

## Mediating Role of Social Network Support in the Relationship Between Depression and Online Social Networking

Kim, In-Hye\*, B.H.Sc., O.T., Park, Hae-Yean\*\*, Ph.D., O.T., Nam, Sang-Hun\*\*\*, Ph.D., O.T.

\*Dept. of Occupational Therapy, Graduate School of University, Master's Course, Student

\*\*Dept. of Occupational Therapy, College of Software Digital Healthcare Convergence,  
Yonsei University, Associate Professor

\*\*\*Yonsei New-normal Lifestyle Research Center, Yonsei University, Postdoctoral Researcher

### Abstract

**Objective :** This study investigated the effects of depression on online and offline social interactions among middle-aged and older adults with the aim of enhancing their social connectivity and mental well-being.

**Methods :** Utilizing the Patient Health Questionnaire-9 and the Lubben Social Network Scale-6, this study assessed depression and social relationships in 429 middle-aged adults. We explored the mediation effects of offline relationships on online interactions using path analysis and the Sobel test.

**Results :** Significant links were found between depression and social relationships in a cohort of educated males averaging 63 years of age. Offline interactions mediated 32% of the influence of depression on online relationships, with strong model fit indices emphasizing the importance of offline social interactions.

**Conclusion :** This study highlights the role of active engagement in online and offline networks in improving mental health and managing the impact of depression on social activity among older adults, helping prevent isolation.

**Keywords :** Aged, Depression, Internet, Social isolation, Social networking

## I. Introduction

The rapid advancement of technology has significantly reshaped communication and interaction in society (Jones, 2015). Innovations such as smartphones and social media platforms have redefined daily life, enabling individuals to maintain connections over vast distances and access information rapidly (Klonoff et al., 2022). These developments have transformed traditional communication paradigms, introducing new social engagement methods and altering self-perception and community roles (Beneito-Montagut et al., 2023). For older adults, these technological changes provide opportunities to overcome physical limitations in social interaction (Klonoff et al., 2022).

Online social relationships offer unique opportunities for middle-aged and older adults to maintain existing connections and forge new ones (Cummings et al., 2002; Hülür & Macdonald, 2020; Oh et al., 2014). The accessibility of online communities acts as a lifeline for those facing mobility issues or geographical isolation, enabling participation in social interactions that would otherwise be inaccessible (Hülür & Macdonald, 2020). Active engagement in online networks can enhance feelings of connectedness and reduce the risk of isolation, which is particularly relevant as this demographic navigates aging challenges (Cotten et al., 2013). Digital platforms provide new forms of companionship that transcend traditional boundaries, catering specifically to the interests of older adults and fostering a sense of belonging (Izadi-avanji et al., 2021).

Offline social relationships remain crucial (Macdonald & Hülür, 2021). These relationships

provide essential avenues for emotional support, mental health, and overall well-being. Face-to-face interactions significantly contribute to a sense of community and shared experiences (Rosen & Kelly, 2022), which are difficult to replicate online (Donovan & Blazer, 2020). Balancing digital and traditional interactions is crucial for maximizing mental health and well-being (Kroencke et al., 2023).

Previous research has often segmented the study of online and offline social networks, focusing on their independent effects on social dynamics. For instance, Salathe et al. (2013) demonstrated that online networks can either enhance or impede real-world interactions, significantly influencing behaviors and events (Hanway et al., 2021). Additionally, the preferential attachment model explains how online interactions can predict offline social tie formation, suggesting strong interdependence between these realms (Kwak & Kim, 2017).

However, these studies sometimes overlook the nuanced ways in which online and offline interactions can simultaneously influence each other and the broader implications for mental health, particularly concerning the mediating role of conditions like depression (Twenge et al., 2018). There is a research gap regarding the integrated analysis of how depression mediates both online and offline social relationships, offering new insights into how these interactions collectively impact the psychological well-being of middle-aged and older adults. This approach is distinct as it considers the compounded effects of digital and physical socializations, rarely addressed comprehensively in current literature.

The interaction between online and offline social relationships involves complex dynamics,

each offering unique benefits and challenges (Lieberman & Schroeder, 2020). For middle-aged and older adults, managing this balance is critical, as it profoundly affects social inclusion, community sense, and resilience against isolation and depression (Benvenuti et al., 2020). The mediating role of depression in these relationships can degrade the quality of both types of interactions, heightening feelings of loneliness and disconnection (Nowland et al., 2018). Therefore, effective strategies must harness the strengths of both digital and traditional engagements to build a cohesive support network that aligns with the contemporary lifestyles of older individuals.

This study aims to explore the role of depression in mediating the relationship between offline and online social relationships among middle-aged and older adults. It examines how depression affects the quality and extent of social interactions in both spheres and assesses the contributions of different types of social relationships to psychological well-being. By identifying effective interventions, this research seeks to alleviate the negative effects of depression on social relationships, ultimately enhancing the life quality of this demographic.

## II. Methods

### 1. Data and subject selection

Data were collected via an online survey conducted by a research specialist firm in April 2023. The study collected data from 429 individuals. The study collected the participants' general information, along with their levels of depression,

online social relationships, and offline social networks. The inclusion criteria for the study participants were as follows: individuals aged 55 years or older who were residing in the community were included. Participants residing in facilities such as hospitals or nursing homes were excluded. Additionally, individuals with dementia or experiencing cognitive impairment were excluded from the study. This study was conducted following the approval from the Yonsei University Mirae Institutional Review Board (Approval No. 1041849-202304-SB-061-01).

### 2. Research instruments

#### 1) Independent variable: Depression (Patient Health Questionnaire-9: PHQ-9)

The Patient Health Questionnaire-9 (PHQ-9) is a self-report questionnaire with nine items to measure depression (Kroenke et al., 2001). It evaluates each of the nine Diagnostic and Statistical Manual of Mental Disorders Fourth Edition criteria for major depressive disorder. The PHQ-9 asks respondents how often they have been bothered by problems over the past two weeks, with each item scored on a 4-point Likert scale ranging from 0 (not at all) to 3 (nearly every day). The total score ranges from 0 to 27, with scores categorized as none (0~4), mild (5~9), moderate (10~14), moderately severe (15~19), and severe depression (20+). We coded non depression(0~4) as 1 and depression(5~19) as 0.

#### 2) Dependent variable: Online social relationships

To investigate the participants' online social network characteristics (gender, age, and residence), given the widespread use of smartphones, sections

from the 2020 Internet Usage Survey conducted by the Ministry of Science and ICT in 2021 were used (National Information Society Agency of Korea, 2021). For this study, only questions related to the social impact of the Internet were selected to collect information from the participants. The Online Social Relationships included the question, "How many people have you communicated with online over the past week?" Responses were coded as 1 = 3 or more people, 0 = 2 or fewer people. Additionally, the question "How often do you use instant messaging on an average day?" was asked, with responses coded as 1 = 10 or more times a day, 0 = fewer than 10 times a day. Finally, the question "How much time do you spend on social networking sites (SNS) on an average day?" was included, with responses coded as 1 = 1 hour or more, 0 = less than 1 hour. The responses to these three questions were then summed to create a composite score, with a maximum possible score of 3.

### **3) Mediating variable: Offline social relationships (Lubben Social Network Scale-6: LSNS-6)**

The Lubben Social Network Scale-6 (LSNS-6), a condensed version of the LSNS developed by Lubben (1988) in 1988 and later refined by Lubben et al. (2006), is a screening tool used to measure social networks. It comprises six items, with three questions about relationships with family and relatives and three questions about relationships with friends and acquaintances. The total score is 30, with low scores indicating isolation; a score below 12 suggests a risk of social isolation. Studies have reported a high internal reliability of 0.83, with subscales for family and relatives ranging from 0.84 to 0.89 and those of friends and other

acquaintances from 0.80 to 0.82.

### **4) Controlled variables**

The controlled variables in this study include sex, age, residential area, educational attainment, number of chronic illnesses, and self-rated health. These variables are crucial as they can influence both depression and offline social relationships. For instance, gender differences in depression are well-documented, with women typically reporting higher rates of depression than men (Kuehner, 2017). Age also plays a significant role, as depression rates and social interactions can vary widely across different age groups (Kessler et al., 2010). Residential area impacts social relationships and mental health, with urban and rural settings offering different levels of social interaction opportunities (Peen et al., 2010). Educational attainment is another important factor; higher educational levels are often associated with better mental health and more extensive social networks (Bjelland et al., 2008). The number of chronic illnesses can directly affect both physical and mental health, leading to higher depression rates and reduced social interactions (Scott & Scott, 2009). Finally, self-rated health is a strong predictor of both depression and social relationships, with poorer self-rated health correlating with higher depression and weaker social networks (Jylhä, 2009).

## **3. Research model**

The research model for analyzing the direct effect of depression on online social relationships and the indirect effect mediated by offline social relationships is illustrated in Figure 1.

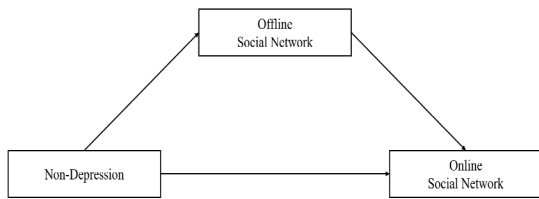


Figure 1. Study Models for the Mediation Analyses

#### 4. Analysis Methods

The participants' general characteristics were analyzed using descriptive statistics. The direct effect of depression on online social relationships and the indirect effect mediated by offline social relationships were analyzed using mediation effect analysis based on the method proposed by Baron and Kenny (1986), which utilizes path analysis. The mediating effect of offline social relationships was tested for statistical significance using the Sobel test. According to Baron and Kenny (1986), a mediating variable is an element that explains the relationship between independent and dependent variables. To prove mediation, there must be significant correlations between the independent variable and both the mediator and dependent variable: if the mediator significantly relates to the dependent variable, thereby reducing or eliminating the effect of the independent variable, mediation is established. In this study, the relationships between the independent variable, the dependent variable, and the mediator variables were examined for significance using path analysis. Descriptive statistics and mediation effects were analyzed using SAS version 9.4 (SAS 9.4: SAS Institute Inc., Cary, North Carolina, USA).

### III. Results

The general characteristics of the data used in this study are presented in Table 1. The majority of participants were male ( $n = 256$ , 59.67%), with an average age of 63.66 years ( $SD = 5.34$ ). A significant proportion of participants had a college education ( $n = 230$ , 53.61%), and a substantial number were currently employed ( $n = 182$ , 42.42%). Regarding self-reported health, low scores indicate better health, with an average score of 2.92 ( $SD = 0.83$ ). The average number of family members was 2.54 ( $SD = 1.06$ ), and the average number of chronic illnesses was 1.76 ( $SD = 1.17$ ). The average of online social relationships was 1.03 ( $SD = 0.74$ ), LSNS-6 score was 12.47 ( $SD = 7.50$ ), and PHQ-9 score was 4.22 ( $SD = 4.61$ ).

The mediating effect of offline social relationships on the relationship between depression and online social relationships was examined, and the results are presented in Table 2 and Figure 2. Non-depression ( $\beta = .13$ ,  $p = .0045$ ) and offline social network ( $\beta = .37$ ,  $p < .0001$ ) both showed significant positive correlations with online social relationships. Further, a significant positive correlation was found between non-depression and offline social network ( $\beta = .16$ ,  $p = .0012$ ). The fit indices for the mediation model of the relationship between depression and online social relationships goodness of fit index: 1.00, normed fit index: 1.00, and comparative fit index: 1.00 were statistically significant. The Sobel test confirmed the statistical significance of the mediating effect of offline social relationships in the relationship between depression and online social relationships ( $p < .0001$ ). The total effect ( $\beta = 0.19$ ,  $p < .0001$ ), direct effect ( $\beta = 0.13$ ,  $p = .0045$ ), and

indirect effect ( $\beta = .06, p = .0024$ ) of depression on online social relationships were significant, suggesting that offline social relationships partially mediate the relationship by 32%.

Table 1. Participants' Demographic Characteristics (N = 429)

Characteristics	n (%)
Sex	
Male	256 (59.67)
Female	173 (40.33)
Age, Mean (SD)	
55-64 years	203 (47.32)
65-74 years	214 (49.88)
More than 75 years	12 (2.80)
Residential area	
Urban	333 (77.62)
Mid-urban	96 (22.38)
Educational attainment	
No formal education	1 (0.23)
Elementary school graduation	2 (0.47)
Middle school graduation	11 (2.56)
High school graduation	134 (31.24)
College graduation	230 (53.61)
Master's degree graduation	38 (8.86)
Doctorate degree graduation	13 (3.03)
Employment status (Yes)	182 (42.42)
Self-rated health, Mean (SD)	2.92 (0.83)
Family members, Mean (SD)	2.54 (1.06)
Number of chronic illnesses, Mean (SD)	1.76 (1.17)
Online social relationships, Mean (SD)	1.03 (0.74)
LSNS-6, Mean (SD)	12.47 (7.50)
PHQ-9, Mean (SD)	4.22 (4.61)

n = number; LSNS-6 = Lubben Social Network Scale-6; PHQ-9 = Patient Health Questionnaire-9; SD = Standard Deviation.

Table 2. Mediation Analysis Results of LSNS Between Depression, Social Support Networks, and Online Social Network

Pathway	Unstandardized coefficient ( $\beta$ )	SE	Standardized coefficient ( $\beta$ )	t value	p-value
Non-depression → Online social network	0.20	0.07	.13	2.84	.0045**
Offline social network → Online social network	0.04	0.01	.37	8.87	< .0001***
Non-depression → Offline social network	2.53	0.79	.16	3.24	.0012**

SE = Standard Error; Controlled variable = sex, age, residential area, educational attainment, number of chronic, self-rated health. \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .

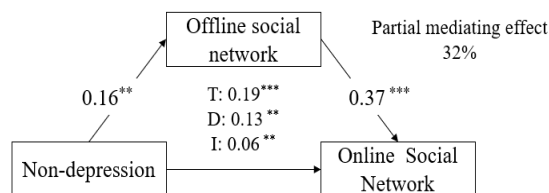


Figure 2. Mediating Effect of Offline Social Networks Between Non-Depression and Online Social Networks

T = total effect; D = direct effect; I = indirect effect.

## IV. Discussion

This study corroborates the positive association between non-depression and active participation in online social networks. This finding is in line with previous study (Westmaas et al., 2020), which noted that active online engagement could potentially enhance one's sense of belonging and social support, thereby contributing to better mental health outcomes. Moreover, our analysis suggests that for the elderly population, this relationship may be more pronounced due to the reduced mobility and physical limitations that come with age, making online networks a valuable tool for social interaction (Doe et al., 2022).

The 32% mediation effect underscores the importance of real-world interactions in bolstering online engagement. It is indicative of the complex interplay between the two realms of social

interaction. This complexity is further highlighted by contrasting the findings with those relating to younger demographics, where increased online social engagement may sometimes negatively affect offline relationships, leading to digital addiction and social isolation (Al-Kandari & Al-Sejari, 2020).

In contrast to the findings related to younger age groups, our study suggests that among individuals aged 55 and over, the activation of online social networks may be a positive outcome of an active offline social life. This assertion aligns with the findings of a previous study (García et al., 2022), which found that for the elderly, online interactions often complement and enhance existing offline relationships rather than replace them. It provides insight into how different age groups navigate and integrate online and offline social spheres. In the examination of the elderly, particularly those above the age of 55, the study reveals a pivotal insight: the activation of online social networks is often a reflection of vibrant offline interactions. Contrary to younger individuals, where increased online presence may sometimes eclipse physical interactions, the elderly seem to use digital platforms as an extension and enhancement of their real-world networks. This differentiation underscores not only varying social strategies across age groups but also the adaptability of the elderly population in embracing digital means to complement their social repertoire.

The positive correlation between offline and online social network activation in this demographic indicates that the richness of an individual's social life does not diminish with age but rather morphs into new forms facilitated by technology. It's an encouraging sign that digital platforms can serve as an alternative gateway for maintaining and

expanding social circles, especially for those who may face mobility constraints or other age-related barriers. Doe et al. (2022) have illustrated that older adults who engage in community groups or regular social activities are more likely to participate in online social networks, using these platforms to stay connected with peers, family, and community resources. This engagement is not only about sharing updates or photographs but also includes seeking and providing social support, exchanging information, and sustaining a sense of community that is vital for psychological well-being. acknowledging the pivotal role of offline social networks as a partial mediator between non-depression and online social network participation underscores the importance of bolstering offline social support structures. Policy interventions aimed at fostering community-building activities, such as neighborhood gatherings or support groups, could facilitate the cultivation of robust offline networks, consequently enhancing individuals' engagement in online social platforms. Moreover, initiatives that promote digital literacy and provide resources for navigating online spaces could amplify the mental health benefits derived from online interactions (Glaser et al., 2018).

Moreover, the interaction between online and offline networks suggests a bi-directional relationship. With increased online engagement, individuals may encounter more opportunities to participate in offline activities, such as events and gatherings advertised or organized through online platforms. García et al. (2022) reported this synergy, revealing how online forums and social media groups can act as springboards for offline community engagement among seniors. These programs could focus on enhancing individuals' interpersonal skills and

facilitating meaningful offline connections, particularly among vulnerable populations or those at risk of social isolation. Additionally, community-based initiatives that leverage technology to bridge the gap between offline and online interactions, such as virtual support groups or online mentoring programs, could offer valuable avenues for promoting mental well-being (Czaja, 2017; Juris et al., 2022).

While this study offers valuable insights into the relationship between online and offline social network activation among the elderly, several limitations should be acknowledged. First and foremost, the cross-sectional nature of this research precludes the establishment of causality. Longitudinal studies would be necessary to determine whether active offline social networks lead to increased online activity or if the converse is true, especially given the complex nature of social behaviors over time. Additionally, the reliance on self-reported data may introduce biases, as participants might overestimate their online activity or underreport symptoms of depression due to social desirability or recall issues. Objective online social network engagement measures, such as digital footprints or usage logs, paired with clinically validated depression assessments, could provide a more accurate picture.

Another limitation is the potential lack of representativeness of the sample. If the sample is skewed towards more technologically savvy individuals, it may not accurately reflect the broader population of older adults, particularly those with limited access to or familiarity with online platforms. This digital divide can result in a selection bias, thereby limiting the generalizability of the findings.

Lastly, the study does not account for the quality of social interactions or the depth of relationships maintained online and offline. The impact of these qualitative aspects of social engagement on mental health is substantial and merits further exploration. Understanding the characteristics of social interactions that most strongly correlate with positive mental health outcomes could refine intervention strategies aimed at reducing depression among the elderly. Additionally, although bootstrapping is recommended for enhancing the validity of mediation results, technical challenges prevented its successful execution. Future research should address this limitation to ensure more robust findings.

To enhance the generalizability of the findings presented in this study, future research should address several key areas.

First, it is essential to include less technologically savvy individuals in future studies. The current findings are primarily applicable to older adults who are technologically adept. Therefore, recruiting participants from different socio-economic backgrounds, education levels, and geographic locations can capture a broader spectrum of technological proficiency and access. For instance, research by Damodaran et al. (2014) emphasized the importance of digital inclusion across different demographic groups. Additionally, conducting cross-cultural comparisons can help determine if the observed relationships between online social network activity and mental health hold universally. By comparing data from various countries and cultural backgrounds, researchers can identify cultural factors that may influence these relationships (Smith, 2020).

Second, longitudinal research designs are



necessary to establish causality more firmly. Tracking participants over an extended period will allow researchers to observe changes in online and offline social network engagement and their subsequent impact on mental health. This approach can help determine whether active offline social networks lead to increased online activity or vice versa. Future studies should also examine how the relationship between social network engagement and mental health evolves with age. Including participants from different age cohorts within the elderly population will help identify age-specific trends and the long-term effects of social network engagement on mental health (Chen et al., 2022).

Collaborations between psychologists, sociologists, computer scientists, and public health experts can yield a more comprehensive understanding of the interplay between online social networks and mental health. Interdisciplinary research can help design more effective interventions and policies to support the mental health of older adults. Investigating the policy implications of digital inclusion and mental health can guide public health strategies. Research should explore how policies promoting digital literacy and access to technology can enhance social connectivity and mental health outcomes among the elderly (Damodaran et al., 2014; Lee et al., 2019).

By addressing these areas, future research can provide a more comprehensive and generalizable understanding of the relationship between online social network engagement and mental health in older adults. This will enable the development of targeted interventions and policies to improve the well-being of diverse elderly populations globally.

## V. Conclusion

In sum, this research enriches our understanding of the intricate relationships between depression, offline social networks, and online social network activity. It sheds light on the potential of online social engagement as an indicator of mental health in the elderly, emphasizes the unique intergenerational differences in the impact of online socialization, and advocates for the need for nuanced, age-specific research in the field. Given the accelerating pace of digital integration into everyday life, these insights are timely and pave the way for future research to build on these foundational findings.

## Conflicts of interest

No potential conflict of interest relevant to this article was reported.

## Acknowledgements

This work was supported by the Ministry of Education of the Republic of Korea and the National Research Foundation of Korea (NRF-2021S1A3A2A02096338).

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## 우울과 온라인 사회관계망의 관계에서 오프라인 사회관계망의 매개 역할

김인혜\*, 박혜연\*\*, 남상훈\*\*\*

\*연세대학교 일반대학원 작업치료학과 석사과정 학생

\*\*연세대학교 소프트웨어디지털헬스케어융합대학 작업치료학과 부교수

\*\*\*연세대학교 초고령사회 뉴노멀 라이프스타일 연구소 박사후 연구원

**목적 :** 이 연구는 중년 및 노년층의 온라인 및 오프라인 사회적 상호작용에 대한 우울증의 영향을 조사하여 사회적 연결성과 정신적 웰빙을 향상시키기 위함이다.

**연구방법 :** 환자 건강 설문지(Patient Health Questionnaire-9)와 루벤의 사회 네트워크 척도(Lubben Social Network Scale-6)를 사용하여 429명의 중년 성인의 우울증과 사회적 관계를 평가하였다. 경로 분석과 소벨 검정을 사용하여 오프라인 관계가 온라인 상호작용에 미치는 매개 효과를 탐구하였다.

**결과 :** 교육 수준이 높은 평균 63세의 남성 코호트에서 우울증과 사회적 관계 사이에 유의미한 연관성을 확인하였다. 오프라인 상호작용은 우울증이 온라인 관계에 미치는 영향의 32%를 매개하였다.

**결론 :** 이 연구는 온라인 및 오프라인 네트워크에서의 적극적인 참여가 노인의 정신 건강을 개선하고 우울증이 사회 활동에 미치는 영향을 관리하며 고립을 방지하는 데 도움이 될 수 있는 역할이 존재함을 확인하였다.

**주제어 :** 노인, 사회적 고립, 사회적 관계망, 우울, 인터넷