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The dark side of the association between internet use and older adults' subjective wellbeing: the role of subjective social class

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Abstract

Objectives The majority of studies exploring the relationship between internet use and subjective wellbeing among older adults tend to overlook the mediating mechanisms, particularly psychological ones. Additionally, while research has concluded that internet use is significantly associated with higher levels of subjective wellbeing, it remains unclear whether these associations might become insignificant or negative under certain conditions. To address these gaps, this study investigated the association between internet use and subjective wellbeing in older adults, with a focus on the mediating role of hope and the moderating role of subjective social class.

Method A sample of 1,045 older adults was selected from the Chinese General Social Survey. SPSS 24.0 and its PROCESS macros were utilized for data analyses. The bootstrapping method with 5,000 resamples was utilized to examine the mediating role of hope. Interaction terms were formulated to assess the moderating roles of subjective social class.

Results The results revealed that older adults who used the internet were more likely to report higher levels of subjective wellbeing than those who did not. Hope served as a key psychological mechanism mediating this relationship. Additionally, subjective social class moderated the association between internet use and subjective wellbeing: the positive association was significant among older adults with higher subjective social class, whereas no significant association was observed among those with lower social class. Interestingly, subjective social class also moderated the relationship between hope and subjective wellbeing, albeit in the opposite direction.

Conclusions These findings contribute to our understanding of the psychological mechanisms underlying internet use and older adults' subjective wellbeing. Furthermore, they provide implications for considering the relative dark of internet use on subjective wellbeing for older adults with lower subjective social class.

Keywords Internet use, Subjective wellbeing, Hope, Subjective social class

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Introduction

Older adults' subjective wellbeing is recognized as a critical component of "successful aging" [1]. Studies have shown that subjective wellbeing plays a significant role in predicting an individual's physical health, mental health, and social functioning in old age [2]. Consequently, enhancing the subjective wellbeing of older adults has emerged as a pressing social concern, especially in China, which harbors the world's largest aging population. Concurrently, internet technology has experienced rapid development over the past decade, with older individuals gaining access to the internet at low cost. Against the backdrop of population aging and the rapid advancement of internet technology, it is imperative to investigate the relationship between internet use and subjective wellbeing among older adults, along with potential mediating and moderating mechanisms. Clarifying these inquiries is essential to provide empirical evidence for designing internet-based intervention strategies aimed at enhancing the subjective wellbeing of older adults.

Currently, research on the relationship between internet use and subjective wellbeing primarily focuses on adolescents and children [3–5], with comparatively fewer studies exploring this relationship among adults [6], especially among older adults. Given the significant differences between these two groups in the purpose, intensity, duration, and psychological experience of internet use, measurement tools and research findings targeting adolescents and children may not be directly applicable to older adults [7]. Therefore, it's necessary to test the association between internet use and subjective wellbeing among older adults.

Furthermore, it must be acknowledged that some studies have explored the relationship between internet use and subjective wellbeing among older adults [8–13]. However, these studies have some limitations, which our study aims to address. Firstly, these studies often utilize single-item scales (e.g., "How happy do you feel?" or "How satisfied are you with your life?") to assess the subjective wellbeing of older adults [14, 15], thus failing to comprehensively capture the multidimensional nature of this concept through multi-item scales. Secondly, many studies have been conducted in Western contexts [9, 10], with relatively few focusing on the Chinese context characterized by a collectivist culture and rapid yet uneven social development. Thirdly, the majority of these studies primarily delve into the direct relationship between internet use and subjective wellbeing among older adults [9, 13, 16], somewhat overlooking the underlying mediating mechanisms, especially the psychological mechanisms. Lastly, while previous studies have generally concluded that internet use significantly enhances the subjective wellbeing of older adults [14, 15], it remains unclear whether these associations may become insignificant or even negative under some conditions.

Drawing on data from a nationwide survey of Chinese residents utilizing a multistage restricted sampling method, this study aims to investigate the association between internet use and the subjective wellbeing of Chinese older adults, along with its mediating and moderating mechanisms. Specifically, this study addresses three questions: Firstly, it examines the association between internet use and the subjective wellbeing of older adults in the context of China. Secondly, to elucidate the psychological mechanisms underlying this association, this study investigates the mediating role of hope in the above relationship. Identifying this mechanism can inform internet-based intervention strategies, prioritizing interventions that target the psychological process of hope to enhance the subjective wellbeing of older adults. Thirdly, to delineate the boundary conditions in these relationships, this study explores the moderating roles of subjective social class in the association between internet use and subjective wellbeing, as well as the relationship between hope and subjective wellbeing. Considering moderating variables is essential as it can elucidate which groups benefit most from the internet and which groups benefit least, aiding in tailoring precise intervention strategies for subjective wellbeing among older adults with varying levels of subjective social class.

Internet use and subjective wellbeing

Social networks and social activities are two primary theoretical perspectives used to understand the relationship between internet use and older adults' subjective wellbeing [17, 18]. On one hand, internet use can be regarded as a form of online social network [17]. Older adults can utilize the internet to communicate with family members and friends in the virtual world. Adequate social networks not only directly promote older adults' subjective wellbeing but also buffer the negative effects of adverse life events in old age (e.g., widowhood, functional limitations, and social isolation) on older adults' subjective wellbeing [19]. On the other hand, the use of the internet can also be seen as a form of online social activity [18], such as online learning, entertainment activities, and information searching in the virtual world. The activity theory demonstrates that adequate social activities in old age can maintain older adults' connections with society, thereby improving subjective wellbeing [20].

Aligned with the preceding theoretical perspectives, numerous studies have corroborated that internet use substantially enhances the subjective wellbeing of older adults [13–15]. However, these studies still exhibit two limitations that warrant attention. Firstly, these studies typically employ single-item scales rather than validated multiple-item scales to assess subjective wellbeing

[13–15], which may not fully capture the multifaceted nature of subjective wellbeing [21], thereby limiting the persuasiveness of the conclusions drawn. Secondly, many of these studies have been conducted in Western contexts [9, 10, 13], with relatively few focusing on China—a nation characterized by a collectivist culture. Collectivist culture is defined by two key traits—strong interpersonal orientation and a spirit of self-sacrifice—that may impact internet use and subjective well-being among Chinese populations [22]. On one hand, collectivist culture emphasizes close interpersonal relationships within groups [22], which fosters a strong intrinsic motivation among older adults to use the internet to connect with important others, such as family members and friends. This cultural inclination may lead to an increased rate of internet use among older adults. On the other hand, collectivist culture also places a high value on individual sacrifice for the group, especially when personal interests conflict with collective goals [23], which may negatively influence individuals' subjective well-being within this framework. Consequently, older adults in China may face a paradox: higher rates of internet use coexisting with lower levels of subjective wellbeing. Therefore, further investigation of this relationship could provide valuable insights into how internet use might be leveraged as a basis for interventions aimed at improving the subjective wellbeing of older adults in a collectivist cultural context. Therefore, this study aims to investigate the association between internet use and subjective wellbeing among Chinese older adults, and hypothesis 1 is listed as follows.

Hypothesis 1 Internet use is positively associated with higher levels of subjective wellbeing among Chinese older adults.

Mediating role of hope: a psychological perspective

Existing studies predominantly examine the direct association between internet use and older adults' subjective wellbeing, overlooking potential mediating mechanisms [9, 13, 16]. While some studies partially address this gap by investigating the mediating roles of social relationships and activity participation, known as social mechanisms [14, 24, 25], there is limited attention given to psychological mechanisms. Understanding the psychological mechanisms is crucial, as subjective wellbeing is intrinsically linked to positive psychological experiences, which may be significantly influenced by specific psychological processes. In the field of positive psychology, hope is defined as "the positive cognitive appraisal towards the future that one could find the pathways and maintain the motivations to achieve goals" [26]. Hope comprises two fundamental components: pathways thinking (perceived confidence of producing reasonable pathways to desired goals) and agency thinking (perceived motivation to utilize pathways to maintain efforts in achieving desired goals) [26].

Internet use can enhance hope among older adults by fostering two essential ways of thinking associated with hope. Specifically, regarding pathway thinking, digital literacy serves as an explanatory framework. There is a reciprocal relationship between internet use and digital literacy in older adults [27, 28]. On one hand, digital literacy is a prerequisite for internet use [27]; on the other, using the internet can further enhance digital literacy over time [28]. A high level of digital literacy enables older adults to seek informational support and identify solutions to challenges commonly encountered in later life, such as income reduction, declining functional abilities, and chronic health conditions. In other words, internet use provides older adults with viable pathways to pursue their goals, thereby reinforcing pathway thinking—a core component of hope.

In terms of agency thinking, technology-mediated support provides a meaningful explanatory framework [29]. Older adults can utilize the internet—a form of technology-mediated support—to maintain social connections, which not only enhances their perceptions of social support [30] but also bolsters their self-efficacy [31] and sense of control in coping with stress stemming from environmental challenges [32]. The increased sense of social support, self-efficacy, and control enabled by internet use can fulfill essential psychological needs for autonomy, competence, and relatedness [30]. According to self-determination theory [33], satisfying these needs is foundational to fostering intrinsic motivation. Thus, internet use helps cultivate intrinsic motivation to enhance older adults' subjective wellbeing, thereby embodying agency thinking—another core component of hope.

In summary, internet use facilitates older adults in achieving their goal of subjective wellbeing, a primary goal in individuals' later life, by concurrently bolstering the two fundamental components of hope: pathways thinking and agency thinking. Therefore, hypothesis 2 is formulated as follows.

Hypothesis 2 Internet use is positively associated with higher levels of hope among Chinese older adults.

Furthermore, Ellis's "Activating Event-Belief-Consequence" (ABC) theory posits that an activating event impacts one's beliefs regarding cognitive appraisals, subsequently influencing the resulting consequences in terms of emotion or behavior [34]. In essence, beliefs associated with cognitive appraisals serve as a mediating factor in the relationship between an activating event and its outcomes. Drawing upon the ABC theory, this study considers internet use as the activating event, which affects the consequence of subjective wellbeing

by enhancing hope—the belief associated with cognitive appraisals. Therefore, this study proposes hypothesis 3.

Hypothesis 3 Hope mediates the association between internet use and subjective wellbeing among older adults.

Moderating roles of subjective social class

Studies have reported a significant improvement in subjective wellbeing due to internet use among older adults [13–15]. However, it remains unclear whether, under certain circumstances, internet use may have an insignificant or even negative association with older adults' subjective wellbeing. This study investigates the moderating role of older adults' subjective social class in the association between internet use and their subjective wellbeing. Furthermore, to clarify whether the influence path of internet use on older adults' subjective wellbeing through enhancing their levels of hope varies under different boundary conditions, this study additionally examines the moderating role of subjective social class in the relationship between hope and subjective wellbeing.

Social class can be delineated into subjective and objective dimensions, with subjective social class referring to an individual's perception of their socioeconomic status within society, gauged through comparative evaluations with others [35]. Consequently, social comparison theory can be applied to comprehend the moderating role of subjective social class. This theory scrutinizes the processes through which individuals evaluate themselves relative to others in terms of social class [36]. Broadly, social comparison comprises two types: upward comparison, wherein individuals compare themselves with those in a better-off position [37], and downward comparison, wherein individuals compare themselves with those in a less favorable position [38]. Downward comparison can bolster self-esteem and self-enhancement [39], thereby enhancing subjective wellbeing, while upward comparison may evoke feelings of relative deprivation and inequity [40], leading to a decline in subjective wellbeing.

A potential scenario is that the association between internet use and subjective wellbeing might vary depending on subjective social class. Internet use may expose older adults to information highlighting disparities in income distribution and public services, potentially reinforcing perceptions of their lower socioeconomic status among older adults with lower subjective social class [41]. Moreover, internet use might facilitate access to misleading information, exacerbated by limited educational attainment and informational support, making it challenging for individuals with lower subjective social class to discern the authenticity of information. Consequently, when using the internet, older adults with lower subjective social class may tend toward upward comparison by shifting their reference groups for comparison to those with a much higher social class in the digital realm, potentially counteracting the benefits of promoting subjective wellbeing by utilizing the internet as they may experience significant feelings of relative deprivation and inequity [40]. On the other hand, during the process of using the internet, older adults in the higher subjective social class can access more information about individuals with lower subjective social class, such as poverty and limited access to care services. This information may reinforce their perception of belonging to a higher subjective social class, thereby shaping a cognitive style toward downward comparison, which can enhance their self-esteem and self-enhancement [39], thereby improving subjective wellbeing. Therefore, this study posits hypothesis 4a.

Hypothesis 4a: Subjective social class moderates the association between internet use and subjective wellbeing, with the association being stronger for older adults with a higher subjective social class compared to those with a lower subjective social class.

In addition, according to need theory, once individuals acquire sufficient psychological resources to meet demands and cope with threats from their environment, the relationship between subjective social class and subjective wellbeing should diminish [42]. Hope, a cognitive appraisal related to goal achievement, is considered a fundamental psychological need [43]. Internet use may foster hope—a valuable psychological resource—among older adults with lower subjective social class, indicating the fulfillment of their psychological needs. Individuals meeting their psychological needs are more likely to proactively adjust their reference groups for comparison and adopt comparison strategies conducive to subjective wellbeing, such as downward comparison [39]. Consequently, the adverse association between lower subjective social class and subjective wellbeing when using the internet may diminish among older adults with lower subjective social class. Similarly, for older adults with higher subjective social class, as hope improves, the positive association between subjective social class and subjective wellbeing when using the internet may also diminish. Therefore, this study proposes hypothesis 4b. The proposed model in this study is illustrated in Fig. 1.

Hypothesis 4b: Subjective social class moderates the association between hope and subjective wellbeing, with the association being stronger for older adults with a lower subjective social class compared to those with a higher subjective social class.

Building on the preceding theoretical analysis, this study establishes a theoretical framework, as illustrated in Fig. 1, which also outlines all the research hypotheses formulated in this study.

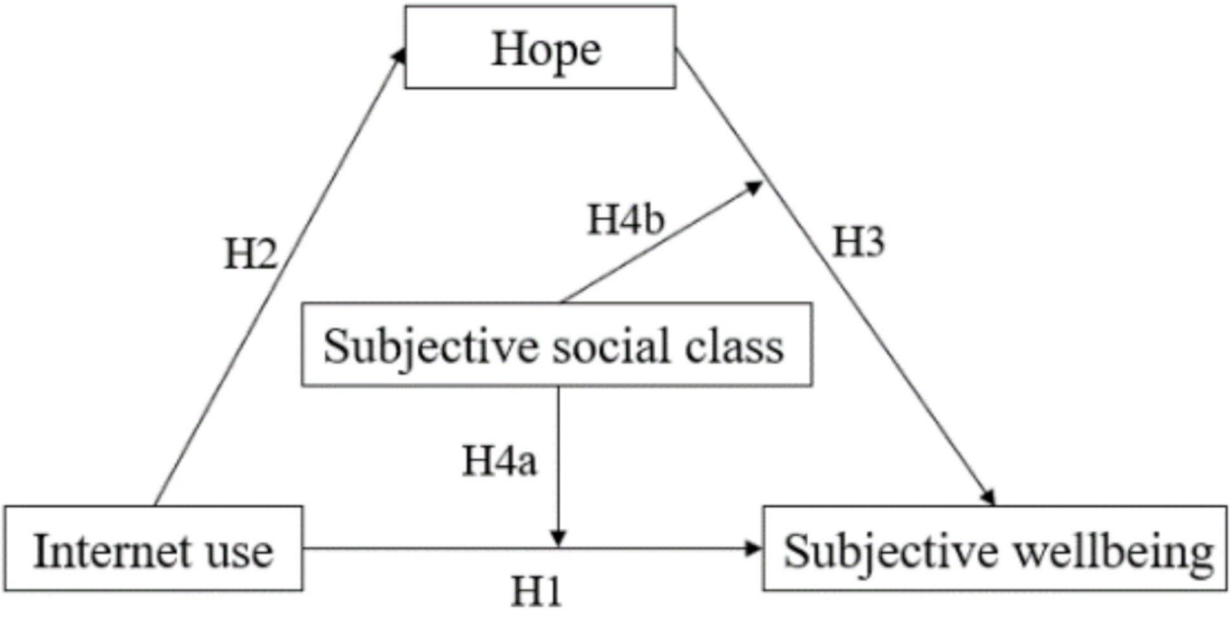

Fig. 1 Theoretical framework of this study

Materials and methods

Participants

Data were obtained from the 2017 wave of Chinese General Social Survey (CGSS), employing a multistage stratified sampling method to collect a nationally representative sample of participants aged 18 years and above [44] (available online at http://cgss.ruc.edu.cn/English/Home.htm). This study focuses on individuals aged 60 and above. To address the issue of missing values in the variables (with the percentage of missing data falling within a reasonable range), we employed the listwise deletion method. This approach was justified based on the following considerations: First, we assessed the characteristics of the missing data using Little's MCAR multivariate test, which confirmed that the missing data were completely random. Second, we conducted difference tests comparing the samples before and after the removal of cases with missing values. The results indicated no significant differences in the core variables and sociodemographic characteristics between the two samples. These findings confirm that the removal of cases with missing values does not introduce bias into the statistical analyses. In total, 1,045 valid participants were included in our analysis, with an average age of 68.76 (standard deviation (SD) = 7.09). Males constituted 46.99% of the sample. Among the older adults, 23.25% were employed, 78.47% had attained an education, 74.45% were married, and 19.33% lived alone. The average number of children, hospitalizations in the last year, and functional health score were 2.39 (SD = 1.54), 0.66 (SD = 1.43), and 3.03 (SD = 1.04), respectively. Detailed descriptions of the demographic, family, and health characteristics of the valid participants are presented in Table 1. Furthermore, this study received research ethics approval from the institution overseeing the CGSS.

Measurements

Internet Use

Internet use encompasses multidimensional aspects such as whether to use it, the purpose, intensity, and duration of usage. Presently, most psychological measurement tools for assessing internet use are tailored for adolescents and children [45–47], with limited development of instruments specifically designed for older adults [7]. Given the notable disparities in internet use patterns among different age groups, employing scales originally crafted for adolescents and children to measure internet use in older adults may lead to inaccuracies [7]. Hence, this study adopts a measurement approach for internet use inspired by gerontology, wherein this concept is evaluated using a single-item question ("Did you use the internet last year?") through self-reporting by older adults. We operationalized internet use as a binary variable, assigning a value of "1" if the participant reported using the internet in the past year. This measurement offers the advantages of simplicity and directness and is widely utilized in research examining internet use among older adults [25, 41, 48, 49].

Furthermore, CGSS only evaluated internet use based on whether individuals used it, neglecting to capture aspects such as purpose, intensity, and duration of usage. This limitation indicates that our study could not

Table 1 Descriptive statistics of the valid participants

Variables		Frequency (*N*)	Percentage (%)
Demographic characteristics	Age Range: 60–93	M = 68.76	SD = 7.09
	Gender		
	Male	491	46.99
	Female	554	53.01
	Whether work		
	No	802	76.75
	Yes	243	23.25
	Educated		
	No	225	21.53
	Yes	820	78.47
	Monthly income (RMB)	M = 5506.19	SD = 25008.35
Family characteristics	Have a spouse		
	No	267	25.55
	Yes	778	74.45
	Living alone		
	No	843	80.67
	Yes	202	19.33
	Number of children Range: 0–11	M = 2.39	SD = 1.54
Health characteristics	Functional health Range: 1–5	M = 3.03	SD = 1.04
	Times of hospitalization Range: 0–20	M = 0.66	SD = 1.43

comprehensively assess internet use across these dimensions. However, considering that older adults in China have not been using the internet for an extended period, the actual usage rate among older adults is relatively low, and the purposes of use are generally singular [50], the variations in these dimensions of internet use among this demographic are likely minimal. To sum up, given the absence of validated psychological measurement tools specifically designed for assessing internet use among older adults and the current landscape of internet use among them in China, it is relatively reasonable to focus solely on whether individuals use the internet or not as a measure of internet use among older adults.

Subjective Wellbeing

The Chinese version of the Subjective Wellbeing Scale for Chinese Citizens (SWBS–cc) was employed to assess subjective wellbeing in the CGSS dataset [51]. This scale comprises 20 items, such as "I am very satisfied compared with the people around me". Each item was rated on a six-point Likert scale ranging from "strongly disagree" to "strongly agree". After recoding the reverse-scored items, the scores for all items were summed to derive a total score representing subjective wellbeing, with higher scores indicating greater subjective wellbeing. The SWBS–cc has demonstrated satisfactory reliability and validity among Chinese older adults [44, 51]. In this study, Cronbach's α coefficient was calculated to be 0.731.

Hope

The State Hope Scale (SHS) for adults was utilized in the CGSS survey to evaluate hope [26]. This scale comprises six items organized into two dimensions: three items measure agency thinking (e.g., "I am trying my best to pursue my goal now"), and three items measure pathways thinking (e.g., "I can think of numerous ways to achieve my recent goals"). Participants rated each item on an eight-point Likert scale, ranging from "strongly disagree" to "strongly agree". The scores for the six items were summed to derive a total score representing hope, with higher scores indicating greater levels of hope. The SHS has demonstrated satisfactory reliability and validity among Chinese older adults [23, 44]. In this study, Cronbach's α coefficient was calculated to be 0.889, indicating strong internal consistency.

Subjective Social Class

The MacArthur Scale of Subjective Social Status was employed to evaluate subjective social class [35]. Respondents were asked to select the position that best reflected their circumstances on a six-point Likert scale ranging from one to five, which included the options "far below average", "below average", "average", "above average", and "far above average". Higher scores indicated higher levels

of perceived socioeconomic status and, consequently, a higher subjective social class [35]. This measurement approach has been widely adopted to assess subjective social class and has demonstrated strong reliability and validity within the older population in China [44, 52].

Control Variables

Control variables include three aspects of demographic, family, and health characteristics. Firstly, demographic characteristics were measured in terms of age, gender (0 = female, 1 = male), at work (0 = no, 1 = yes), education (0 = no, 1 = yes), and monthly income (RMB). Secondly, family characteristics were assessed in terms of living alone (0 = no, 1 = yes), spouse (0 = did not have, 1 = had), and number of children. Thirdly, health characteristics were measured in terms of number of times of hospitalization in the last year and functional health (1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent).

It is important to note that the older adults analyzed in this study were born before 1957, a time when educational attainment in China was generally low, and illiteracy was prevalent among a significant portion of the population. Using conventional educational classifications, such as "primary school", "junior high school", "high school", "undergraduate", and "graduate", could result in an abnormally skewed data distribution. To address this issue, the study adopts a simplified classification system, categorizing education into two groups: "uneducated" and "educated". This approach has been validated in prior research [53].

Urban-rural disparities in Chinese society are evident across multiple dimensions, including demographic characteristics, family structure, and health status. For example, urban older adults typically have higher levels of education and income, fewer children, and better overall health compared to their rural counterparts (Feng et al., 2024). These differences create a high degree of collinearity between urban-rural distinctions and these variables. Including both urban-rural differences and these related factors in the analysis could lead to biased estimates. Therefore, following the recommendations of existing literature [54], we chose not to include urban-rural differences as control variables in this study.

Statistical analyses

SPSS 24.0 and its PROCESS macros were utilized for data analyses. Initially, descriptive statistics and correlation analyses were conducted. Subsequently, ordinary least squares regression analysis was employed to examine Hypotheses 1 and 2. To test Hypothesis 3, the bootstrapping method with 5,000 resamples was utilized, and the mediating effect was considered significant if the 95% confidence interval did not encompass "0". Next, interaction terms were formulated to assess Hypotheses 4a and 4b. Should the interaction terms prove significant, simple slope analyses were conducted based on one standard deviation above and below the mean of subjective social class (M ± 1SD). Finally, the moderated mediating model was assessed using the bootstrapping method.

Results

Descriptive statistics and correlation analyses

Table 2 shows the means, standard deviations, and correlations of internet use, subjective wellbeing, hope and subjective social class. Internet use is positively correlated with subjective wellbeing ($r = 0.172$, $p < 0.001$) and hope ($r = 0.133$, $p < 0.001$). Subjective wellbeing is positively correlated with hope ($r = 0.437$, $p < 0.001$), and subjective social class ($r = 0.111$, $p < 0.001$).

The result of the mediating role of hope

The results for the mediating role of hope are presented in Table 3. Models 1 and 2 show that older adults who used the internet were more likely to report higher levels of subjective wellbeing ($\beta = 3.234$, $t = 3.813$, $p < 0.001$) and hope ($\beta = 1.241$, $t = 2.246$, $p < 0.05$), supporting hypotheses 1 and 2. Model 3 shows that hope was positively associated with better subjective wellbeing ($\beta = 0.614$, $t = 14.021$, $p < 0.001$). Furthermore, the bootstrapping results show that hope played a significant mediating role ($\beta = 0.762$, 95% CI = 0.014, 1.473), supporting hypothesis 3.

The results of the moderating roles of subjective social class

The results for the moderating roles of subjective social class are shown in Table 4. The interaction of internet use and subjective social class was positively associated with subjective wellbeing ($\beta = 0.124$, $t = 1.968$, $p < 0.05$), while the interaction of hope and subjective social class

Table 2 Descriptive statistics and correlation analyses of the crucial variables

Variables	M	SD	Internet use	Subjective wellbeing	Hope
Internet use	0.263	0.441	1		
Subjective wellbeing	82.769	11.572	0.172***	1	
Hope	25.437	7.418	0.133***	0.437***	1
Subjective social class	2.499	0.803	0.051	0.111***	-0.038

Note. 1.*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

Table 3 Testing for the mediating role of hope

Variables	Model 1 (Subjective wellbeing)			Model 2 (Hope)			Model 3 (Subjective wellbeing)		
	β	SE	t	β	SE	t	β	SE	t
Age	0.135	0.057	2.358*	0.012	0.037	0.325	0.128	0.053	2.430*
Male (ref: female)	0.930	0.731	1.271	0.337	0.476	0.707	0.723	0.671	1.078
At work (ref: no)	0.143	0.868	0.165	0.493	0.565	0.871	−0.160	0.796	−0.201
Educated (ref: no)	4.111	0.898	4.580***	2.722	0.585	4.655***	2.439	0.832	2.933**
Monthly income	0.000	0.000	1.897	0.000	0.000	1.101	0.000	0.000	1.587
Have a spouse (ref: no)	−0.057	1.035	−0.056	1.369	0.675	2.029*	−0.898	0.951	−0.944
Living alone (ref: no)	1.894	1.091	1.737	0.954	0.711	1.343	1.308	1.001	1.307
Number of children	−0.294	0.252	−1.167	−0.099	0.164	−0.601	−0.233	0.231	−1.010
Times of hospitalization	−0.743	0.245	−3.040**	−0.398	0.159	−2.498*	−0.499	0.225	−2.219*
Functional health	0.207	0.058	3.564***	0.076	0.038	2.023*	0.160	0.053	3.001**
Internet use	3.234	0.848	3.813***	1.241	0.553	2.246*	2.472	0.779	3.171**
Hope							0.614	0.044	14.021***
Bootstrapping results for the mediating of hope on the association between internet use and subjective wellbeing									
Boot	*Effect*	*SE*	*LLCI*	*ULCI*					
Unstandardized	0.762	0.377	0.014	1.473					
Standardized	0.066	0.033	0.001	0.128					

Note. (1) *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$; (2) The coefficients are unstandardized

Table 4 Testing for the moderating roles of subjective social class

Variables	Model 4 (Subjective wellbeing)		
	β	SE	t
Age	0.012	0.004	2.611**
Male (ref: female)	0.059	0.058	1.032
At work (ref: no)	−0.008	0.068	−0.123
Educated (ref: no)	0.198	0.071	2.778**
Monthly income	0.001	0.001	1.431
Have a spouse (ref: no)	−0.063	0.082	−0.773
Living alone (ref: no)	0.115	0.086	1.344
Number of children	−0.026	0.019	−1.291
Times of hospitalization	−0.044	0.019	−2.281*
Functional health	0.014	0.005	2.947**
Internet use	0.212	0.067	3.159**
Hope	0.393	0.028	14.078***
Subjective social class	−0.128	0.031	−4.046***
Internet use × Subjective social class	0.124	0.063	1.968*
Hope × Subjective social class	−0.068	0.028	−2.461**

Note. (1) *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$; (2) The coefficients are standardized

was negatively associated with subjective wellbeing ($\beta = -0.068$, $t = -2.461$, $p < 0.01$). As illustrated in Fig. 2; Table 4, when the subjective social class was low, the association between internet use and subjective wellbeing was not significant, but when the subjective social class was high, the association was significant ($\beta_{low} = 0.089$, $t = 0.934$, $p = 0.351$; $\beta_{high} = 0.336$, $t = 3.781$, $p < 0.001$). Therefore, hypothesis 4a was supported. Contrary to the above direction of the moderating role, when the subjective social class was low, the association between hope and subjective wellbeing was larger than it was for older adults with high subjective social class ($\beta_{low} = 0.461$, $t = 11.637$, $p < 0.001$; $\beta_{high} = 0.325$, $t = 8.235$, $p < 0.001$), supporting hypothesis 4b.

Discussion

Association between internet use and subjective wellbeing

This study demonstrates a significant association between internet use and higher levels of subjective wellbeing among older adults. Existing research primarily focuses on exploring the relationship between internet use and subjective wellbeing, along with other outcome variables, in children and adolescents [3–5]. Our findings confirm that despite differences between children and adolescents, and older adults in the purpose, intensity, duration, and psychological experience of internet use [7], both groups may experience changes in subjective wellbeing due to internet use. Additionally, this finding aligns with previous research on internet use and

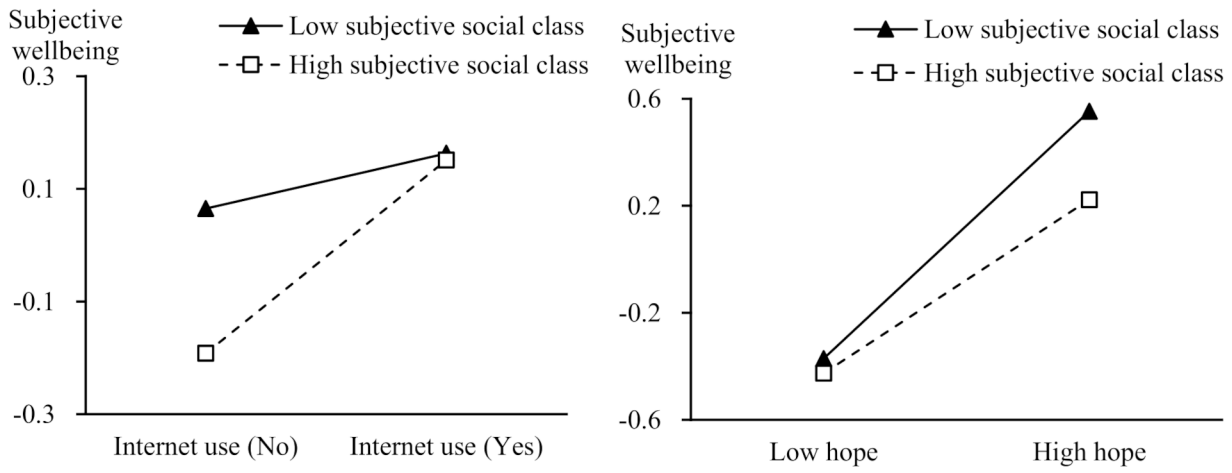

Fig. 2 The moderating roles of subjective social class by applying the simple slope analyses. Variables had been standardized

subjective wellbeing among older adults [9, 10, 13, 15]. Compared to this literature, the strengths of this study are twofold. First, it employs a multi-item scale to comprehensively measure subjective wellbeing, leading to more accurate conclusions. Second, by focusing on Chinese older adults, this study contributes to the literature within the context of a collectivist culture.

To elucidate the above association, it is imperative to consider the challenges older adults face as they age, including functional impairments, which may impede their ability to maintain social networks and engage in activities, ultimately impacting their subjective wellbeing. Internet use serves as a potential remedy to overcome these barriers, allowing older adults to transcend functional limitations and geographical distances [14]. Through internet use, older adults can seek information, communicate with others, and participate in online entertainment, compensating for deficiencies in real-world social networks and activities participation. Given the importance of robust social connections and engagement in activities for subjective wellbeing among older adults [20], internet use plays a pivotal role in enhancing their subjective wellbeing.

Mediating role of hope

This study also revealed that older adults who used the internet were more likely to report higher levels of hope, a finding explicable through the lens of hope theory. Firstly, older adults can acquire both informational and emotional support through internet functionalities such as information searching and communication. Social support has been shown to augment subjective wellbeing [55]. Consequently, internet use may bolster older adults' pathways thinking toward goals of subjective wellbeing, which is the preferential goal of older adults highlighted by the socioemotional selectivity theory [56]. Secondly, internet use is associated with higher levels of self-efficacy and sense of control, thereby fulfilling psychological needs for autonomy and competence. Additionally, internet use can facilitate closer connections with society, further addressing the psychological need for relationships. According to the self-determination theory [33], autonomy, competence, and relationships are foundational for forming intrinsic motivation, indicating internet use has the potential to fortify older adults' agency thinking toward goals. In summary, internet use enhances older adults' pathways thinking and agency thinking toward goals, ultimately leading to improvements in their levels of hope.

This study further revealed that hope plays a significant role in subjective wellbeing and mediates the relationship between internet use and subjective wellbeing. This finding is in line with the argument put forth by Yilmaz and Karaoglan Yilmaz [6], suggesting that individuals' states of hope can influence their psychological wellbeing. Moreover, Ellis's ABC theory was employed to elucidate the mediating role of hope. According to this theory, an activating event influences a person's beliefs, which in turn affect the resulting wellbeing outcomes [34]. In this study, internet use serves as the activating event, initially impacting older adults' hope—defined as the belief regarding one's cognitive appraisals to find pathways and maintain motivation to achieve goals. Subsequently, hope acts as a predictor factor that influences subjective wellbeing. Considering that existing studies predominantly focus on the mediating roles of social networks and activities participation in the relationship between internet use and older adults' wellbeing [24, 25, 48, 49], which are known as social mechanisms, this study contributes by being one of the first to examine the mediating role of hope from the perspective of psychological mechanisms.

Moderating roles of subjective social class

The results additionally show that subjective social class moderated the association between internet use and older adults' subjective wellbeing, with the association being significant for older adults with higher subjective social class rather than for those with lower subjective social class. The result is consistent with existing studies [57, 58], in that subjective social class is a kind of positive psychological resource, and a lack of it weakens the positive associations between predictive factors and a person's wellbeing outcomes [57] and strengthens the negative relationships between predictive factors and a person's wellbeing outcomes [58]. To explain it, when older adults with lower subjective class use the internet to seek information and participate in online activities, they are also exposed to more information from individuals with higher social class in the virtual world. As a result, in the process of social comparison, they are likely to change their reference groups for comparison to individuals with a much higher social class in the virtual world, which traps them in strong feelings of relative deprivation and unfairness [40], and further undermines the positive association between internet use and subjective wellbeing for older adults with lower subjective social class. Therefore, although internet use is positively associated with subjective wellbeing for older adults with higher subjective social class, it has a relatively negative relationship with subjective wellbeing for older adults with lower subjective social class. Given that existing studies have primarily concluded that internet use significantly improves the subjective wellbeing of older adults [9, 13–15], this finding suggests that there are important boundary conditions (different levels of subjective social class of older adults) for this positive association.

The results further suggest that subjective social class moderated the association between hope and older adults' subjective wellbeing, with the association being stronger for older adults with lower subjective social class than for those with higher subjective social class, which is opposite to its moderation direction on the association between internet use and subjective wellbeing. To explain it, according to need theory, once individuals acquire sufficient psychological resources to meet demands and cope with threats from their environment, the relationship between subjective social class and subjective wellbeing should diminish [42]. Considering hope is one of the fundamental psychological needs of human beings [43], the negative relationship between lower subjective social class and a person's subjective wellbeing would be weakened. Finally, combined with ABC theory, the opposite moderating directions indicate that even though the activating event (internet use) is likely to have a negative effect on older adults with lower subjective social class, their belief related to cognitive appraisal (hope) is likely to have a positive effect on them.

Theoretical contribution

This study makes several theoretical contributions that have not been emphasized in existing research. Firstly, by confirming the positive relationship between internet use and subjective wellbeing among older adults in the Chinese context, it demonstrates that despite China's collectivist culture emphasizing offline social connections, online interactions facilitated by the internet are also highly significant for older adults. Additionally, despite regional variations in internet infrastructure development and low internet usage rates among older adults in China, these constraints do not impede older adults from benefiting from internet use to enhance their subjective wellbeing. Secondly, this study proposes and verifies the mediating role of hope between internet use and subjective wellbeing among older adults, representing psychological mechanisms. Given the limited attention in existing studies to the mediating mechanisms of the association between internet use and older adults' subjective wellbeing, coupled with a lack of exploration into psychological mechanisms, this finding provides a novel theoretical framework for understanding why internet use can improve their subjective wellbeing. Lastly, this study confirms the moderating role of subjective social class perceived by older adults, highlighting that internet use does not always lead to improved subjective wellbeing. Specifically, for older adults with a low subjective social class, internet use may expose them to more social unfairness information, thus intensifying upward social comparison and weakening the benefits of internet use on subjective wellbeing by triggering a heightened sense of deprivation and injustice.

Implications and limitations

This study has several implications. Firstly, given internet use is significantly related to older adults' subjective wellbeing, it is crucial to enhance the development of age-friendly internet devices and bridge the "digital divide" among older adults. These steps are essential prerequisites for future online interventions targeting older adults' subjective wellbeing. Secondly, the mediating role of hope in the association between internet use and older adults' subjective wellbeing underscores the importance of geriatric social workers designing online intervention strategies aimed at fostering hope among older adults using the internet. This is particularly pertinent for older adults with lower subjective social class, as interventions targeting hope may have a more pronounced role on enhancing subjective wellbeing in this group. Thirdly, the absence of discernible benefits of internet use for older adults with lower subjective social class highlights

the need to prevent these individuals from experiencing a decline in wellbeing while using the internet. To achieve this, older adults with lower subjective social class should be vigilant about the authenticity of online information. Additionally, government authorities should intensify their supervision of online content and act as a "gatekeeper" to ensure the safety and reliability of internet usage among older adults.

The limitations of this study should be noted. Firstly, this study's cross-sectional design prevents it from fully addressing the issue of reverse causality between variables. Specifically, previous research has demonstrated a bidirectional relationship between internet use and adult welfare outcomes [59]. As such, the conclusions of this study should be interpreted with caution, and future research employing longitudinal designs is necessary to address potential reverse causality. Despite this limitation, several factors provide theoretical and empirical support for the relationships observed in this study. On one hand, from a theoretical perspective, ABC theory posits that an activating event (e.g., internet use) influences an individual's beliefs and cognitive appraisals (e.g., hope), which subsequently affect emotional or behavioral outcomes (e.g., subjective wellbeing) [34]. This theoretical framework establishes a logical causal relationship among the variables investigated in this study. On the other hand, from an empirical standpoint, existing research employing longitudinal designs [12] and instrumental variable methods [16] has validated the causal effect of internet use on the subjective wellbeing of older adults. These findings lend credibility to the proposed relationships, even within the limitations of the present study's design. Secondly, CGSS only assessed whether respondents used the internet, without investigating the purpose, intensity, and duration of usage. Consequently, this study could not comprehensively measure the status of internet use among older adults by considering these dimensions. However, given that older adults in China have not been using the internet for an extended period, the actual usage rate among this demographic is relatively low, and the objectives of use are generally singular (Jin et al., 2024), suggesting that variations in these dimensions of internet use among older adults in China may not be substantial. Therefore, it is relatively reasonable to use the binary variable of whether to use the internet as the measurement, which has been also widely employed in existing literature [48, 49]. Furthermore, objective social class offers a clear advantage in terms of measurement compared to subjective social class. While this study accounted for the potential influence of objective social class by controlling for variables such as education level and monthly income, future research should aim to more precisely examine the moderating effects of objective social class. Additionally, comparing these findings with those derived from subjective social class would provide a more comprehensive understanding of their respective roles. Finally, this study selected hope as the psychological mechanism to understand the relationship between internet use and older adults' subjective wellbeing. However, apart from hope, other psychological processes warrant attention, such as self-efficacy, a sense of meaning in life, and psychological resilience. Research on other psychological mechanisms is warranted in the future.

Conclusion

Based on the analysis of 1,045 nationally representative samples of Chinese older adults, this study draws the following conclusions: Firstly, internet use is significantly associated with a higher level of subjective wellbeing among Chinese older adults. Secondly, hope mediates the above relationship, representing a psychological mechanism, which could be elucidated by the hope theory. Thirdly, the perceived subjective social class of older adults plays significant moderating roles. On one hand, the positive relationship between internet use and subjective wellbeing is significant among older adults of high subjective social class but not among those of low subjective social class. On the other hand, compared to older adults from high subjective social classes, the relationship between hope and subjective wellbeing is stronger among those from low subjective social class. Hence, the directions of the moderating role of subjective social class on these two associations are opposite, and social comparison theory could be utilized to explain the moderating roles of subjective social class.

The significance of these conclusions is twofold: Firstly, by examining the mediating role of hope, this study not only theoretically unveils the psychological mechanism underlying the relationship between internet use and older adults' subjective wellbeing but also practically suggests that internet-based intervention strategies should prioritize targeting hope among older adults to enhance their subjective wellbeing. Secondly, by exploring the mediating roles of subjective social class, this study theoretically demonstrates that there is an important boundary condition (different levels of subjective social class) in the positive relationship between internet use and older adults' subjective wellbeing. In practice, it suggests the need to take measures to compensate older adults with low subjective social class for the potential reduction in their subjective wellbeing when utilizing the internet.

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Author contributions

"Denghao Zhang was involved in writing–original draft, and writing–review & editing of this article. Jiaming Shi was involved in conceptualization, methodology, writing–original draft, writing–review & editing, supervision,

and project administration of this article. Zhixin Feng was involved in review & editing, visualization, validation, and supervision of this article. All authors reviewed the manuscript."

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Data availability
The data for the analysis of this paper comes from the secondary data of the "China General Social Survey", and more specific information can obtain through the link of http://cgss.ruc.edu.cn/.

Declarations

Ethics approval and consent to participate
the data collection was approved by the Ethics Committee of the Institute of Renmin University of China. Each participant was informed of the purpose of this survey. The participation of each participant in the study was voluntary, and they were assured that their privacy would be strictly protected.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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References

1. Chan BCL, Luciano M, Lee B. Interaction of physical activity and personality in the subjective wellbeing of older adults in Hong Kong and the United Kingdom[J]. Behav Sci. 2018;8(8):71. https://doi.org/10.3390/bs8080071.
2. Steptoe A, Deaton A, Stone AA. Subjective wellbeing, health, and ageing[J]. Lancet. 2015;385(9968):640–8. https://doi.org/10.1016/S0140-6736(13)61489-0.
3. Avci U, Karaoglan Yilmaz FG, Yilmaz R. Parental attitude and Instagram addiction: the mediating role of obsessive-compulsive disorder[J]. Psychol Sch. 2023;60(3):830–42. https://doi.org/10.1002/pits.22796.
4. Karaoglan Yilmaz FG, Ustun AB, Zhang K, et al. Smartphone addiction, nomophobia, depression, and social appearance anxiety among college students: a correlational study[J]. J Ration Emot Cogn Behav Ther. 2023. https://doi.org/10.1007/s10942-023-00516-z.
5. Yilmaz R, Sulak S, Griffiths MD, et al. An exploratory examination of the relationship between internet gaming disorder, smartphone addiction, social appearance anxiety and aggression among undergraduate students[J]. J Affect Disord Rep. 2023;11:100483. https://doi.org/10.1016/j.jadr.2023.100483.
6. Yilmaz R, Karaoglan Yilmaz FG. Problematic internet use in adults: the role of happiness, psychological resilience, dispositional hope, and self-control and self-management[J]. J Ration Emot Cogn Behav Ther. 2023;41(3):727–45. https://doi.org/10.1007/s10942-022-00482-y.
7. Feng Z, Shi J, Jiang C, et al. The impact of internet use on depression symptoms among older adults: the mediating role of social networks and the moderating role of urban-rural disparity[J]. J Psychol Sci. 2024;47(1):161–9. https://doi.org/10.16719/j.cnki.1671-6981.20240119. (In Chinese).
8. Erickson J, Johnson GM. Internet use and psychological wellness during late adulthood[J]. Can J Aging. 2011;30(2):197–209. https://doi.org/10.1017/S0714980811000109.
9. Nakagomi A, Shiba K, Kawachi I, et al. Internet use and subsequent health and well-being in older adults: an outcome-wide analysis[J]. Comput Hum Behav. 2022;130:107156. https://doi.org/10.1016/j.chb.2021.107156.
10. Nimrod G. Changes in internet use when coping with stress: older adults during the COVID-19 pandemic[J]. Am J Geriatr Psychiatry. 2020;28(10):1020. https://doi.org/10.1016/j.jagp.2020.07.010.
11. Nimrod G, Bachner YG, Lifshitz R. Internet use and well-being in later life: a functional approach[J]. Aging Ment Health. 2018;22(1):85–91. https://doi.org/10.1080/13607863.2016.1232370.
12. Szabo A, Allen J, Stephens C, et al. Longitudinal analysis of the relationship between purposes of internet use and well-being among older adults[J]. Gerontologist. 2019;59(1):58–68. https://doi.org/10.1093/geront/gny036.
13. Rosenberg D, Taipale S. Social and satisfied? Social uses of mobile phone and subjective wellbeing in later life[J]. Hum Technol. 2022;18(1):45–65. https://doi.org/10.14254/1795-6889.2022.18-1.4.
14. Li J, Zhou X. Internet use and Chinese older adults' subjective well-being (SWB): the role of parent-child contact and relationship[J]. Comput Hum Behav. 2021;119:106725. https://doi.org/10.1016/j.chb.2021.106725.
15. Shi J, Liu M, Fu G, et al. Internet use among older adults: determinants of usage and impacts on individuals' well-being[J]. Comput Hum Behav. 2023;139:107538. https://doi.org/10.1016/j.chb.2022.107538.
16. Lu H, Kandilov IT. Does mobile internet use affect the subjective well–being of older Chinese adults? An instrumental variable quantile analysis[J]. J Happiness Stud. 2021;22:3137–56. https://doi.org/10.1007/s10902-021-00365-6.
17. Chen E, Wood D, Ysseldyk R. Online social networking and mental health among older adults: a scoping review[J]. Can J Aging. 2022;41(1):26–39. https://doi.org/10.1017/S0714980821000040.
18. Schehl B, Leukel J, Sugumaran V. Understanding differentiated internet use in older adults: a study of informational, social, and instrumental online activities[J]. Comput Hum Behav. 2019;97:222–30. https://doi.org/10.1016/j.chb.2019.03.031.
19. Uchino BN, Cacioppo JT, Kiecolt-Glaser JK. The relationship between social support and physiological processes: a review with emphasis on underlying mechanisms and implications for health[J]. Psychol Bull. 1996;119(3):488–531. https://doi.org/10.1037/0033-2909.119.3.488.
20. Havighurst RJ. Successful aging[J]. Gerontologist. 1961;1(1):8–13. https://doi.org/10.1093/geront/1.1.8.
21. Abdel-Khalek AM. Measuring happiness with a single-item scale[J]. Soc Behav Pers. 2006;34(2):139–50. https://doi.org/10.2224/sbp.2006.34.2.139.
22. Hofstede G, Bond MH. Hofstede's culture dimensions: an independent validation using Rokeach's value survey[J]. J Cross Cult Psychol. 1984;15(4):417–33. https://doi.org/10.1177/0022002184015004003.
23. Dang Q, Zhang B. Linkage from self-sacrifice to hope through the intervening roles of perceived family support and attitudes to aging in Chinese older adults[J]. J Happiness Stud. 2022;23(6):2405–26. https://doi.org/10.1007/s10902-022-00504-7.
24. Chopik WJ. The benefits of social technology use among older adults are mediated by reduced loneliness[J]. Cyberpsychol Behav Soc Netw. 2016;19(9):551–6. https://doi.org/10.1089/cyber.2016.0151.
25. Yu K, Wu S, Chi I. Internet use and loneliness of older adults over time: the mediating effect of social contact[J]. J Gerontol B Psychol Sci Soc Sci. 2021;76(3):541–50. https://doi.org/10.1093/geronb/gbaa004.
26. Snyder CR, Sympson SC, Ybasco FC, et al. Development and validation of the state hope scale[J]. J Pers Soc Psychol. 1996;70(2):321–35. https://doi.org/10.1037/0022-3514.70.2.321.
27. Bansal N, Choudhary H. Growing old in the digital era: a qualitative study of internet use and outcomes among urban Indian older adults[J]. Work Older People. 2024;28(4):317–35. https://doi.org/10.1108/WWOP-08-2023-0032.
28. Liu S, Zhao H, Fu J, et al. Current status and influencing factors of digital health literacy among community-dwelling older adults in southwest China: a cross-sectional study[J]. BMC Public Health. 2022;22(1):996. https://doi.org/10.1186/s12889-022-13378-4.
29. Llorente-Barroso C, Kolotouchkina O, Mañas-Viniegra L, et al. ICT-mediated learning as a form of socio-emotional support for older adults[J]. Interact Des Archit. 2022;548–33. https://doi.org/10.55612/s-5002-054-001.
30. Ashida S, Heaney CA. Differential associations of social support and social connectedness with structural features of social networks and the health status of older adults[J]. J Aging Health. 2008;20(7):872–93. https://doi.org/10.1177/0898264308324626.
31. Lang FR, Featherman DL, Nesselroade JR. Social self-efficacy and short-term variability in social relationships: the MacArthur successful aging studies[J]. Psychol Aging. 1997;12(4):657–66. https://doi.org/10.1037/0882-7974.12.4.657.

32. Khoo SS, Yang H. Social media use improves executive functions in middle-aged and older adults: a structural equation modeling analysis[J]. Comput Hum Behav. 2020;111:106388. https://doi.org/10.1016/j.chb.2020.106388.
33. Deci EL, Ryan RM. The what and why of goal pursuits: human needs and the self-determination of behavior[J]. Psychol Inq. 2000;11(4):227–68. https://doi.org/10.1207/S15327965PLI1104_01.
34. Dryden W, Bond FW. Reason and emotion in psychotherapy: Albert Ellis[J]. Br J Psychiatry. 1994;165(1):131–5. https://doi.org/10.1192/bjp.165.1.131.
35. Adler NE, Boyce T, Chesney MA, et al. Socioeconomic status and health: the challenge of the gradient[J]. Am Psychol. 1994;49(1):15–24. https://doi.org/10.1037/0003-066X.49.1.15.
36. Festinger L. A theory of social comparison processes[J]. Hum Relat. 1954;7(2):117–40. https://doi.org/10.1177/001872675400700202.
37. Wheeler L. Motivation as a determinant of upward comparison[J]. J Exp Soc Psychol. 1966;1(1):27–31. https://doi.org/10.1016/0022-1031(66)90062-X.
38. Wills TA. Downward comparison principles in social psychology[J]. Psychol Bull. 1981;90(2):245–71. https://doi.org/10.1037/0033-2909.90.2.245.
39. Gibbons FX, Lane DJ, Gerrard M, et al. Comparison-level preferences after performance: is downward comparison theory still useful?[J]. J Pers Soc Psychol. 2002;83(4):865–80. https://doi.org/10.1037/0022-3514.83.4.865.
40. Cundiff JM, Matthews KA. Is subjective social status a unique correlate of physical health? A meta-analysis[J]. Health Psychol. 2017;36(12):1109–25. https://doi.org/10.1037/hea0000534.
41. Feng T, Liu Y. The impact of internet use on the subjective class identity of the elderly in the digital age[J]. J Xi'an Jiaotong Univ (Soc Sci). 2022;42(2):122–31. https://doi.org/10.15896/j.xjtuskxb.202202013. (In Chinese).
42. Chen B, Luo L, Wu X, et al. Are the lower class really unhappy? Social class and subjective well-being in Chinese adolescents: moderating role of sense of control and mediating role of self-esteem[J]. J Happiness Stud. 2021;22(2):825–43. https://doi.org/10.1007/s10902-020-00253-5.
43. Schüler J, Baumann N, Chasiotis A, et al. Implicit motives and basic psychological needs[J]. J Pers. 2019;87(1):37–55. https://doi.org/10.1111/jopy.12431.
44. Shi J, Jiang C. Hope agency and hope pathways: exploring the relationships between social class and subjective wellbeing in different age groups[J]. Curr Psychol. 2024a;43(12):11303–13. https://doi.org/10.1007/s12144-023-05229-1.
45. Dhir A, Chen S, Nieminen M. Psychometric validation of the Chinese compulsive internet use scale (CIUS) with Taiwanese high school adolescents[J]. Psychiatr Q. 2015;86(4):581–96. https://doi.org/10.1007/s11126-015-9351-9.
46. Lin C, Ganji M, Pontes HM, et al. Psychometric evaluation of the persian internet disorder scale among adolescents[J]. J Behav Addict. 2018;7(3):665–75. https://doi.org/10.1556/2006.7.2018.88.
47. Mak K, Lai C, Ko C, et al. Psychometric properties of the revised Chen Internet Addiction Scale (CIAS-R) in Chinese adolescents[J]. J Abnorm Child Psychol. 2014;42(7):1237–45. https://doi.org/10.1007/s10802-014-9851-3.
48. Kamin ST, Seifert A, Lang FR. Participation in activities mediates the effect of internet use on cognitive functioning in old age[J]. Int Psychogeriatr. 2021;33(1):83–8. https://doi.org/10.1017/S1041610220003634.
49. Li Z, Yang M. Internet use and depressive symptoms among Chinese older adults: the mediation and suppression effects of social capital[J]. Front Psychol. 2021;12:729790. https://doi.org/10.3389/fpsyg.2021.729790.
50. Jin Y, Hu W, Feng Y. Internet use and the life of older adults aged 50 and above in the digital era: findings from a national survey[J]. Popul Res. 2024;48(1):40–55. (In Chinese).
51. Xing Z, Huang L. The relationship between age and subjective well-being: evidence from five capital cities in mainland China[J]. Soc Indic Res. 2014;117(3):743–56. https://doi.org/10.1007/s11205-013-0396-6.
52. Du G, Lyu H, Li X. Social class and subjective well-being in Chinese adults: the mediating role of present fatalistic time perspective[J]. Curr Psychol. 2022;41(8):5412–9. https://doi.org/10.1007/s12144-020-01058-8.
53. Shi J, Jiang C. Association between participation in adult education and subjective wellbeing among older adults: the mediating roles of social isolation and digital isolation and the moderating roles of educational level[J]. Educ Gerontol. 2024b;50(8):746–61. https://doi.org/10.1080/03601277.2024.2328890.
54. Shi J, Liu X, Feng Z. Age-friendly cities and communities and cognitive health among Chinese older adults: evidence from the China Health and Retirement Longitudinal Studies[J]. Cities. 2023;132:104072. https://doi.org/10.1016/j.cities.2022.104072.
55. Kahn RL, Antonucci TC. Convoys over the life course: attachment, roles, and social support[M]. Life-Span Dev Behav. 1980;3:253–86.
56. Carstensen LL. Social and emotional patterns in adulthood: support for socioemotional selectivity theory[J]. Psychol Aging. 1992;7(3):331–8. https://doi.org/10.1037/0882-7974.7.3.331.
57. Marques S, Swift HJ, Vauclair C, et al. Being old and ill' across different countries: social status, age identification and older people's subjective health[J]. Psychol Health. 2015;30(6):699–74. https://doi.org/10.1080/08870446.2014.938742.
58. Mu C, Jester DJ, Cawthon PM, et al. Subjective social status moderates back pain and mental health in older men[J]. Aging Ment Health. 2022;26(4):810–7. https://doi.org/10.1080/13607863.2021.1899133.
59. Hartanto A, Yong JC, Toh WX, et al. Cognitive, social, emotional, and subjective health benefits of computer use in adults: a 9-year longitudinal study from the midlife in the United States (MIDUS)[J]. Comput Hum Behav. 2020;104:106179. https://doi.org/10.1016/j.chb.2019.106179.

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