression/substance use disorder. In either short or long duration condition, there is a weak correlation between SES and depression. Also, for both short and long follow up duration conditions, there are weak level of correlations between SES and substance use disorder. The findings indicate that such impact that SES has on

depression and substance use disorder does not alter through time. In other words, having a low SES at baseline increases the chance of people getting diagnosis of depression and substance use disorder in both short term and long term period.

4.2 Contributions

Previous meta-analysis studies on the relationship between SES and depression included both cross-sectional and longitudinal studies (Lorant et al., 2003). This study is the first which systematically reviewed studies on the prospective relationship between these two variables, therefore, a temporal relationship could be determined between SES and depression. In terms of the overall finding, this study showed similar results compared to previous meta-analysis' result, which is that low SES individuals had higher odds of being depressed (Lorant et al., 2003).

There is no meta-analysis studies on the relationship between SES and substance use disorder. The most recent relative meta-analysis study investigated the relationship between SES and substance use behavior (Lemstra et al., 2008), but not a formal diagnoses of substance use disorder. Previous study results revealed that low SES individuals have a higher rate of engaging in substance risk behaviors compared with those of high SES (Lemstra et al., 2008). The findings of our study filled in the blank of the area, which is how SES affects substance use disorder. The result also supports the conclusion of Lemstra et al. in 2008. Moreover, the results of this study could determine the causal relationship between the two variables.

4.3 Mechanisms of the effects

There are several hypothesis providing possible mechanisms behind the observed effects of SES. Low SES individuals are more likely to be exposed to various stressors, such as violence (Peterson et al., 2000) and community disorganization (Evans, 2003), which may have a negative impact on their mental health (McLeod & Kessler, 1990). According to stress

theory, personal resources, including coping style, self-esteem, mastery, and the feelings of in control, buffers the negative impact of stress on mental status (Brown & Harris, 1984; Wheaton, 1980). But for low SES individuals, if their resources are deprived, they would consequently have higher chance to get poor mental health, including getting depression. (McLeod & Kessler, 1990).

For low SES individuals who may face greater stress than high SES ones, they tend to have a different drinking pattern as well (Bloomfield et al., 2006). For high SES individuals, they drink more frequently but with less amount; while for low SES individuals, they are more likely to drink larger amount but with lower frequency. The large amount of alcohol consumption may serve as a coping strategy for low SES individuals in order to deal with stress (Huckle et al., 2010). Even when they consume average level of alcohol, low SES individuals still suffered greater harm than people in high SES (Probst et al., 2014). Another risk factor for low SES people is that they are more likely to have an easily-accessible drug market, which may enable them to be exposed to the risk of developing a maladaptive substance using pattern (Latkin & Curry, 2003).

Previous evidence showed that people of low SES would face more treatment gaps than people of high SES (Newacheck et al., 2003; Steele et al., 2007). They often have lower accessibility (e.g. costs) and availability (e.g. proximity to residence) to health services. Besides, there is a high stigmatization of people of low SES who have substance use disorder, which also works as a treatment barrier (Corrigan et al., 2005; Schomerus et al., 2011). People with substance dependence are often seen as unpredictable, dangerous, and they are expected to be responsible for their problems (Schomerus et al., 2011, Crisp et al., 2000). The stigmatization may consequently reduce their perception of treatment need, and as a result, would decrease their help seeking behavior (Keyes et al., 2010; Glass et al., 2011).

4.4 Study limitations and future studies

There are some limitations of this study. One of the limitations is that although the correlations between SES and outcomes are significant, they are at a weak level. One of the reasons is that all effect sizes included in this analysis are low. Among 30 included correlations, only 3 of which are larger than 0.3, and 20 of which are smaller than 0.2. The average number is 0.14. The significance of this result could be due to the large sample size. There are overall 5,270,999 people included in the studies. It is easy to achieve significance with a large sample size (Porter, 1999). Therefore, the results of the study should be interpreted cautiously. The results imply that there is indeed a difference between effects of low and high SES on depression/ substance use disorder, however, strength of the power might be exaggerated by the large sampling.

Another limitation for this study is that we could not test the relationship between the three variables, which are SES, depression, and substance use disorder, in order to explore how depression and substance use disorder connect in their relationships with SES. Because among 10 included studies, especially 3 studies which measured both depression and substance use disorder incidence as outcomes, none of which provided any results on the relationship between these two variables. Conducting a meta-analysis to summarize the current research state on this topic to explore how these three variables affect each other could be one of the approaches for future researches.

Another limitation is that most studies contributed more than one effect size to the analysis, because they had more than one measure for SES. The average number of correlations per study is 3. All outcomes were weighted equally, despite magnitude. As a result, the findings from one study weighted more heavily than they originally were. This could potentially indicate a bias for the overall results.

One of the problems which should be noticed is that how to measure SES. In this meta-analysis, all articles measured SES as dichotomous variables: low SES vs. high SES. In a previous study, it was found that dichotomous SES variables were less likely to be

correlated with school achievement compared to continuous variables (Sirin, 2004). It was argued that SES is believed to be continuous in nature. But when it is measured and coded, it is artificially categorized, which creates a restricted range. When SES is measured in a restricted range, the correlation with the outcome variable would be reduced (Lipsey & Wilson, 2001). Therefore, whether the same difference exists between the effects of dichotomous SES variables and continuous SES variables, still remains unknown. One of the approaches for future researchers is to explore what the correlations would be like between SES and depression/ substance disorder, if the SES is measured as a continuous variable.

5. Conclusion

To sum it up, the current study presents a statistical summary of the literature on the topic of the prospective impact of SES on depression and substance use disorder. The study also provided an examination on how several factors possibly moderate the relationships between SES and depression and substance use disorder. The results show that SES components have significant but weak correlations with both depression and substance use disorder. For individuals, Lower SES increases both the long term and short term risks of getting diagnosis of depression and substance use disorder.

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Appendices 1: Table of Quality Assessment

Table. Quality assessment of the included studies: study population, exposure, outcome, study design, analysis and data presentation, and overall quality.

Item	Points		
	Yes	No	Not known
Study population			
1 Selection at uniform point	⊕ = 1	⊗ = -1	⊘ = 0
2 Participation rate > 80%	⊕ = 1	⊗ = -1	⊘ = 0
Assessment of risk factor			
3 Exposure assessment blinded	⊕ = 1	⊗ = -1	⊘ = 0
4 Exposure assessed according to validated measures	⊕ = 1	⊗ = -1	⊘ = 0
Assessment of outcome			
5 Outcome assessed identically in studied population	⊕ = 1	⊗ = -1	⊘ = 0
6 Outcome reproducibly	⊕ = 1	⊗ = -1	⊘ = 0
7 Outcome assessed according to validated measures	⊕ = 1	⊗ = -1	⊘ = 0
Study design			
8 Follow-up time > 96 months ¹	⊕ = 1	⊗ = -1	⊘ = 0
9 Withdrawals < 20%	⊕ = 1	⊗ = -1	⊘ = 0
Analysis and data presentation			
10 Appropriate analysis techniques used	⊕ = 1	⊗ = -1	⊘ = 0
11a Adjusted for at least age and sex	⊕ = 1	⊗ = -1	⊘ = 0

¹ The average follow-up period of the included studies