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ORIGINAL RESEARCH

The Effect of Social Media Forwarding on Subjective Well-Being in Chinese Older Adults: A Moderated Mediation Model

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Purpose: In the intersection of the aging and information era, the development of digital aging significantly influences the well-being of older individuals. Given the divergent findings in various studies exploring the effects of social media use on mental health, this study specifically examined the impact of forwarding, a prevalent social media behavior among older individuals, focusing on the effects of use intensity on their subjective well-being (SWB) and the specific mechanisms involved.

Materials and Methods: A total of 323 Chinese older adults completed the questionnaire. SPSS along with Hayes Process Models 4 and 7 was employed to test the hypotheses.

Results: The results indicated that social media forwarding intensity significantly and positively predicted SWB of older adults. This association was partially mediated by perceived social support (PSS) and self-esteem. Gender served as a moderator, highlighting that the positive predictive effects of forwarding intensity on PSS and self-esteem were more pronounced for older men than for older women. Further, the findings confirmed the existence of the moderated mediating effect such that the impact of forwarding on SWB was mediated through both PSS and self-esteem for older men, while, for older women, it was solely mediated by PSS.

Conclusion: This study revealed the positive impact of forwarding, a user-friendly social media function, on the well-being of older adults and elucidated the specific mechanisms through a moderated mediation model. In light of these findings, we propose customizing the development of age-friendly social media functions to address the diverse psychological needs of older adults, taking into account gender differences. These findings may offer valuable insights for constructing digital age-friendly platforms and fostering active aging development.

Keywords: social media forwarding, Chinese older adults, well-being, perceived social support, self-esteem, gender

Introduction

As of June 2023, the number of Internet users in China reached 1.079 billion, of which 13.0% were aged 60 and above.[1] The Internet is widely used by older adults, with a penetration rate of 43.2%,[2] and the gray digital divide is gradually being bridged. For older individuals, the Internet has possessed multifunctional attributes, serving as an information resource, a utility tool, and a social platform, which can be used in various contexts, such as searching for the latest news, acquiring health-related information, participating in online leisure, communicating with family members, participating in social interactions, and as a result, improving social adaptability and mental health.[3,4] This resonates with the tenets espoused by active theory[5] and resocialization theory.[6] Furthermore, extant research has substantiated the significance of bolstering the connection between older adults and the Internet and offering robust digital technology support as a vital means to empower older adults and ameliorate their overall well-being.[7,8]

In the context of Internet use, older adults frequently assume the roles of information consumers rather than producers[9] and favor engaging in interactions through the forwarding function.[10] When older individuals encounter content posted by others that piques their interest and is deemed share-worthy, they can readily share it with their

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connections by simply clicking the "forward" button. This process has evolved into an integral component of the social media ecosystem, catalyzing the exchange and propagation of information.[11] Previous studies have noted the commonality of forwarding behavior, with approximately 35% of tweets on X (formerly Twitter) being retweets and 65% on Sina Weibo.[12] Given the widespread and user-friendly nature of this social media behavior, its potential impact on social interactions, as well as the broader physical and mental well-being of older adults, deserves closer scrutiny. To address these questions and bridge the research gap, the study aims to determine whether social media forwarding behavior carries a positive impact. If affirmative, we want to unravel the specific mechanisms and assess potential gender differences in this impact among older individuals. These inquiries constitute the core focuses of this study.

Social Media Forwarding Behavior and Subjective Well-Being

Subjective well-being (SWB) is an umbrella term used to gauge an individual's sense of well-being, primarily rooted in personal life evaluations.[13] It encompasses reflective cognitive judgments, such as life satisfaction, and emotional responses to current life.[14] Numerous studies conducted in various countries have demonstrated positive correlations between Internet access and use and SWB among older adults by reducing social exclusion and isolation,[15] maintaining and strengthening social connections and emotional gains,[16] providing online leisure and mental exercise,[17] and fostering a sense of accomplishment and satisfaction.[18] However, studies have also presented divergent evidence, indicating either a lack of correlation[19,20] or even negative correlations between Internet use and well-being.[21] For example, excessive Internet use among older individuals has been linked to reduced family involvement,[22] fewer offline interactions,[23] and heightened psychological distress.[24] Inappropriate social comparisons within the online sphere may lead to a sense of relative deprivation and psychological loss.[25] These contrasting research findings are often attributed to the multiplicity of the purposes and manners in which the Internet is used.[26,27] Some studies have emphasized that Internet use should not be simply conceptualized at the macro level, that it is not a singular or generic activity, but it encompasses a plethora of online behaviors, each of which affects older people differently and plays different roles in the aging process.[18,28]

Forwarding is a straightforward and effective Internet use behavior, involving the reading and sharing of information, constituting an active engagement with social media.[29] The forwarded information encompasses an array of content formats, including news, brief comments, article links, images, videos, and so on.[30] Currently, some studies have focused on the factors influencing forwarding behavior[31,32] and predicting user behavior through algorithm models,[33] but no study has yet explored the association between forwarding and psychological well-being of individuals across various age groups.

WeChat stands out as the most widely embraced social platform among Chinese older adults,[34] where the forwarding function is extensively adopted and comprises two main modes: sending content related to personal interests, opinions, or values directly to their social network contacts through a dialog box (eg, in a personal or group chat interface), or displaying it on their homepage and sharing it with their followers (eg, on their WeChat Moment timeline). Through these actions, older adults may acquire effective ways of self-expression and self-presentation. They can indirectly convey thoughts and opinions by citing others' statements to satisfy their desire for communication. They may also meticulously display and organize forwarded content to reflect their unique tastes and craft their digital personas so that others can form specific impressions of them. Research has shown the vital roles of authentic self-expression[35] and positive self-presentation[36,37] in the attainment of SWB. Therefore, we propose that the intensity of forwarding function use may be associated with the levels of SWB in older adults.

The Mediating Roles of Perceived Social Support and Self-Esteem

Perceived social support (PSS) is a crucial factor in predicting the well-being of older adults.[38,39] It reflects the subjective experiences or perceptions of older individuals concerning the care, respect, and significance they receive from the social environment.[40] PSS indicates the availability and sufficiency of social relationships and the satisfaction derived from the support received. It is widely acknowledged as a protective structure of SWB and exhibits substantial associations with its various measures, including positive affect and life satisfaction. Interestingly, it has been shown that PSS can exert a more profound impact on psychological well-being than the actual tangible support available or received.[41]

Social networks, designed to fulfill the fundamental human needs for building and nurturing social connections, provide older adults with the means to sustain and expand their social relationships across temporal and geographical

boundaries.[42] In this context, forwarding serves as a convenient tool. Older users can utilize this function as an opportunity to cultivate interactions with weak relationships, such as acquaintances or community members with whom they may have lost touch over time, supplementing their social connections in the offline world. They can also maintain ties with strong relationships, such as family members and close friends, fortifying the bonds within their core social circles. Based on the above interactions, older adults access opportunities to both offer and receive various forms of support within their social networks, thus fostering stable social connections.[43] Furthermore, it instills in older adults the belief that they possess sufficient resources, including information, emotional support, and tools, to accomplish mental buffering effectively when encountering difficulties or facing high-pressure situations.[44] Thus, we propose PSS as one explanatory pathway linking forwarding intensity and SWB among older adults.

Another concept closely related to SWB is self-esteem, defined as an individual's positive or negative self-evaluation.[45] Individuals with high self-esteem tend to possess a more positive outlook on their abilities and values, displaying a greater willingness to proactively engage in various social activities and interpersonal interactions. They are adept at coping with adversity and stress, demonstrating ease in dealing with a wide array of challenges.[46] High self-esteem is recognized as an indicator of older adults' superior mental health, often associated with reduced feelings of loneliness, diminished death anxiety,[47] and a more optimistic outlook on life.[48] Research has demonstrated that self-esteem is a strong and cross-culturally consistent predictor of SWB.[49,50]

Older adults' self-esteem can be improved by computer learning, Internet utilization, digital media consumption, and social media engagement.[51,52] These technologies contribute to the improvements in learning abilities and memory retention of older individuals, fostering a deeper understanding of their cognitive potential[53] and enabling continuous self-affirmation.[54] In addition to acquiring self-efficacy related to social media use skills, forwarding provides older adults with indirect avenues for opinion output. They can be heard and seen by referencing others' words. Particularly when offering advice, forwarding can mitigate concerns about not being taken seriously, completing the persuasion process through techniques such as "appealing to authority" or "citing others." Through this process, older adults may recover their sense of involvement and value. As previous research has confirmed, older individuals who find means of expression are more likely to experience heightened self-esteem and positive psychological emotions.[55] We thereby hypothesize that self-esteem serves as another explanatory variable linking forwarding intensity and SWB.

The Moderating Role of Gender

Online gender differences have been an important part of information system research, referring to the differences in Internet use between men and women, including attitudes toward technology, usage frequency, and usage patterns, which also persist among older age demographics.[56,57] The agency-communion distinction perspective of social role theory explains these differences, corresponding to the observation that men often manifest agentic traits, while women tend to exhibit communal traits during socialization.[58,59] In the context of utilizing the Internet, men are more inclined to employ information technology for agentic purposes, adopting a task-oriented approach, displaying a heightened interest in technology, emphasizing power and authority, and excelling in using social networks to demonstrate personal competence and maintain their social status.[60,61] Conversely, women are more inclined to utilize technology for communal purposes, displaying a greater inclination toward social interactions, adopting a relationship-oriented approach, and tending to invest more emotional energy in maintaining family ties and sustaining close relationships with friends.[62,63] Studies have indicated that the impact of social media on the psychological dimensions of older adults may differ by gender, influenced by usage purpose and patterns.[64] Hence, we posit that the roles played by forwarding may diverge based on gender in this study. Specifically, we postulate that forwarding may improve the self-esteem of older men more obviously, providing opportunities to help them show their abilities to the outside world and obtain network social capital, which can better cater to the usage purposes of men.[65] At the same time, we believe that older women are more sensitive to the connection function and companionship attribute of social media, and tend to define themselves and construct interdependent self-construal in their online connections with others.[66] Therefore, we assume that older women are more inclined to perceive social support through forwarding compared to older men. Furthermore, we seek to explore whether the associations between forwarding and SWB via PSS and self-esteem follow distinct pathways for older adults of different genders, examining the existence of the moderated mediating effect.

The Current Study

Drawing upon established theories and prior research, this study aimed to investigate the association between forwarding use and SWB of older adults, the mediating roles of PSS and self-esteem, and the moderating role of gender. To facilitate the above examinations, the study devised a moderated mediation model (see Figure 1) and presented the following hypotheses:

Hypothesis 1. Forwarding intensity would positively predict SWB of older adults.

Hypothesis 2. PSS would mediate the association between forwarding intensity and SWB.

Hypothesis 3. Self-esteem would mediate the association between forwarding intensity and SWB.

Hypothesis 4a. Gender would moderate the association between forwarding intensity and PSS, with a more pronounced effect for older women.

Hypothesis 4b. Gender would moderate the association between forwarding intensity and self-esteem, with a more pronounced effect for older men.

Hypothesis 5. The proposed association between forwarding intensity and SWB via PSS and self-esteem would differ across genders.

Materials and Methods

Procedure and Participants

According to the calculation in G*Power 3.1,[67] a minimum sample size of 130 would be required to draw a statistical conclusion from a linear multiple regression analysis based on the number of the predictors, with a significance level of 0.05, a power of 0.90, and an effect size of 0.15 as referenced from the previous study.[17] Considering the analysis would be conducted in two groups divided by gender, a total of 260 participants were needed.

Due to the challenges associated with acquiring responses from older participants, we utilized a convenience sampling approach to conduct the survey in several communities located in northeastern China, a region characterized by a notable aging population[68] and a moderate level of information technology development.[69] In this research, we established the age criteria for participant inclusion, specifically defining individuals aged 60 years and above for males, and 55 years and above for females. Although variations exist in defining the onset age of older adults across historical periods, cultural contexts, and even within distinct studies,[70] there are still many researchers in the field of aging who have embraced the concept of "pension age" or "retirement age" as a more expedient demarcation line between adulthood and old age.[71] Numerous studies consistently consider this specific temporal juncture as synonymous with the commencement of old age.[72,73] Hence, we selected a comparatively elevated age cut-off to establish an

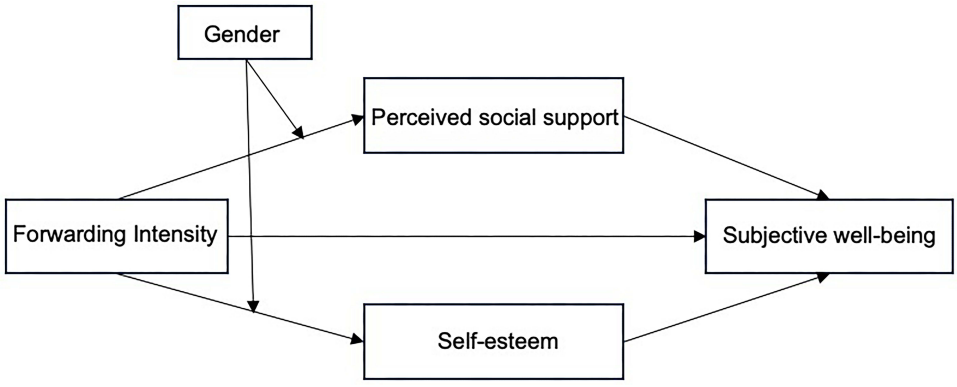

Figure 1 Hypothesized moderated mediation model.

association between retirement age and the commencement of old age, a practice commonly observed in prior studies.[74–76] Ultimately, a total of 356 older adults participated in our survey. This research was approved by the Institutional Review Board of the university. Before data collection, informed consent was obtained from all participants. Subsequently, acknowledging the limited digital proficiency among some of the older participants, we chose a face-to-face distribution method employing paper questionnaires in our research approach. Additionally, a concise introduction to the concept of forwarding behavior on social media was provided to facilitate their responses. Out of the initial 356 participants, 33 were excluded from data analysis due to incomplete responses or failing the attention test. Ultimately, the study included 323 participants (90.73% out of the original 356) who met the inclusion criteria. Table 1 presents specific demographic information. The demographic data within this study, comprising respondents' age, residence patterns, and health level, spans a diverse range, which parallels the information derived from prior large-scale surveys targeting older adults conducted by academic institutions.[77–79] Therefore, combining the research context and research methodology, we posit that this study may furnish partial insights into a facet of social media utilization among older adults in China.

Measures

Forwarding Intensity

Referring to the Facebook intensity scale developed by Ellison et al[80] and the measurement of the reposting intention developed by Wang et al,[32] our research used the revised five items to measure the forwarding intensity on social media among older adults. Participants rated the items (eg, "I'm actively forwarding information" and "Forwarding on social media has become part of my daily routine") on a 5-point Likert type, with higher scores indicating higher forwarding intensity. The Cronbach's alpha for this sample was 0.941. It should be noted that, in this study, forwarding was treated as a social media behavior without specific differentiation in the measurement regarding whether participants forwarded content to the timeline or a dialog box.

Table 1 Demographic Information of the Participants

Characteristics	Categories	Number	Mean ± SD/Percentage
Gender	Female	191	59.13%
	Male	132	40.87%
Age	T	323	68.26±6.61
SAFES	Lower	28	8.67%
	Lower-middle	82	25.39%
	Middle	166	51.39%
	Upper-middle	35	10.84%
	Upper	12	3.72%
Residence pattern	Living with partner	186	57.59%
	Living with children	38	11.76%
	Living with children and grandchildren	60	18.58%
	Living alone	26	8.05%
	Others	13	4.02%
SAHL	Very unhealthy	9	2.79%
	Somewhat unhealthy	31	9.60%
	Moderately healthy	96	29.72%
	Fairly healthy	138	42.72%
	Very healthy	49	15.17%

Abbreviations: SAFES, self-assessed family economics status; SAHL, self-assessed health level.

Subjective Well-Being

SWB was measured by a validated instrument developed by Moum et al,[81] which consists of 4 items, including "In terms of your current living situation, would you say you are mostly satisfied with your life, or mostly dissatisfied?" and "At present do you mostly feel strong and fit, or tired and worn out?" Due to variations in the number of response categories across the items (ranging from 4 to 6), all items were transformed to 0–10 by the algorithm: $X = (Y-1) \times 10/(Z-1)$, where X represents the revised score, Y is the original score and Z is the number of response categories.[82] Higher scores indicated higher levels of SWB. The Cronbach's alpha in this research was 0.758.

Perceived Social Support

PSS was measured by the Chinese version of the Multidimensional Scale of Perceived Social Support (MSPSS) developed by Zimet et al,[83] which consists of 12 items and 3 subscales to measure an individual's perceived level of support from family, friends, and significant others. Participants rated the items (eg, "I have friends with whom I can share my joys and sorrows") on a 7-point Likert scale, with higher scores indicating high levels of PSS. In this research, the Cronbach's alpha was 0.968.

Self-Esteem

Self-esteem was measured by the Rosenberg Self-Esteem Scale (RSES),[45] which has exhibited strong validity among older adults in China.[51] This scale consists of 10 items designed to measure global self-esteem and is commonly employed for evaluating personality traits. Participants rated the items (eg, "I feel that I have a number of good qualities" and "I certainly feel useless at times") on a 4-point Likert scale. The item scores were summed after reverse coding of the negatively worded items, with higher scores indicating higher self-esteem. The Cronbach's alpha for this sample was 0.903.

Control Variables

In this study, we also controlled for several personal characteristics, including age, residence patterns, self-assessed family economic status, and self-assessed health level. Gender was a dummy variable (0 = female, 1 = male), age was converted from self-reported birth year to a numerical value, and residence patterns were classified into five categories outlined in Table 1. Additionally, respondents were requested to evaluate their family economic status and personal health level on 5-point. All of the above personal characteristics have been confirmed to be associated with SWB of older adults in previous studies.[84–87]

Data Analysis

We statistically analyzed the data using SPSS 26.0 and PROCESS 3.4.1. Initially, correlation analysis was conducted for the four main variables. Next, we assessed the mediating effects of PSS and self-esteem using Hayes' PROCESS macro program Model 4.[88] Finally, we evaluated the moderating effect of gender using Model 7. The significance of the moderated mediating model was also assessed through bootstrapping with 5000 resamples and a 95% confidence interval.

Results

Correlation Analysis

We conducted the correlation analysis for four main variables. Table 2 shows that forwarding intensity was positively associated with PSS ($r = 0.297$, $p < 0.01$), self-esteem ($r = 0.282$, $p < 0.01$), and SWB ($r = 0.284$, $p < 0.01$). PSS was positively associated with self-esteem ($r = 0.700$, $p < 0.01$) and SWB ($r = 0.608$, $p < 0.01$). Self-esteem was positively associated with SWB ($r = 0.582$, $p < 0.01$).

Mediation Effect Test

We conducted the parallel mediator analysis using Model 4 in SPSS PROCESS to examine the indirect associations from forwarding intensity to SWB via PSS and self-esteem, with personal characteristics entered as covariates. As shown in Table 3, forwarding intensity positively predicted older adults' PSS (Coeff = 0.742, $p < 0.001$), self-esteem (Coeff = 0.246, $p < 0.001$), and SWB (Coeff = 0.116, $p = 0.028$). Thus, Hypothesis 1 was supported. Moreover, PSS (Coeff = 0.152, $p < 0.001$) and self-esteem (Coeff = 0.302, $p < 0.001$) positively predicted SWB. And the bias-corrected percentile

Table 2 Means, Standard Deviations, and Correlations of the Main Variables (N=323)

Variables	Mean	SD	1	2	3	4
1. Forwarding intensity	12.793	5.711	1			
2. PSS	58.362	15.543	0.297**	1		
3. Self-esteem	30.015	5.484	0.282**	0.700**	1	
4. SWB	24.143	7.743	0.284**	0.608**	0.582**	1

Note: **$p < 0.01$.
Abbreviations: PSS, perceived social support; SWB, subjective well-being.

Table 3 Results of the Parallel Multiple Mediator Model Analysis

	Consequent								
	PSS			Self-esteem			SWB		
Antecedents	*Coeff*	*SE*	t	*Coeff*	*SE*	t	*Coeff*	*SE*	t
Constant	11.353	9.547	1.189	17.442	3.398	5.133***	−10.087	3.599	−2.802**
Forwarding intensity	0.742	0.140	5.301***	0.246	0.050	4.943***	0.116	0.053	2.201*
PSS	——	——	——	——	——	——	0.152	0.026	5.776***
Self-esteem	——	——	——	——	——	——	0.302	0.074	4.096***
Control variables									
Gender	−2.059	1.641	−1.255	−0.833	0.584	−1.426	0.177	0.590	0.299
Age	0.288	0.123	2.340*	0.041	0.044	0.942	0.006	0.045	0.137
SAFES	1.529	0.931	1.641	0.726	0.332	2.189*	1.163	0.336	3.458***
Residence pattern	−0.074	0.546	−0.136	0.087	0.194	0.449	0.323	0.196	1.653
SAHL	4.091	0.889	4.602***	1.333	0.316	4.214***	2.927	0.330	8.862***
R^2	0.182			0.167			0.579		
F	11.707***			10.584***			54.074***		

Notes: *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.
Abbreviations: PSS, perceived social support; SWB, subjective well-being; SAFES, self-assessed family economics status; SAHL, self-assessed health level.

bootstrap analysis showed that both PSS (indirect effect = 0.113, 95% CI = [0.063, 0.166]) and self-esteem (indirect effect = 0.074, 95% CI = [0.030, 0.131]) exhibited significant partially mediating effects in the association between forwarding intensity and SWB, with the proportions of the mediating effects to the total effect being 37.17% and 24.58% respectively. Thus, Hypothesis 2 and Hypothesis 3 were supported.

Moderated Mediation Effect Test

To test the moderating effect of gender, Model 7 was then conducted. As shown in Table 4, gender did moderate the associations between forwarding intensity and PSS (Coeff = 0.549, $p = 0.049$) and self-esteem (Coeff = 0.327, $p < 0.001$), with positive moderating effects in both cases. In comparison to older women, the effects of forwarding intensity on PSS and self-esteem were more pronounced in older men. Upon dividing forwarding intensity into low-intensity and high-intensity, determined by one standard deviation from the mean, the moderating effects were illustrated as shown in Figure 2. Therefore, Hypothesis 4a was rejected and Hypothesis 4b was supported.

Finally, we examined the significance of indirect associations via PSS and self-esteem across different genders. According to the findings presented in Table 5, the 95% Bootstrap CI straddled 0 (−0.004 to 0.186) for the indirect association between forwarding intensity and SWB via PSS, indicating that gender did not moderate this indirect association. Conversely, the CI was entirely above 0 (0.031–0.190) for the indirect association via self-esteem, indicating that gender played a moderating role in this association. Specifically, the indirect association via self-esteem was only

Table 4 Results of the Moderated Mediation Model Analysis

Antecedents	Consequent								
	PSS			Self-esteem			SWB		
	Coeff	*SE*	t	*Coeff*	*SE*	t	*Coeff*	*SE*	t
Constant	18.566	9.460	1.963	19.395	3.329	5.826***	−8.665	3.577	−2.423*
Forwarding intensity	0.713	0.140	5.088***	0.229	0.049	4.643***	0.117	0.052	2.246*
PSS	——	——	——	——	——	——	0.152	0.026	5.779***
Self-esteem	——	——	——	——	——	——	0.301	0.074	4.093***
Gender	−2.165	1.635	−1.325	−0.896	0.575	−1.558	——	——	——
Forwarding intensity * gender	0.549	0.278	1.972*	0.327	0.098	3.339***	——	——	——
Control variables									
Age	0.307	0.123	2.497*	0.053	0.043	1.214	0.009	0.044	0.199
SAFES	1.452	0.928	1.564	0.680	0.327	2.082*	1.162	0.336	3.461***
Residence pattern	−0.082	0.543	−0.150	0.083	0.191	0.433	0.322	0.195	1.647
SAHL	4.164	0.886	4.702***	1.377	0.312	4.419***	2.929	0.330	8.881***
R^2	0.192			0.196			0.579		
F	10.682***			10.956***			61.965***		

Notes: *$p < 0.05$; ***$p < 0.001$.
Abbreviations: PSS, perceived social support; SWB, subjective well-being; SAFES, self-assessed family economics status; SAHL, self-assessed health level.

found for older men (95% Bootstrap CI: 0.055–0.219), but not for older women (95% Bootstrap CI: −0.012 to 0.079). To clarify, for older men, forwarding intensity positively influenced SWB through both PSS and self-esteem pathways, whereas for older women, forwarding intensity only influenced SWB through the mediation of PSS but not through self-esteem.

Discussion

This study aims to explore the association between social media forwarding intensity and SWB among older adults, as well as the mediating and moderating mechanisms. By constructing a moderated mediation model and conducting empirical tests, this study drew the following conclusions.

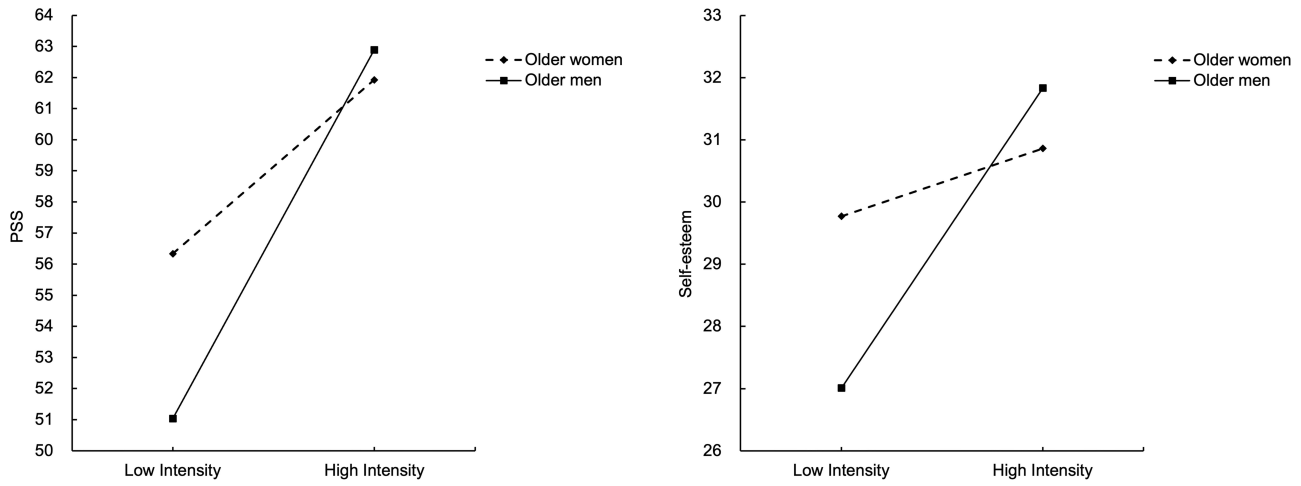

Figure 2 The moderating effects of gender on the associations between forwarding intensity and perceived social support and self-esteem.
Abbreviation: PSS, perceived social support.

Table 5 Indices of the Moderated Mediation Model

Forwarding intensity > PSS > SWB				
Index of moderated mediation: Index (0.083); BootSE (0.047); BootCI (−0.004 to 0.186)				
Gender	Effect	BootSE	BootLLCI	BootULCI
Female	0.074	0.030	0.019	0.135
Male	0.157	0.041	0.082	0.244
Forwarding intensity > Self-esteem > SWB				
Index of moderated mediation: Index (0.099); BootSE (0.042); BootCI (0.031 to 0.190)				
Gender	Effect	BootSE	BootLLCI	BootULCI
Female	0.029	0.023	−0.012	0.079
Male	0.127	0.042	0.055	0.219

Abbreviations: PSS, perceived social support; SWB, subjective well-being; LLCI, lower limit confidence interval; ULCI, upper limit confidence interval.

The Effect of Forwarding on SWB

This study affirmed that forwarding intensity positively predicted SWB in older adults, aligning with Hypothesis 1. Firstly, it validates the user-friendliness and effectiveness of the forwarding function. For older adults, it serves as an easily accessible tool that provides a low-entry way to participate in the digital realm. It ensures that older individuals do not have to feel digitally excluded due to technological barriers. Secondly, the validation of Hypothesis 1 partially responds to the proposal by Lifshitz et al to interpret older adults' Internet use behavior from a functional approach.[18] In other words, it advocates for the necessity of conducting media effect studies grounded in categorized discussion of the diverse goals of older adults' social media use and the corresponding functional applications. Among various functional uses, the forwarding function, acting as the communication bridge, streamlines daily tasks and mitigates social avoidance, thereby fostering social participation and promoting positive psychological emotions in older adults.[89,90] This further emphasizes the affirmative utility of social media for older adults, where the effective use of informational and social features serves as valid evidence supporting the theory of network gain.[91] Consequently, it becomes imperative to establish favorable conditions for older adults. This includes creating an age-friendly digital environment, encouraging older adults to surmount the barriers associated with the "access gap" and "usage gap", and facilitating their transition from being part of the "silent majority" to gradually voicing their presence in the information flow. These efforts are crucial for maintaining their connections with society, harnessing the benefits of the digital era, and effectively reducing feelings of loneliness while enhancing overall well-being.

The Mediation Effects of PSS and Self-Esteem

Our research findings validated that PSS played a partial mediating role in the positive association between forwarding intensity and SWB in older adults. That is, forwarding exerts its impact by facilitating relationship maintenance. This proactive behavior of initiating social interactions with messaging may help older adults receive positive feedback, such as timely responses or positive comments and likes. According to Social Presence Theory, the interactivity of digital media and the confirmation of timely feedback expectations are pivotal factors in perceiving the presence of others in a virtual environment.[92] Such feedback enables older adults to experience feeling cared for and listened to, fulfilling their needs for attention and emotional support, resulting in a heightened sense of social connectedness,[93] and continuous enhancement of PSS and SWB. This aligns with the research findings of Oh et al, indicating that positive psychological effects of social media use only occur when accompanied by actual supportive interactions and the subsequent experience of positive emotions.[94] The procurement of such support is also recognized as a primary motivation for engaging in online social networks.[95] Therefore, we encourage older adults to proactively initiate new social interactions, actively

engage in online socialization spanning various age groups, establish and maintain diverse social relationships through meaningful conversations, compensate for the natural decline in offline social networks that occurs with age, and enrich their psychological well-being. This advice may hold particular importance for older individuals with compromised health or limited mobility, for whom the active use of social media in establishing and maintaining social connections may be of even greater significance.[96]

Simultaneously, as mentioned in the literature section, self-esteem served as another pathway to elucidate the association between forwarding intensity and SWB. The rationale behind this can be elucidated through the researchers' conceptualization of social media empowerment.[7,97] Firstly, social media empowers older adults by providing them with technological capabilities. Through the convenient one-click sharing function, older individuals gain successful experience in using social media. This, to some extent, increases their self-assessment of social media skills[98] and enhances their cognitive adaptability in overcoming online barriers.[7] Secondly, forwarding provides psychological empowerment to older adults by creating channels to expand discourse space. Older adults engage in diverse information sharing, including expressing personal opinions by citing others, conveying warm greetings, offering practical information to others, and even attempting to influence decision-making and guide others' actions. Regardless of the underlying intent behind forwarding, this process can potentially mitigate the feelings of powerlessness and enhance the sense of control. By providing guidance or advice, older adults may be transformed from passive recipients of information to active agents in the network of power relationships, potentially re-experiencing the senior roles of helpers and educators.[99] If the information shared is adopted or has a positive impact on others, they may experience a higher sense of accomplishment and SWB.[100] According to the Selective Optimization with Compensation model,[101] the self-efficacy resulting from skill mastery and the reinstated opportunities to express can counteract the diminishing roles experienced by older individuals when they step back from societal involvement and confront the reversal of intergenerational power dynamics. Therefore, we advocate affording older adults with opportunities and platforms for self-expression. In addition to encouraging indirect self-expression by citing others, it is imperative to champion and facilitate their confident engagement in content creation and value addition. Enabling older individuals to connect with others will empower them to become active sharers of valuable life experience, demonstrate strength and competence in social interactions, and provide opportunities to sustain motivation for leading active lifestyles.[102]

The Moderated Mediation Effect

Our results showed that gender moderated the associations between forwarding intensity and both PSS and self-esteem. First of all, consistent with Hypothesis 4b and previous studies, older men exhibited a higher tendency to derive positive self-assessment from their social media engagement.[64] Men usually regard their careers as the core of their lives, and are often influenced by the traditional concept of "men outside the home, women inside." Consequently, compared with older women, they are more likely to experience relative deprivation stemming from the loss of social roles upon retirement.[103] At this time, social media usage represented by forwarding may play a transitional and adaptive role, affording opportunities to showcase their digital prowess and express themselves. Even if this expression is indirect, they will still realize that they may have the ability to influence others and still have the opportunity to win authority and status. As Lin et al emphasized in the previous study, men exhibit a greater motivation to seek self-status in social networks.[104] Older men tend to affirm their personal identity and invest their self-worth in this process, with the compensatory role of social media being particularly pronounced for them.

Interestingly, contrary to Hypothesis 4a and previous literature, our results showed that older men were more likely to derive PSS through forwarding compared to older women. This may be based on the following reasons. A study on leisure participation of older adults in Shanghai notes that older women are more willing to participate in collective social activities and performing-art activities offline, while older men are more willing to participate in independent detachment-recovery and aesthetic activities.[105] Therefore, we infer that women are more predisposed to establish connections and expand their social circles through offline activities, viewing their social networks as extensions and enhancements of these real-world relationships. Conversely, older men typically have limited offline social interactions, often confined to family and close friends. In this context, virtual social interactions serve as complements. According to the social compensation hypothesis, individuals perceiving a deficiency in their offline social ties are more sensitive to the benefits

of online social interactions.[80,106] They tend to invest more time in building broader social networks through digital means. This process may then potentially result in a divergence between the motivations that older men participate in forwarding and their actual experiences. In other words, although the initial motivation to forward information may not have revolved around seeking social support, they still garnered various positive outcomes. These include adopting a more relaxed and efficient approach to technology use, gaining social compensation and satisfaction in the social identity, and maintaining a sense of order and continuity in their social habits during retirement.

Finally, our findings revealed distinct gender-based variations in the influence mechanisms of forwarding intensity on SWB of older adults. Specifically, for older men, forwarding intensity influenced SWB through the dual mediating roles of PSS and self-esteem. In contrast, for older women, this association was solely mediated through their PSS. To some extent, this demonstrates the relationship-oriented approach of female users and the ability-oriented approach of male users when using social media. Older women generally tend to seek social connections on the Internet, while older men typically strive for a broad sense of accomplishment, and sometimes, interpersonal relationship is also regarded as a symbol of social status for men.[107] Forwarding caters to the diverse needs of older adults based on their gender. This discovery carries practical implications, underscoring the importance for designers of social media platforms to consider gender differences. They should develop tailored functionalities based on the distinct personality traits and actual needs of older adults. By offering customized service and personalized experiences, a more appealing and beneficial social media environment may be created to meet older adults' expectations, thereby enhancing their psychological well-being.

Limitations and Future Research

Although we found some interesting phenomena in the current study, certain limitations warrant consideration. Firstly, the utilization of cross-sectional data impeded the establishment of causal inferences regarding the associations between variables. Subsequent studies may employ longitudinal surveys. Secondly, this study focused on Chinese older adults, a demographic that prioritizes interpersonal interdependence and tends to perceive relationship acquisition as a status marker, in contrast to the emphasis on independence in western culture.[108] Thus, PSS and self-esteem may mediate the association between forwarding intensity and SWB among Chinese older adults. However, the appropriateness of the mediating mechanisms in other cultural contexts remains to be explored in future research. Thirdly, it is crucial to acknowledge that this study, conducted in several communities within the northeastern region, was characterized by constraints such as a limited sample size, a narrower study site, a specific target group consisting solely of elderly individuals likely to engage in outdoor activities in urban settings, and an omission of a diverse array of geriatric characteristics. Therefore, to substantiate the universality and replicability of the research findings, we recommend conducting a broader and more in-depth survey on a larger scale, incorporating the use of telephone interviews as a valid research method. Lastly, it has been found that the digital marginalization of older adults may persist in the use of the forwarding function, where they may be ignored (eg, receiving few replies after forwarding) or challenged and rebutted (eg, being corrected by children or peers). Such violations of expectations may result in a decrease in self-esteem and well-being, particularly in psychologically sensitive older adults.[109] Therefore, when exploring the impact of social media behaviors like forwarding on the mental health of older adults, different feedback mechanisms should also be included in future research.

Conclusion

The current study attempted to explore the impact of the use of forwarding function in social media on the psychological well-being of older adults from the perspective of network gain. The study indicated that forwarding intensity was a significant predictor of SWB among older adults. PSS and self-esteem played partial mediating roles. The association between forwarding intensity and PSS as well as self-esteem was moderated by gender, indicating that forwarding intensity had a more pronounced impact on the psychological profile of older men. Furthermore, this study validated the moderated mediating effect. Forwarding's impact on SWB of older men was mediated through both PSS and self-esteem, while for older women, it was only mediated by PSS. In light of these findings, we suggest the development of easy-to-use, age-friendly social media functions and the construction of digital aging service considering gender differences and

diverse usage needs of older adults, to encourage them to actively integrate into digital life. These actions are crucial for the psychological well-being of older adults within the context of active aging.

Data Sharing Statement

Data supporting the results of this study are available upon requests from the corresponding author.

Ethics Statement

This study adhered to the principles of the Declaration of Helsinki and received ethical approval from the Institutional Review Board of Shanghai Jiao Tong University (No: H20230316I). All participants provided written informed consent before the survey.

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Disclosure

The authors report no conflicts of interest in this work.

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