

Internet Use and Subjective Well-Being among Urban Elderly Women: A Quantitative Study from Chengdu, China

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ABSTRACT

The accelerated digitalisation of everyday life in urban China has reshaped how older citizens sustain social ties, yet older women remain among the least connected groups, and the cultural consequences of their digital participation are poorly understood. Drawing on the competing social compensation and displacement hypotheses, this study examines whether and how internet use is associated with the subjective well-being of urban elderly women. Cross-sectional questionnaire data were collected from 412 women aged 60 years and above residing in urban districts of Chengdu, using a multistage sampling design. Internet use intensity, perceived online social support, loneliness, life satisfaction and psychological well-being were measured with established scales. Hierarchical regression showed that internet use intensity was positively associated with subjective well-being after adjusting for demographic and health covariates. Bootstrap mediation analysis indicated that this association operated through two relational mechanisms, namely greater perceived online social support and reduced loneliness. A small but statistically significant negative association between internet use and the frequency of face-to-face contact provided limited evidence of displacement, yet the compensatory pathways outweighed it, yielding a net positive relationship with well-being. The hypothesised buffering of the internet for the most socially isolated women was not supported. The findings position digital participation as a modest instrument of social inclusion for ageing women, while cautioning against treating online contact as a substitute for embodied community life. Implications for digital inclusion policy in ageing Chinese cities are discussed.

Keywords: internet use; subjective well-being; older women; social compensation; digital inclusion; urban China

INTRODUCTION

Population ageing and digitalisation are two of the defining social transformations of contemporary China, and their intersection is reorganising the cultural fabric of urban later life. By the end of 2023 the population aged 60 and above had reached approximately 297 million, more than a fifth of the national total, while the proportion of older adults who routinely use the internet has risen sharply over the past decade (Wen et al., 2023). For a growing number of older citizens, digital platforms such as WeChat have become the principal infrastructure through which family obligations, friendship, civic information and consumption are now conducted. This shift raises a question that is simultaneously empirical and cultural: when older people move important parts of their social lives online, does their well-being improve, and through what relational processes does any benefit arise?

The question is not gender-neutral. Older women occupy a distinctive position within China's so-called grey digital divide. They tend to have lower lifetime educational attainment, more interrupted labour-market histories and longer life expectancy than older men, which together produce both greater exposure to widowhood and to living alone and weaker structural access to digital skills (Tang et al., 2022). At the same time, women have historically performed the bulk of kin-keeping, the relational labour of maintaining family ties across generations and households. As this labour migrates onto digital platforms, the consequences of being connected, or of remaining unconnected, are likely to fall on older women in particular ways. Understanding the well-being implications of internet use for this group is therefore a matter both of digital inclusion and of cultural equity in an ageing society.

Chengdu offers an especially informative setting for this inquiry. As one of China's most rapidly ageing and most thoroughly digitalised metropolises, the city compresses into a single locale the demographic and technological pressures that will confront the wider country over coming decades. Older women in Chengdu live amid near-universal mobile connectivity, cashless payment systems and platform-mediated public services, so that the costs of digital exclusion are unusually visible and the potential gains from digital participation unusually concrete. Studying this vanguard population allows the cultural dynamics of digital ageing to be observed in an advanced form.

These dynamics are unfolding against an active policy backdrop. Successive national initiatives have sought to extend digital infrastructure to older citizens and to remove the barriers that exclude them from app-based services, reframing digital participation as a dimension of public welfare rather than a private convenience. Yet such initiatives have tended to gauge success by access and usage rates, paying less attention to whether connectivity translates into the relationships and the sense of inclusion that underpin well-being. The present study speaks to this gap by asking not merely whether older women are online, but what being online does for the quality of their lives, and for whom the benefits are greatest.

Research on internet use and the well-being of older adults has grown rapidly, yet the evidence remains divided. A substantial body of work reports that internet use is positively associated with subjective well-being, life satisfaction and mental health among older Chinese adults (Yang et al., 2021; Jin et al., 2023; Yan et al., 2023). Other studies caution that the relationship is conditional, weaker than it first appears, or even negative for some groups, and that the psychological pathways through which any benefit operates are not yet settled (Xie et al., 2021; Zhang et al., 2024a). Much of this literature treats older adults as an undifferentiated category, entering gender as a control variable rather than examining women in their own right, and tends to report direct associations without modelling the relational mechanisms that theory predicts should carry the effect.

This study addresses these gaps in three ways. First, it focuses specifically on urban elderly women rather than on older adults in general, foregrounding a population whose digital experience is shaped by gendered disadvantage. Second, it tests an explicitly theorised model in which internet use is linked to subjective well-being through online social support and loneliness, the two mechanisms at the heart of the social compensation and displacement debate. Third, it examines the displacement claim directly, asking whether internet use is associated with reduced face-to-face contact rather than assuming that online and offline sociability are complementary. In doing so the paper speaks to the journal's concern with digital cultures and social change, treating older women's digital participation not merely as a behaviour to be correlated with a mood score but as a site where cultural inclusion and exclusion in the ageing city are produced. The remainder of the paper reviews the relevant literature and theory, sets out the methodology, presents the empirical results, and discusses their implications for theory, policy and the cultural politics of digital ageing.

LITERATURE REVIEW

Subjective Well-Being in Later Life

Subjective well-being refers to people's own cognitive and affective evaluations of their lives, conventionally comprising a cognitive component, satisfaction with life, and an affective component reflecting the balance of positive over negative states (Diener et al., 1985). In gerontology, subjective well-being is widely treated as a central indicator of successful ageing because it integrates health, social and material circumstances into a holistic self-assessment that predicts morbidity, service use and even mortality. The construct has accordingly become a focus of social policy, with governments and international organisations increasingly treating the well-being of older citizens as a measurable objective rather than a by-product of economic growth.

For older women specifically, well-being is shaped by gendered exposures in later life. Women's greater longevity means that they are more likely than men to spend their final decades as widows, often living alone, and frequently with primary responsibility for the care of grandchildren. These circumstances condition the resources available for a satisfying life and make the relational quality of everyday existence, together with the channels

through which relationships are sustained, especially consequential for women's well-being. Where mobility declines and co-resident kin are absent, the capacity to remain socially embedded becomes a decisive determinant of whether later life is experienced as flourishing or as isolation.

Internet Use and Well-Being among Older Adults

Empirical findings on internet use and older adults' well-being fall into three broad patterns. The first and largest reports positive associations. Internet use predicts higher life satisfaction and subjective well-being among the Chinese elderly, with benefits concentrated among urban, more educated and eastern residents (Yang et al., 2021; Zhang et al., 2024a). Internet use has also been linked to better self-rated physical, mental and overall health in nationally representative middle-aged and older Chinese samples (Wen et al., 2023), and to higher well-being across age groups in analyses of the China General Social Survey (Yan et al., 2023). Evidence from the post-pandemic period suggests that these associations have persisted, and in some respects strengthened, as digital participation has become normalised among older cohorts (Qin & Li, 2025).

A second pattern is conditional or mediated. Several studies find that the apparent benefit operates indirectly, through social capital (Yang et al., 2022), cultural consumption (Wu et al., 2025), or improved mental health, rather than as a direct effect (Hu & Tan, 2025). In this view internet use is not intrinsically beneficial; it is beneficial to the extent that it activates resources and relationships that themselves promote well-being. A third, smaller pattern is cautionary, reporting that internet use can be associated with more depressive symptoms for certain subgroups of older adults, including women and the less educated (Xie et al., 2021). Taken together, this divided evidence indicates that the relationship is real but contingent, and that progress depends on specifying the mechanisms and the populations involved rather than estimating a single average effect.

A further refinement concerns the manner of use rather than its sheer quantity. A growing number of studies distinguish active forms of engagement, such as messaging, posting and participating in groups, from passive consumption, such as scrolling and watching, and report that the two relate differently to well-being. Active and communicative use tends to strengthen social ties and to predict more favourable outcomes, whereas passive use shows weaker or inconsistent associations. This distinction matters for older women, whose online repertoires are often centred on family communication, and it implies that the well-being value of internet use depends on what the technology is used to do. The internet use measure adopted in the present study therefore emphasises communicative and participatory activities alongside informational and transactional ones.

The Social Compensation and Displacement Hypotheses

Two long-standing and competing hypotheses frame how mediated communication relates to well-being. The displacement hypothesis, rooted in early findings that time spent online came at the expense of local social involvement (Kraut et al., 1998), holds that internet use substitutes for face-to-face interaction and therefore erodes the embodied social contact on which well-being depends. The social compensation hypothesis holds the opposite, proposing that online communication supplements offline life, allowing people with constrained mobility or thin local networks to build and maintain supportive ties, and thereby enhancing well-being (Valkenburg & Peter, 2007). The two hypotheses are not mutually exclusive. The same person may experience modest displacement of some offline contact alongside compensatory gains in support, so that the net outcome remains an empirical question rather than a foregone conclusion.

The compensation logic is particularly relevant to urban elderly women. Reduced mobility, the loss of a spouse and the dispersal of adult children across cities mean that valued relationships increasingly cannot be sustained through physical co-presence. Where digital platforms allow these women to remain woven into family and community life, the compensation hypothesis predicts well-being gains, and predicts further that such gains should be largest for the most isolated, for whom the marginal value of an additional channel of connection is greatest. Conversely, if heavy online engagement crowds out the neighbourhood sociability that remains central to urban Chinese later life, the displacement hypothesis anticipates costs. Recent longitudinal work outside China suggests that social internet use is associated with subsequent reductions in loneliness without a clear mediating role of contact frequency (Janssen et al., 2025), while cohort analyses show that rising internet use reshapes, rather than simply increases, older adults' social connectedness (Ang, 2022).

Online Social Support and Loneliness as Mechanisms

Two relational constructs translate the abstract compensation and displacement hypotheses into measurable pathways. Online social support, understood as the perception that one can obtain emotional and informational help through digital channels, represents the compensatory resource that internet use is theorised to generate. Loneliness, the distressing sense that one's social relationships are deficient, represents the relational deficit that compensation is theorised to repair. A consistent literature links internet use among older Chinese adults to lower loneliness, particularly where online activity strengthens family and friend support and social participation (Tang

et al., 2022; Zhang et al., 2024b), although effects vary by residence and by the quality rather than the sheer quantity of contact (Hu & Tan, 2025).

Evidence from other settings reinforces this relational reading. Studies of digital social media among older adults report that online connection can reduce perceived loneliness and social isolation, though the effect is uneven and depends on how platforms are used (Kusumota et al., 2022). Reviews of interventions to reduce isolation and loneliness in later life likewise identify digitally mediated social connection as a promising but inconsistent mechanism, effective when it deepens meaningful relationships and weak when it merely increases the volume of superficial contact (Paquet et al., 2023; Shekelle et al., 2024). Bringing online social support and loneliness into a single model allows the present study to test the compensation account directly, by asking whether internet use is associated with well-being because it raises support and lowers loneliness, rather than inferring a mechanism from a direct association alone.

Gender, Ageing and the Digital Divide in Urban China

The relational gains that the compensation hypothesis anticipates cannot be realised without access, and access is unequally distributed. The grey digital divide describes the gap in access, skills and confidence that separates many older adults from the digital mainstream, and this divide is itself gendered. Older women in China are, on average, less likely than older men to use the internet and more likely to depend on family members to mediate their digital participation, a pattern rooted in cohort differences in education and labour-force experience (Tang et al., 2022). The result is that the very women who might gain most from online compensation, those who are widowed, living alone or housebound, are also those least equipped to convert access into supportive relationships. This tension between the promise of compensation and the reality of unequal digital capability is central to interpreting the well-being consequences of internet use for ageing women, and it motivates the attention this study gives to the moderating role of offline social contact.

The cultural specificity of this divide deserves emphasis. In urban China, the family group chat and the platform feed have become arenas in which grandparenting, festival observance and the circulation of health advice are conducted, activities that have traditionally fallen within women's domain. For older women, competence on these platforms is therefore bound up with the performance of valued social roles, and exclusion from them risks a loss not only of information but of standing within the family. This cultural framing suggests that the well-being stakes of digital participation for ageing women extend beyond individual mood to the maintenance of identity and belonging, and it reinforces the case for treating their connectivity as a question of inclusion rather than of consumer choice.

Research Framework and Hypotheses

Synthesising this literature, the study is grounded in the social compensation and displacement framework and models internet use as a predictor of subjective well-being that operates through online social support and loneliness, while testing whether any well-being benefit is conditioned by the density of offline contact. In this framework, internet use intensity is the independent variable; online social support and loneliness are the mediating mechanisms through which compensation is theorised to operate; face-to-face contact serves as the displacement indicator and as a moderator; and subjective well-being is the dependent variable, with demographic and health characteristics entered as control variables. The following hypotheses are proposed for urban elderly women in Chengdu:

- **H1.** Internet use intensity is positively associated with subjective well-being, net of demographic and health covariates.
- **H2.** Perceived online social support mediates the positive association between internet use and subjective well-being, representing the compensation pathway.
- **H3.** Loneliness mediates the association between internet use and subjective well-being, such that internet use is related to lower loneliness and thereby to higher well-being.
- **H4.** The positive association between internet use and well-being is stronger for women with less frequent face-to-face contact, as predicted by the social compensation account.

In addition, the displacement hypothesis is examined directly by testing whether internet use is associated with reduced frequency of face-to-face social contact, net of covariates.

METHODOLOGY

Study Design

This study employed a quantitative, cross-sectional survey design within a deductive framework to examine how internet use is associated with the subjective well-being of urban elderly women. The survey method was

chosen for its efficiency in collecting standardised data from a sizeable sample and for its suitability for testing the hypothesised relationships through correlational and regression-based analyses. The design enabled assessment of the direct association between internet use and well-being, of the mediating roles of online social support and loneliness, and of the moderating and displacement effects of face-to-face contact.

Participants and Sampling

Participants were 412 women aged 60 years and above residing in the urban districts of Chengdu. Eligibility criteria were female sex, age 60 or older, permanent residence in an urban district for at least one year, and the absence of diagnosed cognitive impairment that would preclude informed participation. A multistage sampling design was used. In the first stage, four urban districts were selected to reflect variation in socioeconomic profile. In the second stage, two residential communities were randomly selected within each district. In the third stage, eligible women were recruited from community registers and neighbourhood activity centres, with quota controls on age band to avoid over-representation of the youngest old. The achieved sample size exceeds the minimum required to detect a small-to-moderate effect in multiple regression with nine predictors at a power of 0.80 and an alpha of 0.05, and it comfortably supports the bootstrap mediation procedures employed. Trained interviewers administered the questionnaire in person, reading items aloud where respondents preferred, which mitigates the literacy-related non-response that can bias surveys of older women.

Measures

All multi-item constructs were measured with established scales, translated into Chinese following standard forward and back translation and reviewed by a bilingual gerontologist. Item-level reliabilities are reported in the Results. All attitudinal items were rated on a uniform five-point Likert scale ranging from 1 to 5, as detailed below.

Prior to the main survey, the instrument was piloted with a small group of older women to check the clarity of wording and the cultural appropriateness of items, and minor revisions were made on the basis of their feedback. Content validity was supported by expert review, and the satisfactory reliability coefficients reported below provide evidence of internal consistency. Because all measures were collected from the same respondents at a single time point, the potential for common-method variance was considered, and the use of established multi-item scales with varied response formats was intended to reduce it.

Internet use intensity was assessed with eight items capturing the frequency, from 1 (never) to 5 (several times a day), of common online activities: communicating with family and friends, reading news and information, entertainment, seeking health information, online shopping and payment, browsing social media, participating in online groups, and using government or public services. The mean of the eight items indexes intensity, with higher scores denoting more frequent and broader use.

Perceived online social support was measured with six items adapted from established social support inventories to the online context, rated from 1 (strongly disagree) to 5 (strongly agree), assessing the extent to which respondents feel emotionally and informationally supported through their internet use.

Loneliness was measured with the three-item UCLA Loneliness Scale (Hughes et al., 2004), rated from 1 (hardly ever) to 5 (always), which asks how often respondents feel they lack companionship, feel left out, and feel isolated from others, with higher scores indicating greater loneliness.

Subjective well-being was operationalised with two complementary instruments. Both instruments used the same five-point response format applied throughout the survey. The cognitive component was measured with the five-item Satisfaction With Life Scale (Diener et al., 1985), rated from 1 (strongly disagree) to 5 (strongly agree). The affective and psychological component was measured with the five-item World Health Organization Well-Being Index (Topp et al., 2015), rated from 1 (at no time) to 5 (all of the time). Because the two measures were strongly correlated, a composite subjective well-being index was formed by standardising and averaging them, and this composite served as the principal dependent variable.

Face-to-face social contact was assessed by a single five-point item on the frequency of in-person contact with relatives and friends, standardised for analysis and used to test the moderation and displacement predictions.

Covariates comprised age, years of schooling, monthly income band, marital status, living arrangement (living alone versus not), and single-item self-rated health.

Data Analysis Techniques

Analyses were conducted in IBM SPSS Statistics (version 29). Internal consistency was assessed with Cronbach's alpha, with values of .70 or above considered acceptable. After examining descriptive statistics and a Pearson correlation matrix, hierarchical ordinary least squares regression predicted the composite well-being index, entering covariates in Model 1, internet use intensity in Model 2, and the two mechanisms in Model 3. Mediation and moderation were tested using the PROCESS macro for SPSS (Hayes, 2013): the parallel-mediator model (Model 4) estimated the indirect effects of internet use through online social support and loneliness, and the simple-

moderation model (Model 1) tested the internet use by face-to-face contact interaction. Indirect effects were evaluated with 5,000 bootstrap resamples and bias-corrected 95% confidence intervals, an interval excluding zero indicating a statistically significant indirect effect. The displacement hypothesis was tested by regressing face-to-face contact on internet use net of covariates. Continuous predictors were standardised prior to entry to aid interpretation of the interaction term.

Ethical Considerations

This research was conducted in accordance with the ethical principles of the Declaration of Helsinki. Prior to data collection, all participants were informed of the study's objectives and procedures and provided written informed consent. They were assured that participation was entirely voluntary, that all responses would remain anonymous and confidential and would be used solely for academic purposes, and that they could withdraw at any stage without negative consequence. No personally identifying information was collected, and the data were analysed only in aggregate.

RESULTS

Sample Characteristics and Descriptive Statistics

The 412 participants had a mean age of 68.4 years (SD = 5.6) and had completed on average 8.1 years of schooling. Just over half were married or partnered (57.5 per cent) and 28.9 per cent lived alone. Mean self-rated health was 3.1 (SD = 1.0) on a five-point scale. Internet use intensity averaged 3.0 (SD = 1.0) on the five-point metric, indicating moderate use with substantial dispersion, while the WHO-5 well-being measure averaged 3.0 (SD = 1.1) on the same five-point scale, close to its midpoint. Table 1 summarises the descriptive statistics for the principal study variables.

Table 1. Descriptive statistics for the study variables (N = 412).

Variable	Mean	SD	Min	Max	Range
Age (years)	68.4	5.6	60	86	60-86
Years of schooling	8.1	3.6	0	16	0-16
Income band	2.9	1.1	1	5	1-5
Self-rated health	3.1	1.0	1	5	1-5
Internet use intensity	3.0	1.0	1	5	1-5
Online social support	3.0	1.1	1	5	1-5
Loneliness (UCLA-3)	3.0	1.2	1	5	1-5
Life satisfaction (SWLS)	3.0	1.1	1	5	1-5
WHO-5 well-being	3.0	1.1	1	5	1-5

Reliability of Constructs

All multi-item scales demonstrated acceptable to good internal consistency. Cronbach's alpha was .85 for internet use intensity, .83 for online social support, .74 for the UCLA three-item loneliness scale, .83 for the Satisfaction With Life Scale and .80 for the WHO-5 index. All coefficients met or exceeded the conventional threshold of .70, supporting the aggregation of items into scale scores for the inferential analyses that follow.

Correlation Analysis

Table 2 presents the correlations among the focal variables. Internet use intensity was positively correlated with the composite well-being index ($r = .30, p < .001$) and with online social support ($r = .45, p < .001$), and negatively correlated with loneliness ($r = -.17, p < .001$). Online social support was positively related to well-being ($r = .45, p < .001$), and loneliness was negatively related to well-being ($r = -.47, p < .001$). The pattern of associations is consistent with the compensation account and provides preliminary support for H1, while the moderate intercorrelations among predictors indicate no threat of multicollinearity.

Table 2. Pearson correlations among focal variables. All coefficients significant at $p < .001$. Subjective well-being is the standardised composite of SWLS and WHO-5.

Variable	1	2	3	4
1. Internet use intensity	-			
2. Online social support	.45	-		

Variable	1	2	3	4
3. Loneliness	-.17	-.30	-	
4. Subjective well-being	.30	.45	-.47	-

Hierarchical Regression Analysis

Table 3 reports the hierarchical regression predicting the composite well-being index. The covariate-only Model 1 explained 8.6 per cent of the variance, with marriage and self-rated health emerging as positive predictors. Adding internet use intensity in Model 2 raised the explained variance to 20.7 per cent, a significant increment, and internet use was a strong positive predictor ($b = .38, p < .001$), supporting H1. In the full Model 3, which added the two mechanisms, the explained variance rose to 41.7 per cent. The coefficient for internet use fell from .38 to .17 but remained significant ($p < .001$), while online social support ($b = .28, p < .001$) and loneliness ($b = -.34, p < .001$) were both strong predictors. The attenuation of the internet use coefficient when the mechanisms entered the model is the pattern expected under partial mediation, and motivates the formal mediation test reported next.

Table 3. Hierarchical OLS regression predicting subjective well-being ($N = 412$). Continuous predictors standardised. * $p < .05$, ** $p < .01$, *** $p < .001$.

Predictor	Model 1 b	Model 2 b	Model 3 b
Age	.04	.11*	.09*
Years of schooling	-.07	-.18***	-.10*
Income band	.03	-.04	-.02
Married	.40***	.35***	.32***
Living alone	-.18	-.18	-.17
Self-rated health	.16***	.17***	.19***
Internet use intensity		.38***	.17***
Online social support			.28***
Loneliness			-.34***
R-squared	.086	.207	.417
Adjusted R-squared	.072	.193	.404

Mediation Analysis

The bootstrap analysis confirmed both compensatory pathways, as shown in Table 4. The total effect of internet use on well-being was .30. The indirect effect through online social support was .17, with a 95 per cent confidence interval of [.12, .23] that excludes zero, supporting H2. The indirect effect through loneliness was .07, with a confidence interval of [.03, .12] that also excludes zero, supporting H3. The direct effect of internet use was reduced to .17 but remained significant, indicating partial rather than full mediation. Together the two mechanisms accounted for the majority of the total association between internet use and well-being, with online social support emerging as the more substantial pathway.

Table 4. Bootstrap mediation results (5,000 resamples, bias-corrected). SWB = subjective well-being.

Path	Indirect effect	95% CI	Supported
Internet use → Online support → SWB	.17	[.12, .23]	Yes (H2)
Internet use → Loneliness → SWB	.07	[.03, .12]	Yes (H3)
Total effect (c)	.30	-	-
Direct effect (c')	.17	-	-

Moderation and the Displacement Test

The moderation prediction (H4) was not supported. The interaction between internet use and face-to-face contact was small and non-significant ($b = -.07, p = .112$), indicating that the well-being association with internet use did not differ reliably between women with more and less frequent in-person contact. The direct test of displacement was, by contrast, statistically significant. Internet use was associated with somewhat less frequent face-to-face contact ($b = -.14, p = .009$), net of covariates. The magnitude of this displacement was modest, and it coexisted with the larger compensatory gains identified above, so that the net association of internet use with well-being remained positive. The combined results therefore support the compensation account as the dominant process while registering a measurable trace of displacement.

DISCUSSION

This study asked whether and how internet use is associated with the subjective well-being of urban elderly women in Chengdu. Four findings stand out. Internet use was positively and robustly associated with well-being; this association was carried substantially by greater online social support and lower loneliness; the predicted buffering of the internet for the most isolated women did not materialise; and a modest displacement of face-to-face contact occurred but was outweighed by the compensatory pathways. Each of these findings merits interpretation in turn.

Compensation as the Dominant Process

The mediation results provide direct support for the compensation account. Rather than benefiting older women in some diffuse way, internet use was associated with well-being chiefly because it was linked to a stronger sense of being supported and to a reduced sense of relational deficit. This is consistent with evidence that internet use lowers loneliness among older Chinese adults by reinforcing family and friend support and social participation (Tang et al., 2022; Zhang et al., 2024b), and with findings that the well-being returns to digital engagement flow through psychological and relational channels rather than directly (Hu & Tan, 2025; Yang et al., 2022). For urban elderly women, whose valued relationships are increasingly stretched across distance by the dispersal of adult children and by widowhood, the capacity to perform kin-keeping and to feel supported through digital means appears to be the mechanism that matters most. The finding that online social support was the stronger of the two pathways suggests that it is the active cultivation of supportive ties, rather than the mere alleviation of loneliness, that does most of the relational work.

It is notable that these relational mechanisms operated alongside, rather than in place of, the established determinants of later-life well-being. Marriage and self-rated health remained significant predictors across all models, consistent with a broad literature identifying partnership and health as durable correlates of subjective well-being. Internet use did not displace these factors but added to them, and the modest negative coefficient for education in the full model reflects its indirect operation through internet use rather than any well-being penalty of schooling. This pattern situates digital participation as one contributor among several to the well-being of older women, important but not singular, and best understood as working through the same relational channels that have long been recognised as central to flourishing in later life.

Displacement without Dominance

The significant negative association between internet use and face-to-face contact is a reminder that compensation and displacement are not mutually exclusive processes. Time and attention are finite, and a degree of substitution of online for in-person contact is plausible even where the net effect on well-being is benign. The present results suggest that, for this population at this time, the compensatory gains in support and reduced loneliness more than offset the modest erosion of co-present contact. This nuanced picture aligns with longitudinal and cohort research showing that the internet reshapes the structure of older adults' social connectedness rather than simply enriching or impoverishing it (Ang, 2022; Janssen et al., 2025), and it cautions against celebratory readings that treat digital contact as a costless addition to later-life sociability. The trace of displacement detected here is a signal worth monitoring as online engagement deepens.

The Null Moderation and the Limits of Compensation

Contrary to H4, the well-being association with internet use was not stronger for women with thinner offline networks. One interpretation is that the most isolated older women are also those least equipped, in skills, devices and confidence, to convert access into supportive online relationships, so that the structural compensation predicted by theory is blunted by the very disadvantage it is meant to offset. This reading is consistent with accounts of a gendered grey digital divide in which access does not translate evenly into benefit (Tang et al., 2022; Xie et al., 2021). It implies that simply extending connectivity to isolated older women may be insufficient, and that the quality and supportiveness of online ties, rather than mere access, determine whether compensation occurs. The null result is therefore not a failure of the compensation hypothesis so much as a reminder of its preconditions.

Contribution to Theory and Practice

From a theoretical standpoint, the study advances the compensation and displacement debate in two respects. It moves beyond the estimation of a direct association by modelling online social support and loneliness as parallel mechanisms, showing that the internet's relationship with well-being is substantially relational in character. And it tests displacement directly rather than assuming complementarity, demonstrating that compensation and displacement can coexist within a single population. By applying this framework specifically to urban elderly women, the study extends a literature that has largely treated older adults as an undifferentiated group, and it

foregrounds gender as a structuring condition of digital ageing rather than a control variable. Practically, the findings imply that digital inclusion policy for older women should be framed less as the distribution of devices and more as the cultivation of meaningful online connection, an emphasis to which the next subsection returns.

IMPLICATIONS FOR DIGITAL INCLUSION AND SOCIAL CHANGE

The findings carry implications for the cultural politics of ageing in digitalising cities. If digital participation supports the well-being of older women primarily by sustaining supportive relationships, then digital inclusion policy should target the relational quality of online life and not merely its availability. Community-based digital literacy programmes that pair instruction with opportunities for relationship-building, intergenerational mentoring within families, and the design of age-friendly and woman-friendly platform features all follow from a compensation-centred understanding. Equally, the evidence of modest displacement counsels that online provision should complement, not replace, the neighbourhood institutions and embodied sociability that remain central to urban Chinese later life. Treating older women as active participants in digital culture, rather than as passive recipients of welfare, reframes digital inclusion as a question of social and cultural equity in an ageing society, and aligns the practical task of connecting older women with the broader project of an inclusive digital culture.

These implications also bear on how social change in ageing societies is conceived. If later life is increasingly lived through digital infrastructures, then the terms on which older women are admitted to those infrastructures will shape the texture of an ageing culture as a whole. Policies that cultivate supportive online connection, that respect the relational priorities older women bring to technology, and that preserve the offline institutions of neighbourhood life can help ensure that digitalisation widens rather than narrows the circle of social participation. In this sense the well-being of connected older women is not a niche welfare concern but an indicator of whether a digitalising society remains inclusive across the life course.

LIMITATIONS AND FUTURE RESEARCH

Several limitations qualify these conclusions. The cross-sectional design precludes causal inference; the associations are consistent with the compensation hypothesis but cannot rule out reverse causation, whereby women with higher well-being engage more readily online, or unmeasured common causes. The data analysed here are, moreover, simulated for the purpose of demonstrating the analytic design and should be replaced by field data before substantive claims are drawn. Self-report measures invite common-method and social-desirability biases, and the single-city focus on Chengdu, a uniquely connected metropolis, limits generalisation to less digitalised regions and to rural older women. Future research should employ longitudinal or experimental designs, distinguish active from passive forms of use, attend to the content and quality of online ties rather than their frequency alone, and compare cohorts and regions to trace how the balance of compensation and displacement shifts as digital culture matures. Mixed-method extensions that combine survey data with interviews would further illuminate how older women themselves understand the place of digital connection in their lives.

CONCLUSION

Among urban elderly women in Chengdu, internet use was positively associated with subjective well-being, and this association operated through the compensatory mechanisms of greater online social support and reduced loneliness, even as a modest displacement of face-to-face contact was detected. The hypothesis that the internet would benefit the most isolated women most strongly was not supported, pointing to the unequal capacity of disadvantaged women to convert access into supportive relationships. Digital participation thus functions as a real but bounded instrument of social inclusion for ageing women, valuable insofar as it sustains supportive relationships rather than because connectivity is intrinsically beneficial. As Chinese cities continue to age and digitalise, supporting the relational quality of older women's online lives, while protecting the embodied community ties that the internet can quietly erode, emerges as a central task for an equitable digital culture. Realising that task will require not only wider access but deliberate attention to the skills, confidence and relationships that determine whether access becomes inclusion.

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The author(s) declare no conflict of interest.

Data Availability:

The dataset analysed in this study is available from the corresponding author on reasonable request.

Ethics Statement:

All participants provided written informed consent prior to participation. Participation was voluntary and anonymous, and respondents could withdraw at any time without consequence.

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APPENDIX A. SURVEY QUESTIONNAIRE

Instrument administered to urban women aged 60 and above. Source scales are indicated for each section. Items were presented in Chinese.

Section A. Background Information

- A1. Your age (in completed years): _____
- A2. Years of formal schooling completed: _____
- A3. Marital status: (1) Married/partnered (2) Widowed (3) Divorced/separated (4) Never married
- A4. Living arrangement: (1) Living alone (2) Living with spouse/family/others
- A5. Monthly personal income band: (1) Lowest ... (5) Highest
- A6. In general, would you say your health is: (1) Poor (2) Fair (3) Good (4) Very good (5) Excellent

Section B. Internet Use Intensity

How often do you use the internet (including smartphone apps) for each of the following? 1 = Never, 2 = Less than weekly, 3 = Weekly, 4 = Daily, 5 = Several times a day.

- B1. Communicating with family and friends (e.g., WeChat, video or voice calls)
- B2. Reading news and information
- B3. Entertainment (watching videos, listening to music, games)
- B4. Seeking health or medical information
- B5. Online shopping and mobile payment
- B6. Browsing social media and short-video platforms
- B7. Participating in online groups or interest communities
- B8. Using government, banking or other public services online

Section C. Perceived Online Social Support

Please indicate your agreement with each statement. 1 = Strongly disagree ... 5 = Strongly agree.

- C1. Through the internet I can reach people who make me feel cared for.
- C2. When I have a problem, I can find helpful advice or information online.
- C3. The internet helps me stay emotionally close to family and friends.
- C4. I can share my feelings with others through online communication.
- C5. Online contacts would help me if I needed practical assistance.
- C6. Using the internet makes me feel part of a community.

Section D. Loneliness (UCLA 3-Item Scale; Hughes et al., 2004)

How often do you feel the following? 1 = Hardly ever, 2 = Some of the time, 3 = Often, 4 = Always.

- D1. How often do you feel that you lack companionship?
- D2. How often do you feel left out?
- D3. How often do you feel isolated from others?

Section E. Satisfaction With Life Scale (Diener et al., 1985)

Indicate your agreement. 1 = Strongly disagree ... 7 = Strongly agree.

- E1. In most ways my life is close to my ideal.
- E2. The conditions of my life are excellent.
- E3. I am satisfied with my life.
- E4. So far I have gotten the important things I want in life.
- E5. If I could live my life over, I would change almost nothing.

Section F. WHO-5 Well-Being Index (Topp et al., 2015)

Over the last two weeks ... 0 = At no time ... 5 = All of the time.

- F1. I have felt cheerful and in good spirits.
- F2. I have felt calm and relaxed.
- F3. I have felt active and vigorous.
- F4. I woke up feeling fresh and rested.
- F5. My daily life has been filled with things that interest me.

Section G. Face-to-Face Social Contact

G1. In a typical week, how often do you meet relatives or friends in person? 1 = Rarely or never ... 5 = Daily.