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DOES SOCIAL MEDIA USE AND ADVERSE LIFE EVENTS RELATED TO DEPRESSION? A POPULATION-BASED STUDY USING NEGATIVE-BINOMIAL REGRESSION

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ABSTRACT

The impact of social media use on mental health remains a contentious issue, with varying evidence reported across studies. Concurrently, the prevalence of adverse life events, a significant global social concern, has been increasing. This study investigates the influence of social media use and adverse life events on depression symptoms among individuals in Indonesia. Using a nationally representative sample of 29,793 participants from the Indonesian Family Life Survey Wave 5, depression levels were assessed via the Center for Epidemiologic Studies Depression (CES-D) scale. To account for the overdispersed nature of count data, a negative binomial regression model was utilized to analyze the effects of social media use and adverse life events on depression. The findings reveal that both social media use and the frequency of adverse life events are significantly associated with higher rates of depressive symptoms. Additionally, the study indicates that depression rates are more pronounced among females and younger individuals compared to males and older adults. Educational programs should be designed to raise awareness about the potential mental health risks associated with excessive social media use. Policy makers should also consider integrating mental health support into disaster response plans to better support individuals experiencing adverse life events.
Keywords: *Adverse life event; depression; negative-binomial regression; social media*

INTRODUCTION

Mental health conditions can significantly impact various aspects of an individual's life, including academic or professional performance, familial and social relationships, and social participation. Depression and anxiety are two of the most frequent mental health problems and cost the global economy approximately US$1 trillion annually (WHO, 2021b). Additionally, these depressive disorders are a leading cause of the global burden of disease in most low-income and middle-income countries. Despite this global and economic burden, the portion of worldwide government healthcare expenditure allocated to mental health is very small at a median of less than 2% (WHO, 2021a). Despite evidence showing that trained lay health workers in primary care settings can effectively treat mental disorders using evidence-based interventions (Gallo & Barlow, 2012; Pedrelli et al., 2015), the insufficient allocation of government healthcare spending for mental health reflects a lack of urgency in addressing these issues. While in fact, Mental health curing requires trained providers and sufficient healthcare delivery, such as adequate screening, diagnosis, and treatment.

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Indonesia is one of the developing countries where mental health care is neglected (Arjadi et al., 2015). According to the national basic health survey (RISKESDAS), only 9% of patients with depression have received evidence-based treatments (Cipta & Saputra, 2022). Even worse, the community often stigmatizes people with mental disorders (Hartini et al., 2018). When someone suffers from mental illness, the family treats the subject traditionally, such as applying the practice of pasung, or bringing him/her to spiritual experts rather than mental health care specialists (Subu, 2015). The inappropriate actions are taken mainly due to the lack of knowledge of mental health and its treatments (Subu et al., 2022). The factors causing mental health illness include disasters (Makwana, 2019), social media (Sadagheyani & Tatari, 2020), family conflict (Tannous, 2011), socio-economy status (Freeman et al., 2016), social network (Okamoto et al., 2011).

Research about the impact of online social media usage on mental health has significantly increased over the past two decades. Several studies have reported statistically significant links between social media usage and mental health (Haidt & Allen, 2020; Sujarwoto et al., 2019). Using 418 U.S. Latinos samples (Franco & Carrier, 2020) describe the adverse effect of social media use on mental health in highly acculturated individuals but no or beneficial effect in less acculturated individuals. Haand & Shuwang (2020) study used simple linear regression on a sample of 384 students in Afghanistan and found a positive association between social media addiction and depression. A systematic review using 13 studies by (Keles et al., 2020) describes that the amount of time spent on social media, type of activity, level of investment, and addiction are associated with symptoms of depression, anxiety, and psychological distress. The findings from a study by Sadagheyani and Tatari (2020)a show that social media is like two edge sword that has both positive and negative effects. Indonesia, the 4th largest populated country in the world, had over 140 million internet users in 2017, or at least 54 percent of the population (KOMINFO, 2017). The number increased to 77 percent of the population in 2022, with the top activity being to access social media (APJII, 2022), resulting in more than 160 million social media users in Indonesia tantamount to 60 percent of the total population. Besides accessing social media, Indonesians use their internet connection mostly for online chatting, shopping, gaming, and browsing news (APJII, 2022). According to Chaniago & Sayuti's (2019) research, Indonesian students commonly utilize five social media platforms: WhatsApp, Instagram, Tiktok, Youtube, Facebook, and Twitter. The average duration of social media use in Indonesians is 3 hours and 18 minutes daily (Clinten, 2023). With that large amount of social media use duration, Indonesians are prone to the consequences of social media use on mental health.

This study also explores whether adverse life events have influence on individual's mental health. Adverse Life Events indicates the number of disasters experienced by respondents, including economic disruptions, injuries of household members, things that cause household member to relocate, natural disasters, and civil strife. Studies have reported that disasters and adverse live events negatively affect an individual's mental health (Yetim, 2022). In an ethnically diverse sample of 386 college students, there was a significant positive association between negative life events and higher levels of depression symptoms (Visser et al., 2013). Further, depression in youths is a significant contributor to the risk of suicide (Majeed & Lee, 2017; Thapar et al., 2012). In Indonesian adolescents, the prevalence of depression was 5.1%, whereas, in young adults, it was 5.6% (Suryaputri et al., 2022). For older Indonesians, adverse life event

was found as a significant predictor of depressive symptoms based on a sample of 177 older people living in Bali, Indonesia (Kusuma et al., 2020). Compared to other countries, Indonesia has a notably high natural disaster risk index for occurrences like tsunamis, earthquakes, and climate change hazards such as floods, landslides, droughts, and forest fires (Statista Research Department, 2023). Past studies found that individuals impacted by tsunamis, earthquakes, and other disasters undergo psychological suffering (Beaglehole et al., 2018; Farooqui et al., 2017; Juth et al., 2015).

The rationale of the study

Although past research has contributed significant knowledge to comprehend the repercussions of online social media on diverse aspects of mental health and well-being, certain limitations exist. First, most of these prior studies do not take into account the overdispersion that may exist in discrete data like the data of the Center for Epidemiologic Studies Depression Scale (CES-D). If this problem is not taken into account, it may lead to a diminished standard error and inflated *z*-value and resulting in Further, the systematic review studies include a small number of papers, amounting to less than 15 studies. Second, the majority of the past research focus on the effect of social media use on individual mental health within the context of developed countries. There are limited studies that examine the association between social media use and mental health in developing countries.

This study intends to fill the gaps in previous literature regarding the effect of social media use and adverse life events on mental health through the following approaches. First, we used population-based data from Indonesian Life Family Survey (IFLS) wave 5. IFLS wave 5 interviewed 50,148 individuals in 297 districts throughout Indonesia (Strauss et al., 2016). Thus, this study is among the limited population based-study that aims to examine mental health conditions in a developing country setting. Second, this study uses negative binomial regression, which can handle count data with overdispersion and analyze predictive associations with a count outcome variable, even if it has non-normal, heteroscedastic distributions. Third, this study focuses on mental health conditions in Indonesia, a developing country ranked as the third largest active social media user in the Asia Pacific region, with around 191.4 million users, following China and India (Nurhayati-Wolff, 2023). Hypotheses of the study are as follows: 1) There is a significant effect of social media on mental health conditions indicated by depression symptoms; 2) there is a significant effect of adverse life events on depression symptoms.

METHODS

Data

The data comes from a longitudinal socioeconomics and health survey Indonesian Family Life Survey (IFLS) wave 5. IFLS5 is conducted by the RAND corporation in collaboration with Survey METER. The IFLS 5 survey underwent a thorough review and was approved by IRBs (Institutional Review Boards) in the United States (at RAND) and in Indonesia at the University of Gadjah Mada (UGM). These IRBs ensured that all necessary consent requirements were met for both adults and children before the start of fieldwork. The IFLS5 data can be accessed through the website www.rand.org/ and readers who are interested in using the data are suggested to refer to

the IFLS5 user guide (Strauss et al., 2016). The IFLS5 sample, consisting of over 30,000 individuals residing in 13 out of 27 provinces in the country, represents approximately 83% of the Indonesian population. This study comprises individuals aged 17 to 90 who were included in the sample, both males and females. The final number of samples used in this analysis was 29,793.

Variables and Instrumentation

The dependent variable in this study is the depression symptoms which were measured using a self-report measure of depression, namely the Center for Epidemiologic Studies Depression Scale (CES-D 10). There are ten items in this measure with Likert scale answers ranging from zero (Rarely or none of the time / less than one day) to three (Most of the time/ 5-7 days). The total score is calculated by totaling all items scored after reversing the positive valence items. The possible range for scores is 0-30, with higher scores representing greater degrees of depressed mood. James et al. (2020) explored the psychometric properties of CES-D 10 in 27 low- and middle-income countries, and the result shows that the depressive affect items of CES-D 10 had good internal consistency with a value of $\alpha = .77$, while the positive affect items had an internal consistency of $\alpha = .57$. The sample question includes "I felt depressed." The first independent variable of interest is whether the respondent actively accesses social media. The data for this variable is obtained by extracting the respondents' answers to the "What do you usually use the cell phone for?" question. The data scored one when respondents picked the answer option "E. Social Media (chatting, Facebook, Twitter)" and zero when they did not choose the E option.

The second independent variable of interest is adverse life events, referring to the count of natural disasters, wars, civil conflicts, loss of family members or serious injury due to disasters, things that cause family members to relocate, and fundamental economic disruptions or loss. One sample question to obtain data for this independent variable is "In the last 5 years, was there any natural or another disaster (including civil strife) in the area where you live?" This study includes control variables, namely age (17 – 90 years old), marital status (0 means not yet married, 1 means married, 2 means divorced), and sex (zero for male and one for female).

Statistical Analysis

The analysis is started with exploratory data analysis using descriptive statistics and a histogram. The response is discrete data which is suitable to be handled using Poisson regression. However, in many studies with count outcome, it is often found that the sampling distribution has variance greater than the mean. The disparity in mean and variance is a crucial issue because it violates the Poisson distribution's assumption of equidispersion (i.e. the mean is equivalent to the variance). The issue of the variance greater than the mean for count data is known as over-dispersion (Kassahun et al., 2014). A test for overdispersion is included to confirm the overdispersion existence. Poisson regression will not be suitable to handle count data with overdispersion. Therefore, this study uses negative binomial regression to handle discrete data with overdispersion.

RESULTS AND DISCUSSION

Exploratory Data Analysis

The histogram of the dependent variable is presented in Figure 1. The histogram shows that the data is right-skewed.

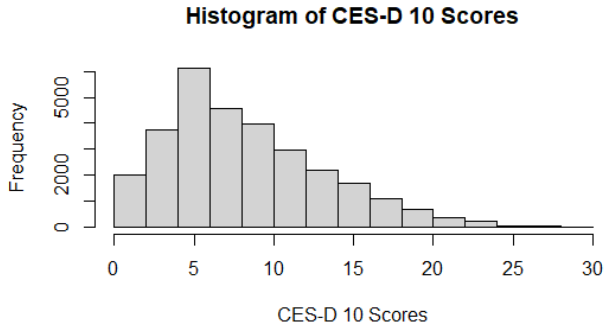

Figure 1 Histogram of CES-D 10 Score as a measure for mental health.

Table 1 illustrates the descriptive statistics of the data. The CES-D 10 scores are discrete data ranging from 0 to 30 with a mean of 8.7703 and a variance of 25.2839. The variance is about three times greater than the mean indicating that overdispersion exists in the data. A test for overdispersion was performed using the *dispersiontest* function in the AER package in R software. This function tests the null hypothesis of equidispersion in Poisson GLMs against the alternative of overdispersion and/or underdispersion. The results show that the dispersion score is 2.785, which is greater than 1 with a p-value less than 0.001, confirming that overdispersion exists in the data.

Nearly one-fourth of the sample actively access social media through their phone. The age of the respondents ranges from 17 to 90, with an average of 38 years old. The average number of adverse life events experienced by the subjects in this study is 0.24 with a standard deviation of 0.48, and the maximum number of adverse life events reached 5. The proportion of males and females is more or less equally distributed. Most of the subjects in the sample are married (76.29%), and the rest are either not yet married or divorced.

Table 1

Demographic characteristics of the sample and the descriptive statistics of the study variable

Variable	N	%	Mean	S.D.	Range
CES-D 10	29793		8.77	5.028	0-30
Use Social Media?					
No	22631	75.96			
Yes	7162	24.03			
Adverse Life Event	29793		0.24	0.48	0-5
Age	29793		38.47	14.40	17-90
Sex					
Male	13880	46.58			
Female	15913	53.41			
Marital Status					
Not yet married	4666	15.66			

Married	22730	76.29
Divorced	2397	8.04

Negative Binomial Regression

In this section, we provide the results of negative binomial regression modelling in the Table 2. Table 2 contains information of two negative binomial regression models where the Model 1 includes Social Media Use and demographics factors as predictors and Model 2 includes Adverse Life Event as additional predictors. Then we compare the two models using Likelihood Ratio Test to see if an additional predictor namely Adverse Life Event is needed in the model.

Table 2. Estimates of negative binomial regression models

	Model 1			Model 2		
Independent Variable	b	S.E	t-value	b	S.E	t-value
Social Media- Yes	0. 0795*	0.0089	8.921	0.0836*	0.0089	9.395
Adverse Life Event				0.0716*	0.0067	10.607
Age	-0.0065*	0.0003	-22.441	-0.0064*	0.0002	-22.213
Sex-Female	0.0288*	0.0068	4.254	0.0305*	0.0067	4.511
Marital Status-Married	-0.0428*	0.0106	-4.030	-0.0434*	0.0106	-4.095
Marital Status-Divorced	0.0154	0.0173	0.891	0.0122	0.0172	0.707
Intercept	2.4116	0.0136	176.377	2.3894	0.0138	173.052

Table 2 shows the estimation of the effect of social media use and adverse life events on mental health represented by depressive symptoms (CES-D). Social media use was significantly related to depression symptoms in both models, even after correcting for control variables. The number of adverse events in life was also significantly associated with depressive symptoms. The log Likelihood test between Model 2 and Model 1 was significant with a p-value of 0.000 (df=8), indicating that adding the Adverse Life Event variable to the model is important in explaining variation in the depression symptoms variable. Thus, the final model in this study is model 2, where social media use and adverse life event are the contributing factors to depression. Both variables were found to have positive relationships with depression symptoms. This indicates that People who use social media are expected to have higher CESD score which imply that they have higher possibility of being depressed than those who do not use social media. In addition, the more frequent disasters or fundamentally terrible experiences that happened in one's life would increase the logs of expected counts of CESD score.

Looking at the estimation for the control variables, the effect of marital status on depressive symptoms shows no difference between divorced and not yet married. The effect was not significant, which can be interpreted as there is no relationship between single status and depression. Conversely, depression was found to be significantly associated with married status. In addition, the models illustrated that females are more

likely to be depressed than males. Age was negatively linked to depressive symptoms, indicating that elderly people are less depressive than youths.

DISCUSSION

This investigation plays a part in the prominent studies on social media use and its relation to mental health (Keles et al., 2020; Lin et al., 2016; Shensa et al., 2018; Vidal et al., 2020). This research boasts several remarkable strengths, such as: 1) employing data obtained from a sample encompassing the nationwide population; 2) focusing on Indonesia, a nation where the fast-growing use of the internet and social media coincides with an overlooked mental health service industry; 3) using negative binomial regression models for analyzing right-skewed discrete outcome data which provide a better adjustment for overdispersion in the data compared to Poisson regression; 4) controlling for demographic variables. When the data is asymmetrically distributed, the ordinary linear regression tends to under/overestimate the predictors' effect on the response's tail probabilities. Moreover, overdispersion exists in the data as the variance is nearly three times larger than the mean. When the data are overdispersed, the use of a negative binomial regression model handles better than Poisson regression which assumes the variance is equal to the mean.

Recent perspectives on depression-social media connections (Bekalu et al., 2019; Valkenburg, 2022) emphasize that social media use has a divergent impact on psychological well-being. Earlier studies state that daily social media use is a temporal or not a strong risk factor for depression (Kreski et al., 2021; Primack et al., 2021), but many others reveal a significant correlation between social media use and depression symptoms (Ivie et al., 2020; Shensa et al., 2018). The present study found that social media use is positively related to depression. The present findings are consistent with other research indicating that social media use harms mental health (Huang, 2022; Lee et al., 2020), and the harm gets more serious with prolonged utilization of social media (Lee et al., 2020). Additionally, the results indicate that social media use is more detrimental for single female Indonesian than male and married Indonesian citizens. However, the effect magnitude of social media use is relatively small, suggesting that there seem other factors moderating the effect of social media use on depressive symptoms. This finding endorses the growing belief that the alleged direct connections between social media usage and symptoms of depression may be overstated. Previous research indicates that disasters and negative life events may threaten individuals' overall well-being (Kraaij & de Wilde, 2001; Lowe et al., 2019). Natural disasters significantly increase psychological distress and depression (Beaglehole et al., 2018), and negative life events induce depressive symptoms and stress (Guang et al., 2017). In line with previous studies, our analysis found that the number of adverse life events significantly increases the rate of depressive symptoms. This relationship remains significant after controlling for the demographic variables.

Results of this study also indicate that depression is less prevalent among older individuals in Indonesia and more prevalent among youths. A past study by Arias de la Torre et al. (2021) states that depression is more prevalent in middle adulthood individuals. Our finding is also parallel with (WHO, 2021b) report that females had higher depressive symptoms scores than males. In addition, a community-based survey in Indonesia also found that being female is one of the risk factors for depression (Suryaputri et al., 2022). If depression is not handled properly, it can lead to suicide (WHO, 2021b). Further, this research found that married individuals are less likely to be

depressed than single. This finding is in line with the results of the study by Hsu & Barrett (2020), which states that marital status is related to negative psychological well-being and those married individuals have a better outcome than those who were never married or previously married.

Limitations & Implications

This study has several limitations. First, given the cross-sectional nature of the data, causal inferences regarding the relationships between social media use on depressive symptoms are only suggestive and await confirmation with longitudinal data. Second, this study does not include information on when the adverse event happened. The time-frame classification of the adverse life event might suggest heterogeneous effects between childhood, teenage, middle or late adulthood on depressive symptoms. Nonetheless, the significances of this study for the public include: 1) depression symptom is associated positively with social media use and adverse life events; 2) the results for some indicators of mental health demonstrate a benefit for individuals who are married in comparison to those who were never married or previously married; 3) females and younger age are more likely to have a negative outcome of depressive symptoms.

CONCLUSION

To sum up, this study indicates that social media usage is a significant predictor of depression among Indonesians. In other words, individuals who use social media are more likely to experience depression than those who do not use it. Additionally, the study confirms that adverse life event is a significant predictor of depression, with individuals who have experienced more adverse life events having higher depression scores. In future research, it would be valuable to explore which types of social media use may be beneficial or harmful to mental health, determine the timing of adverse life events that have the most significant impact on mental health, and identify the age range most at risk of depression.

Suggestions for Future Research

Future research should explore which type of social media use may be harmful or beneficial to mental health; the time frame of when the adverse life event happened that affects mental health the most; and highlight the age range that is a high risk of depression.

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