

Short-Form Video Applications Usage and Functionally Dependent Adults' Depressive Symptoms: A Cross-Sectional Study Based on a National Survey

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Objective: This study constructed a theoretical model based on the social compensation theory and used it to investigate the effects of short-form video applications usage on depressive symptoms among functionally dependent adults.

Methods: An empirical analysis was conducted based on a national sample of 8752 adults aged 45+ from China Family Panel Studies (CFPS) wave 2020. This study examined the effects of short-form video applications usage on depressive symptoms in functionally dependent adults by constructing linear regression models. Further, the mediating effect of interpersonal relationship, and the moderating effect of video games were then sequentially analyzed with the help of macro PROCESS4.0 tool.

Results: Results showed that: (1) short-form video applications usage significantly reduced the level of depressive symptoms among functionally dependent adults; (2) interpersonal relationship exerted a mediating effect of 10.36% in the process of short-form video applications usage reducing the level of depressive symptoms among functionally dependent adults; (3) video games attenuated the healing effect of short-form video applications usage on the level of depressive symptoms in functionally dependent adults, but not significantly in the functionally dependent adults aged 60+.

Conclusion: New electronic media, represented by short-form video applications, have the potential to intervene in the mental health of functionally dependent adults. Social policymakers should consider adopting relevant e-healing measures to enhance the well-being of vulnerable groups.

Keywords: short-form video applications usage, functionally dependent adults, depressive symptoms, interpersonal relationship, video games

Introduction

Functional dependency has been defined as the extent to which a person is limited in performing activities of daily living such as walking up and down stairs, dressing and undressing, or walking.¹ Although the incidence of functional disability has been declining in recent years, the rapid aging of the population has also led to a significant increase in the total number of functionally dependent people with care needs in the future.² The results of the Fourth China Urban and Rural Sample Survey on Living Conditions of the Elderly show that in 2015, the number of functionally disabled and partially functional elderly in China reached 40.63 million, accounting for 18.3% of the elderly population.³ Meanwhile, the total functional disabled population in China is expected to grow to 136.24 million to 136.74 million by 2030.⁴ Notably, somatic factors such as functional dependency and limited physical activity have been conceptualized as a chronic stressor,⁵ which disrupts an individual's ability to interact with the physical and social environment, and thus is often comorbid with depression. Multiple findings underscore the reciprocal relationship between onset of functional disability and depressive symptoms.^{6–8} However, the majority of functionally dependent adults do not receive effective treatment

for mental disorders due to a lack of healthcare resources and the stigma associated with functional dependency.^{9,10} Given substantial social and health ramifications, reducing depressive symptoms in functionally dependent adults remain an urgent public health issue.

Recently, the short-form video applications have been gradually gaining popularity worldwide, providing an alternative means of reaching out to society and promoting access to healthcare, particularly among populations with functional dependency.¹¹ As of December 2023, the number of short-form video applications users in China reached 1.053 billion, accounting for 96.4% of the total number of Internet users, an increase of 41.45 million from December 2022.¹² In contrast to traditional social media, short-form video applications feature powerful push algorithms, accessibility, personalization and are more entertaining,¹³ offering a unique portal for people with functional dependency to disclose themselves, including the challenges and accessibility barriers they encounter.¹⁴ The present studies have shown that depression prevention interventions based on short-form video applications are more standardized and cost-effective than face-to-face interventions. A cluster randomized controlled trial supported that short-form video applications-based mental health interventions showed more reduction in depressive symptoms compared to usual school provision at 6 months.¹⁵ In addition, using digital apps for physical activity (eg, TikTok, YouTube) has shown to be a promising approach to mitigate the burden of depressive symptoms aggravated by the pandemic worldwide.^{16,17} Albeit important, recent studies also questioned the beneficial role of short-form video applications usage on the grounds of negative relationship with psychological well-being. For example, Perlis and his colleagues discovered that over 5000 adults with no or minimal depressive symptoms on preliminary survey who reported the use of short-form video applications were more likely to report elevated levels of depressive symptoms on a later survey.¹⁸ Some scholars further pointed out that the high duration of short-form video applications usage could contribute to short-form video addiction,¹⁹ which in turn had further increased the risk of depression and anxiety.²⁰

While such empirical evidence has been accumulating in the general adolescents, college students and older adult population, scarce attention has been given to the potential significance of short-form video applications usage in ameliorating the effects on depression of the specific type of stress brought about by functional dependency. Given the widespread utilization and unique features of short-form video applications, developing targeted digital interventions calls for an enhanced understanding of the use of short-form video applications in this vulnerable subgroup of functionally dependent adults. To bridge the knowledge gap, it is necessary to explore the impact of a short-form video applications-based mental health intervention on depressive symptoms in Chinese functionally dependent adults and provide a reference for the accurate prevention and intervention of related psychological problems.

Hypothesis Development

Short-Form Video Applications Usage and Depressive Symptoms

Findings from five longitudinal cohort studies indicated that if older adults are excluded from the Internet, regardless of living in high-income or lower-middle-income countries, they will face a higher risk of functional dependency and depression.²¹ While researchers of Internet use have been producing a good deal of studies regarding different aspects of online behavior and psychosocial health outcomes, studies focusing on people with functional dependency have just started to emerge. For example, diverse online activities can potentially alleviate the depression symptoms of middle-aged and older adults with functional disability, with options including chatting, watching news and videos.^{22,23} In addition, a hybrid study explored the experiences of functionally dependent adults regarding online health communities and found that higher levels of intensity of online community use predicted lower levels of depressive symptoms.²⁴ Specifically, participants explained that the online community provided a unique space to connect with others who had gone through similar experiences and to share their stories with a wider audience, and that this connection helped to reduce depressive symptoms. This speculation can be observed in similar short-form video applications usage research. For example, Li et al found that autobiographical accounts on short-form video applications platforms play an important role in dispelling the illness-related stigma for people living with depression.²⁵ Based on this, the study hypothesized that the use of short-form video applications is an effective way to reduce depressive symptoms in functionally dependent adults, and the following hypothesis was proposed:

H1: The short-form video applications usage has a negative effect on depressive symptoms among functionally dependent adults.

The Mediating Role of Interpersonal Relationship

The interpersonal theory of depression emphasizes the important role of interpersonal relationships in an individual's psychological development,²⁶ and that high-quality interpersonal relationships can be an effective buffer against the negative impact of physical health conditions on mental health.²⁷ However, functionally dependent adults are limited in mobility or movement in daily life and therefore lack opportunities for offline interactions with others, which prevents them from engaging in social relationships and fulfilling social roles. Indeed, studies have shown that disabled elderly with poor physical functioning experience restriction of social activities,²⁸ objective social isolation from friends and family²⁹ and withdrawal from social connections.³⁰ According to the social compensation theory, people who have difficulties in offline face-to-face interactions will compensate for offline deficits through online means.³¹

As mentioned earlier, scholars have found that individuals with low self-esteem, loneliness, and social isolation are more inclined to seek relational support through media channels when they experience difficulties in real life.³² Obviously, new technologies have been regarded as the portal to social experiences outside of individual's space and home. Short-form video applications, as a space where social scripts and relationship expectations are negotiated, help to make up for the lack of social resources people have in the offline world. Especially in terms of effects, emerging studies on short-form video applications usage experiences have consistently reported that short-form video applications platforms enhanced interpersonal relationships through shared videos and also having common things to discuss within relationships.^{33–35} In addition, according to the parasocial interaction theory, users easily develop an affective proximity to the content creator or the media figures in the short videos, and as a result, develop a kind of parasocial relationships.³⁶ As a result, short-form video applications usage can fulfill a variety of social needs, including establishing new friendships and romantic relationships,³⁵ demonstrating intergenerational relationships³⁷ and creating virtual intimacy with the people they follow.³⁸ Extending this line of research, we proposed the following hypothesis:

H2: The short-form video applications usage is positively associated with the interpersonal relationships in functionally dependent adults.

Supportive interpersonal relationships are associated with a lower risk of depression. Multiple studies have demonstrated the lasting effects of high-quality peer relationships on depressive symptoms in adults, such that higher levels of neighborhood quality and peer relationships in childhood significantly reduce their depressive symptoms in mid- and late-life.^{39,40} Research on bisexual stigma further shown that depressive symptoms associated with minority stress can be mitigated by social support from parents and friends.⁴¹ Among the individuals aging with functional disabilities, Jensen and his collaborators found that levels of perceived friend support were negatively associated with depression symptoms.⁴² Yang also observed that the perceived social support, especially from intimate relationships and satisfaction with the amount or quality of support, buffered the effects of disability on increments in depressive symptoms in late life.⁴³ In sum, interpersonal relationship may be an important mediator of the alleviating effect of short-form video applications usage on depressive symptoms. Based on this, the following hypotheses were posited:

H3: The higher-quality interpersonal relationships can potentially alleviate the depression symptoms among functionally dependent adults.

H4: Interpersonal relationships mediate the relationship between short-form video applications usage and depressive symptoms in functionally dependent adults.

The Moderating Role of Video Games

Video games are a game where the user interacts with a video device and generates visual and auditory feedback.⁴⁴ The social interactivity and entertainment of video games create a more immersive experience were the primary factors for users' continued play frequency and extended duration.⁴⁵ Burgeoning scholarly attention devoted to uncover the negative

relationships between the higher-frequency video game usage and depressive symptoms.⁴⁶ For example, clinically depressed patients who were experimentally exposed to playing action video games showed a more pronounced reduction in depressive symptoms.⁴⁷ Low or moderate video games players have lower rates of depressed mood than non-gamers.^{48,49}

However, time spent on screen activities, especially through playing video games, is functionally similar to brushing short-form video applications. According to the time displacement hypothesis, increasing video games use most likely detracts from time spent on other media activities, which in turn lead to a decline in functioning in non-gaming areas of life.^{50,51} At the same time, gamers gain a strong sense of immersion when they enter the flow state, leading to longer access times and suppressed attention to external stimuli.^{52,53} A longitudinal study of German adolescents has important implications for this argument: social media use is strongly correlated with TV use, and TV use is more strongly correlated with negative outcomes than social media use. When all effects were estimated in the same model, changes in TV use were associated with changes in depressive symptoms.⁵⁴ Similarly, we hypothesized that those who engaged in higher levels of video games would need to allocate individual attentional resources more efficiently to the gaming experience, which in turn attenuates the effect of short-form video usage on depressive symptoms, whereas users who played fewer video games were more susceptible to the effects of short video use. Taken together, video games exposure may interact with short-form video applications usage to predict depression-related outcomes. Hence, we formulated the following hypothesis:

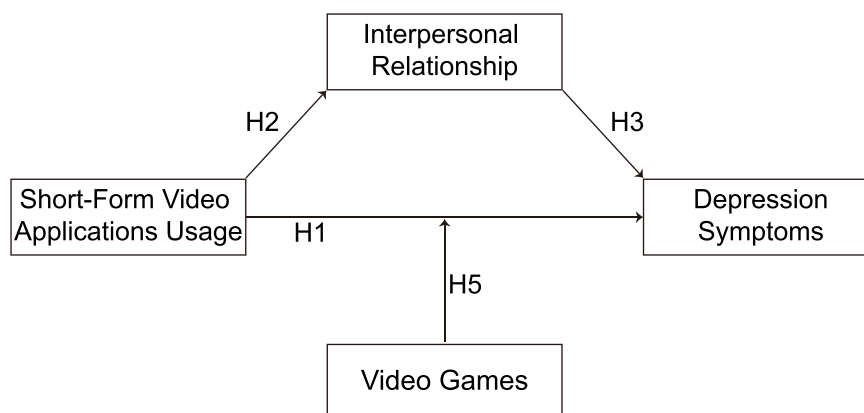
H5: Video games play a moderating role in the relationship between short-form video applications usage and depression symptoms in functionally dependent adults.

Thus, in light of prior literature on short-form video applications usage, interpersonal relationship, video games, depression symptoms and the model of social compensation theory, we proposed the research model (see the Figure 1).

Methods

Data and Participants

This study used data from the China Family Panel Studies (CFPS), a nationwide, large-scale, multidisciplinary social tracking survey conducted by the China Social Science Survey Center at Peking University. It covered 25 provinces/municipalities/autonomous regions in China, accounting for 95% of the Chinese population, with a target sample size of 16,000 households, including all members of the sample households; it was a multi-stage probability sample extracted using implicit stratification. Up to now, CFPS had completed and publicized seven waves of national-level survey data,



H4: Interpersonal relationships mediate the relationship between short-form video applications usage and depressive symptoms in functionally dependent adults.

Figure 1 Proposed research model.

providing the basis for academic research and public policy analysis. Because only the CFPS 2020 wave questionnaire measures two important variables, short-form video applications usage and video games, only the CFPS 2020 wave sample was used in this study.

Functional dependency was defined as an individual's inability to perform the activities of daily living (ADL). On the basis of the previous studies,^{55,56} we screened the functionally dependent samples based on the 7-item activity of daily living scale in CFPS 2020 wave, which incorporated items of the physical activities of daily living and instrumental activities of daily living. The 7-item activity of daily living describe the ability to live independently, such as independent outdoor activities, independent eating, independent kitchen activities, independent use of public transportation, independent shopping, independent cleaning and hygiene and independent laundry. Functional dependency in any items of the physical and instrumental activities of daily living was recorded as "no difficulty" versus "with difficulty". This study defined the sample as mildly functionally dependent adults who were unable to perform more than one activity independently, and otherwise as adults who could care for themselves in a basic way. Of the total sample of 28,530 in CFPS 2020, the activity of daily living was measured only for the sample aged 45 and older, or 9091 samples. Then, missing sample data for short-form video applications usage and video games were removed, resulting in 8752 samples being retained. Among them, 4306 (49.20%) were female samples and 4446 (50.80%) were male samples.

Measures

Depressive Symptoms

In the CFPS 2020 wave dataset, depressive symptoms were measured using a simplified version of the Center for Epidemiologic Studies' CES-D 8-item self-report scale, which has been endorsed in several studies.^{57,58} The scale measures the respondent's behavior or feelings over the last week through 8 items, specifically (1) I feel depressed, (2) I find it hard to do anything, (3) I do not sleep well, (4) I feel happy, (5) I feel lonely, (6) I live a happy life, (7) I feel sad and upset, and (8) I do not feel able to go on with my life. Then, after adjusting for the reverse question items, a four-point scale was coded, as follows: hardly ever (less than a day) coded as 1; some of the time (1–2 days) coded as 2; often (3–4 days) coded as 3; and most of the time (5–7 days) coded as 4, and the final total was obtained as a depressive symptom index ranging from 8 to 32, with a larger score indicating a higher level of depression. Cronbach's alpha is 0.779.

Short-Form Video Applications Usage

Respondents' use of short-form videos applications was measured in the CFPS 2020 wave dataset using two items, ie, (1) In the past week, have you watched short-form videos (TikTok, KuaiShou, Small Volcano, Weishi, Douyu, etc.) or live streaming network platform programs? (2) In the past week, have you watched short-form videos or live streaming network platform programs (TikTok, KuaiShou, Small Volcano, Weishi, Douyu, etc.) almost every day? Based on these two question items, this study coded never watching short-form videos as 1, watching but not every day as 2, and watching short-form video every day as 3, which were used to measure respondents' short-form video applications usage, with larger values indicating higher intensity of short-form video applications usage.

Interpersonal Relationship

In the CFPS 2020 wave dataset, respondents' self-rated interpersonal relationships were measured using a single question item as follows: if a score of 0 represents the lowest and a score of 10 represents the highest, how good do you perceive your interpersonal relationships to be? The higher the value, the better the respondent's perceived interpersonal relationships.

Video Games

Respondents' video game usage was measured in the CFPS 2020 wave dataset using two items, namely: (1) In the past week, have you played video games (including handheld games such as Honor of Kings, etc.; online games played on computers such as World of Warcraft, Tianlong Baibe, etc.; and other mini-games such as Dou Di Zhu (Landlord), Kaixin Farm, QQ Games, etc.)? (2) Did you play video games almost every day in the past week? Based on these two question items, this study coded never playing video games as 1, playing video games but not every day as 2, and playing online games every day as 3. This was used to measure the respondents' video games usage, with larger values indicating more video games played.

Control Variables

This study selected control variables from four aspects: demographic characteristics, residential characteristics, income status, and health status. (1) Personal characteristics (gender, age, marital status, years of education): gender is categorized as female and male; age and years of education are self-reported continuous data from the respondents; and marital status includes married and other (unmarried, single, widowed, etc.) (2) Residence characteristics (residence, location of China): residence is categorized as rural and urban; location of China includes northeast China, western China, central China, and eastern China. (3) Income status (annual personal income): annual total income is a continuous type of data self-reported by the respondents in 100,000RMB. (4) Health status (self-assessed health status): Self-assessed health status was measured by a five-point Likert scale and self-reported by respondents.

Statistical Analysis

This study first used SPSS26 software to analyze the descriptive statistics of the overall sample, and then the *T* test and χ^2 test examined whether there was a significant difference in depressive symptoms between the 45–59 years old sample and the 60 years old and above sample, and whether other characteristics were specifically significantly different between the two groups (Table 1). Then, OLS models were constructed to test the effects of short-form video applications usage on depressive symptoms in the overall sample, middle-aged sample, and elderly sample, respectively (Table 2), and endogeneity analysis was also conducted. Third, this study conducted mediation effects test (Table 3) for Model 4 with the help of the macro PROCESS4.0 tool and calculated the total, direct, and indirect effects of the mediation model using the self-help method (Table 4). Finally, Model 1 examined the moderated effects with the help of the macro PROCESS4.0 tool (Table 5).

Table 1 Descriptive Statistics of All Variables (N=8752)

Variable	Type of Statistics	Total Sample (n = 8752)	Aged 45–59 (n = 5134)	Aged 60+ (n = 3618)	T test / χ^2 Test
Depressive symptoms	Mean (SD)	13.65 (4.35)	13.74 (4.28)	13.51 (4.44)	2.44**
Short-form video applications usage	Mean (SD)	1.52 (0.83)	1.72 (0.90)	1.23 (0.61)	28.56***
Interpersonal relationship	Mean (SD)	7.24 (1.99)	7.12 (1.96)	7.41 (2.03)	−6.72***
Video games	Mean (SD)	1.07 (0.33)	1.09 (0.37)	1.04 (0.27)	6.11***
Gender					2.73
Female	n (%)	4306 (49.20%)	2564 (49.94%)	1742 (48.15%)	
Male	n (%)	4446 (50.80%)	2570 (50.06%)	1876 (51.85%)	
Age		58.60 (9.25)	51.97 (4.07)	68.01 (5.70)	0.02***
Marriage status					0.31
Married	n (%)	8641 (98.73%)	5066 (98.68%)	3575 (98.81%)	
Others	n (%)	111 (1.27%)	68 (1.32%)	43 (1.19%)	
Years of education	Mean (SD)	0.09 (0.99)	0.12 (1.15)	0.05 (0.71)	3.38***
Residence					4.00*
Rural	n (%)	4670 (53.36%)	2779 (54.13%)	1891 (52.27%)	
Urban	n (%)	4082 (46.64%)	2355 (45.87%)	1727 (47.73%)	
Annual income (100,000 RMB)	Mean (SD)	0.11 (0.26)	0.17 (0.30)	0.03 (0.13)	26.32***
Self-assessed health status	Mean (SD)	2.82 (1.24)	2.92 (1.23)	2.68 (1.25)	8.94***
Location of China					71.71***
Northeast China	n (%)	1095 (12.51%)	606 (11.80%)	489 (13.52%)	
Western China	n (%)	2599 (29.70%)	1683 (32.78%)	916 (25.32%)	
Central China	n (%)	2182 (24.93%)	1294 (25.20%)	888 (24.54%)	
Eastern China	n (%)	2876 (32.86%)	1551 (30.21%)	1325 (36.62%)	

Note: Robust standard errors in parentheses; *** $p < 0.001$, ** $p < 0.01$, * $p < 0.5$.

Table 2 Regression Results of Short-Form Video Applications Usage Affect Depressive Symptoms

Variables	Full Sample	Middle-aged Sample (Aged 45–59)	Elderly Sample (Aged 60+)
Short-form video applications usage	–0.217*** (0.054)	–0.193** (0.063)	–0.308** (0.107)
Gender (ref: female)	–0.867*** (0.090)	–0.586*** (0.117)	–1.215*** (0.140)
Age	–0.029*** (0.005)	–0.025 (0.014)	–0.010 (0.012)
Marriage status (ref: married)	2.613*** (0.423)	2.689*** (0.560)	2.434*** (0.635)
Years of education	–0.022 (0.039)	–0.001 (0.043)	–0.108 (0.088)
Residence (ref: rural)	–0.838*** (0.089)	–0.607*** (0.115)	–1.120*** (0.142)
Annual income	–0.462** (0.148)	–0.689*** (0.162)	–0.374 (0.435)
Self-assessed health status	–0.992*** (0.038)	–1.000*** (0.049)	–0.978*** (0.059)
Location of China (ref: western China)			
Northeast China	–0.657*** (0.151)	–0.556** (0.195)	–0.791*** (0.240)
Central China	–0.625*** (0.122)	–0.633*** (0.152)	–0.641** (0.203)
Eastern China	–1.013*** (0.112)	–0.893*** (0.142)	–1.138*** (0.181)
Constant	19.883*** (0.366)	19.470*** (0.770)	19.043*** (0.894)
Observations	8752	5134	3618
R-squared	0.132	0.126	0.145
F	113.80***	63.17***	53.97***

Note: Robust standard errors in parentheses; ***p<0.001, **p<0.01.

Table 3 Results of Mediating Effects Analysis

Outcome Variable	Predictive Variable	R ²	F	β	Standard Errors	LLCI	ULCI
Equation1 Interpersonal relationship	Short-form video applications usage	0.028	22.756***	0.102***	0.027	0.048	0.156
Equation2 Depressive symptoms	Short-form video applications usage	0.142	120.258***	–0.195***	0.056	–0.305	–0.085
	Interpersonal relationship			–0.221***	0.022	–0.264	–0.178
Equation3 Depressive symptoms	Short-form video applications usage	0.132	121.011***	–0.217***	0.056	–0.328	–0.107

Note: Control variables include gender (ref: female), age, marriage status (ref: married), years of education, residence (ref: rural), annual income, self-assessed health status, location of China (ref: western China). Standard errors in parentheses; ***p<0.001; number of bootstrap samples for percentile bootstrap confidence intervals is 5000.

Results

Descriptive Statistics of All Variables

Table 1 reports the statistical description of the overall sample. The overall sample was 8752 of which 4446 (50.80%) were males and 4306 (49.20%) were females. The overall sample mean for depressive symptoms was 13.65 ± 4.35 , and the age group aged 45–59 (13.74 ± 4.28) scored higher than the age group aged 60+ (13.51 ± 4.44). Three variables, short-

Table 4 Total Effect, Direct Effect and Indirect Effect of the Mediation Effect Model

	Effect	Boot SE	Boot LLCI	Boot ULCI	Ratio of Indirect to Total Effect	Ratio of Indirect to Direct Effect
Total effect	−0.217***	0.056	−0.328	−0.107	–	–
Direct effect	−0.195***	0.056	−0.305	−0.085	–	–
Total indirect effect	−0.022**	0.006	−0.035	−0.011	10.36%	11.56%

Note: *** $p < 0.001$, ** $p < 0.01$. Boot SE, Boot LLCI and Boot ULCL is estimated standard error under bias-corrected percentile bootstrap method, and 95% confidence interval lower and 95% confidence interval upper, and Boot LLCI and Boot ULCL do not overlap with zero, number of bootstrap samples for percentile bootstrap confidence intervals is 5000.

Table 5 Results of Moderating Effects Analysis

Variables	Full Sample	Middle-aged Sample	Elderly Sample
Short-form video applications usage	−0.210*** (0.057)	−0.187** (0.065)	−0.300* (0.121)
Video games	−0.563** (0.185)	−0.593** (0.217)	−0.532 (0.348)
Short-form video applications usage × Video games	0.476** (0.156)	0.482** (0.182)	0.480 (0.299)
Control variables	Yes	Yes	Yes
R-squared	0.133	0.128	0.146
F	103.351***	57.588***	47.458***

Note: Control variables include gender (ref: female), age, marriage status (ref: married), years of education, residence (ref: rural), annual income, self-assessed health status, location of China (ref: western China). Standard errors in parentheses; *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$; number of bootstrap samples for percentile bootstrap confidence intervals is 5000.

form video applications usage, interpersonal relationship and video games, show similar characteristics, indicating that the middle-aged group is significantly different from the elderly group. In terms of age distribution, the mean age of the overall sample was 58.60 years, with 5134 samples in aged 45–59 and 3618 samples in aged 60+. The results of t -test and χ^2 test showed that the samples of aged 45–59 age group and aged 60+ age group showed significant differences in statistically significant differences in the variables of depressive symptoms, short-form video applications usage, interpersonal relationship and video games, and in the variables of age, years of education, residence, annual income, self-assessed health status, and location of China, which are the control variables.

Global and Subsample Regression Analysis Results

Table 2 reports the OLS regression results for short-form video applications usage affecting depressive symptoms. The results show that short-form video applications usage significantly and negatively affects depressive symptoms among functionally dependent adults in the full sample, middle-aged sample, and elderly sample. That is, short-form video applications usage among functionally dependent adults significantly reduced depressive symptoms in the full sample (-0.217 , $p < 0.001$), middle-aged sample (-0.193 , $p < 0.01$), and elderly sample (-0.308 , $p < 0.01$). Therefore, H1 was fully supported. In addition, to further exclude the effect of confounding factors, this study conducted endogeneity analysis and Hausman test, which showed that the current results were not affected by confounding factors, ie, all explanatory variables in the model were exogenous.

The Mediating Effect of Interpersonal Relationship

Table 3 reports the empirical testing process and results for interpersonal relationship. Specifically, the test for mediating effects was conducted in a total of three steps with the help of model 4 using PROCESS 4.0. In Step 1, short-form video applications usage significantly and positively affects the interpersonal relationship ($\beta = 0.102$, $p < 0.001$); in Step 2, short-form video applications usage ($\beta = -0.195$, $p < 0.001$) and interpersonal relationship ($\beta = -0.221$, $p < 0.001$) significantly

negatively affected depressive symptoms; in Step 3, short-form video applications usage significantly negatively affected depressive symptoms ($\beta = -0.217$, $p < 0.001$), suggesting that the interpersonal relationship partially mediated the negative relationship between short-form video applications usage and depressive symptoms, supporting H2, H3 and H4.

After testing Hypothesis 2.3 and 4, this study also calculated the total effect, direct effect and indirect effect of the mediation model. Table 4 shows that in the mediation model of short-form video applications usage \rightarrow interpersonal relationship \rightarrow depressive symptoms, short-form video applications usage affects depressive symptoms by including both direct effect and indirect effect components, ie, the total indirect effect (-0.022) accounts for the total effect (-0.217) to a proportion of 10.36%, and the proportion of direct effect (-0.195) reached 11.56%, but still weaker than the direct effect. In addition, the above tests for total effect, direct effect and indirect effect are all statistically significant with 95% confidence intervals that do not overlap with zero.

The Moderating Effect of Video Games

This section will test whether video games can intervene in the relationship between short-form video applications usage and depressive symptoms. During the empirical testing process, the independent and moderator variables were centered in order to exclude the effect of potential multicollinearity, and then the moderated effects test was implemented with the help of model 1 of PROCESS4.0 tool. Detailed results are reported in Table 5, where the interaction terms of short-form video applications usage and video games had a significant effect on depressive symptoms in both the full sample ($\beta = 0.476$, $p < 0.01$) and the middle-aged sample ($\beta = 0.482$, $p < 0.01$) had a positive effect in both, but no significant effect in the elderly sample. It indicates that video games weakened the alleviating effect of short-form video applications usage on depressive symptoms in both full sample and middle-aged sample. That is, among respondents who played few video games, the relationship between the negative effect of short-form video applications usage on depressive symptoms was stronger; among respondents who played more video games, the relationship between the negative effect of short-form video applications usage had a weaker negative effect relationship on depressive symptoms. Overall, Hypothesis 5 was partially supported.

Discussion

Based on the extension of social compensation theory and the time displacement hypothesis, this study explored the potential mechanisms for explaining the association between short-form video applications usage and depressive symptoms in functionally dependent adults. It was found that short-form video applications usage could reduce the risk of depressive symptoms in functionally dependent adults, in which interpersonal relationships played a 10.36% mediating effect in the negative relationship between short-form video applications usage and depressive symptoms, and video games weakened the negative relationship between short-form video applications usage and depression symptoms.

First, our findings revealed the digital “healing” value of short-form video applications usage in functional dependent adults. Such a “healing” phenomenon during short-form video applications usage is inconsistent with previous studies.^{6,59,60} For example, Perlis et al discovered that there is an association between short-form video applications usage and worsening depressive symptoms in adults.¹⁸ In contrast, this study of functionally dependent adults in China found that short-form video applications usage led to higher levels of self-rated mental health. This result echoes “the disability paradox”,⁶¹ which states that the majority of older adults maintain a subjective sense of well-being despite functional decline, far exceeding the judgments made by nondisabled adults based on stereotype and stigma.^{62,63} One possible explanation is that we should be aware of subpopulations of adults when it comes to short-form video applications usage. Compared with healthy adults, the functionally dependent adults may have fewer problems with short-form video applications overuse and addiction. This may be one of the reasons for the inconsistencies observed in previous studies. This is not difficult to understand because for functionally dependent adults, short video applications may be the best, and sometimes the only, option for accessing daily information resources.²⁴ This further suggests that short-form video applications usage among functionally dependent adults in China is not a source of negative emotions, and early digital technology interventions of short-form video applications usage should be considered as a possible effective strategy for preventing mental health problems among functionally dependent adults.

Second, interpersonal relationships could be an effective buffer between short-form video applications usage and depressive symptoms. For functionally dependent adults in need of long-term care, the availability and quality of interpersonal relationships

are of great significance. The use of short-form video applications may help these functionally dependent adults increase social support in interpersonal relationships, thereby reducing depressive symptoms. This result is consistent with previous findings, Allen et al revealed that network size and confidant support provide emotional reassurance and have been shown to ease distress and ameliorate depressive symptoms among persons with disability.⁶⁴ Our finding highlights the relative importance of interpersonal relationship in reducing the depression symptoms associated with functional declines. This confirms the findings of the social compensation theory that social media can help functional dependent adults expand interpersonal communication to gain more social recognition and inclusion, so as to obtain emotional and emotional satisfaction and compensation. Further, our finding mirrors the poor-get-richer effect applied to social media research, which proposed that lonely individuals who interact in a “public Facebook” setting could benefit from using “Facebook” in this way.⁶⁵

Furthermore, functionally dependent adults’ high time investment in video games lead to a lower time investment in their short-form video applications usage, resulting in negative relationship outcomes. This association suggested that video games attenuated the negative relationship between short-form video applications usage and depressive symptoms. On the one hand, our findings found that the use of short-form video applications was able to reduce depressive symptoms, but at the same time frequent video games playing may have weakened this effect. In other words, the short-form video applications-based mental health intervention showed potential to reduce depressive symptoms among Chinese functionally dependent adults, and the effects were more significant if the minimum video games playing frequency was reached. Therefore, a hypothesis that may account for our findings is that if short-form video applications time displaced video games time, it would yield a net benefit for them. This finding adds new evidence to the time displacement hypothesis, which states that an individual’s high time investment in leisure activities leads to a lower time investment in their shared leisure activities, resulting in negative relationship outcomes.⁶⁶ These observations would further suggest that, in reducing risks of depression, we should notice that the contextualized and differentiated uses of video games in terms of both users and screen time activities.

It is worth noting that, unlike the overall sample and the middle-aged sample, the attenuating effect of video games was not maintained in the functionally dependent adults aged 60+. More specifically, in this study, video games may diminish the efficacy of short-form video applications use on depressive symptoms in full and middle-aged samples of functionally dependent adults. However, there was no facilitating or inhibiting effect on functionally dependent older adults. It can be stated that the lack of homogeneity of the functionally dependent adults related to age may have contributed to accentuate the differences between the age groups. It seems reasonable that there are generational differences in attitudes toward video games.⁶⁷ This generational difference stems from the availability of video games and negative beliefs. On the one hand, based on the theory of limited resources,⁶⁸ attention is a finite shared resource and any behavior reallocates total limited resources from competing behaviors.⁶⁹ During a fixed leisure period, short-form video applications users have a higher likelihood of reducing extraneous cognitive load compared to users who play video games or watch long videos.⁷⁰ Functionally dependent older adults may have difficulty dealing with games that require making quick reaction times, thus limiting the amount and duration of possible video game play. On the other hand, due to negative attitudes and preconceived notions about video games, the older group is more inclined to endorse negative beliefs about video games, which results in a much lower level of use and dependence on video games for the older group than for the middle-aged group.

Certain limitations should be acknowledged. First, the study’s subjective measure of interpersonal relationship may be influenced by individuals’ depressive mood, as functionally dependent adults with depressive tendencies may be less satisfied with their relationships and can lead to problematic short-form video applications usage, and thus bias may affect the results. Second, due to the use of secondary data, the sample for this study only included 45 and older, and future research could be extended to other age groups to explore the impact of short-form video applications usage on functionally dependent adults of different ages.

Conclusions

This study focused on exploring the relationship between short-form video applications usage and depressive symptoms in functionally dependent adults. Our empirical analysis based on the CFPS 2020 wave data found that short-form video applications usage reduces depressive symptoms in functionally dependent adults, while 10.36% of the impact effect is realized through enhancing interpersonal relationship and thus alleviating depressive symptoms. Meanwhile, video games attenuated the mitigating effect of short-form video applications usage on depressive symptoms in both the overall sample and

the middle-aged sample. These findings that functionally dependent adults could benefit from the digital intervention not only expand our knowledge of the effects of engaging in screen-time activities for functionally dependent adults in terms of mental health but also provide important information for public health policies to encourage and support the use of short-form video applications to the functionally dependent adults. In addition, future digital interventions need to take into account age differences and develop tailored strategies for various subgroups to optimize their effectiveness.

Data Sharing Statement

The dataset supporting this study can be obtained by request from the URL (www.isss.pku.edu.cn/cfps/en/index.htm).

Ethical Approval

The database was approved by the Biomedical Ethics Committee of Peking University (IRB00001052-14010). All participants gave written informed consent in accordance with the Declaration of Helsinki. And the present study was approved by the Ethics Committee of Soochow University (SUDA20240830H04).

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Author Contributions

Both authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors declare no competing interests.

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