Effects of Internet Usage on Physical and Mental Health of Seniors in China

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Abstract

In an era where technology, especially the internet, plays a pivotal role in daily life, its impact on different age groups has become a crucial area of study. This research focuses on the aging population in China and aims to explore how these of internet affects their physical and mental health. The primary objective of this study is to investigate the relationship between internet usage and the health outcomes of seniors in China. It seeks to understand how the internet influences physical and psychological health among the elderly. Employing a mixed-methods approach, the study combines quantitative analysis with qualitative insights. The quantitative data is drawn from the China Health and Retirement Longitudinal Study (CHARLS), focusing on variables like internet usage frequency, types of devices used, and specific online activities. Complementing this, qualitative interviews with older individuals offer personal perspectives on internet use, especially during the COVID-19 pandemic. The quantitative analysis reveals a significant association between internet usage and reduced physical pain and loneliness in seniors. Specific factors, such as how often the internet is used, the devices employed, and the nature of online activities, show varied impacts on these health outcomes. Qualitative findings underscore the diverse experiences of seniors with the internet, highlighting its role in mitigating loneliness and maintaining social connections during the pandemic. This study underscores the potential benefits of internet access for improving the physical and mental well-being of seniors in China. It points to the internet as a valuable tool in addressing issues of loneliness and health among the elderly. However, the research also identifies the need for broader studies with more extensive and representative samples and the inclusion of additional variables to fully unravel the causal links between internet usage and health outcomes in aging populations.

Keywords

Psychology, Aging Population, Mental Health, Internet Usage, COVID-19, China, Physical Health, Loneliness

1. Introduction

With the development of modern technology, the internet has become an indispensable part of people's lives. Even elders' response has a high rate of appliance of internet everyday (Niehaves & Plattfaut, 2014). For younger generations, the internet is easy to access and harness. By contrast, it might be more difficult for the aging population to use the internet. For example, researchers have found that 89% of UK older people use non-digital devices instead of smart devices as their primary mode of communication (Oatley, Choudhury, & Buckman, 2021).

Despite this situation, several influences of using the internet have been identified by previous research. The effects on people's mental health are complex. On the one hand, some studies found that individuals who use the internet more frequently are likely to have higher depressive levels (Demir & Kutlu, 2016) and stronger feelings of loneliness (Coget, Yamauchi, & Suman, 2002; Chou & Hsiao, 2000). On the other hand, using the internet can decrease people's loneliness, especially during the pandemic (Coget, Yamauchi, & Suman, 2002; Alheneidi et al., 2021).

Based on the literature review, we raise several research questions: 1) What are the influences of using internet on older people's physical health (measured by body pain)? 2) What are the influences of specific internet using habits on older people's physical health (measured by body pain)? 3) What are the influences of using the internet on older people's mental health (measured by loneliness)? 4) What are the influences of specific internet using habits on older people's physical health (measured by loneliness)? 5) What are individual experiences among older people about using the internet, especially during the pandemic. To answer these questions, we focus on older people in China and adopt mixed methods. Through regression analysis and qualitative interview, we found that internet users scored a lower total pain index than those who do not use the internet. Using different devices also affects the user's total pain index. Meanwhile, internet users have a lower loneliness index than non-internet users. During the pandemic, using the internet helped older people to maintain social relations and obtain social support.

However, there is also research that indicates that internet usage is beneficial for curing loneliness. Elders would give positive attitude toward advance usage of technology such as health caring (Lolich et al., 2019). A study stated that the median loneliness on the research is lower compared to the moderate levels of loneliness in the sample as whole (Cotten et al., 2013). Moreover, the increase of time spent on internet will have a negative correlation of loneliness and pain (Halston et al., 2019). By contrast, technology raised awareness and provide

peer-support for people with health issue (Babbage et al., 2020).

2. Data and Method

2.1. Data

This research uses data collected from the China Health and Retirement Longitudinal Study (CHARLS) in 2018. This longitudinal survey is nationally representative of Chinese population who are 45 years or older. CHARLS data includes comprehensive information including resident's health status, SES, and demographic features, and so on. The measurements we used are described in the following paragraphs. Our dependent variables are "Total pain" and "Loneliness", while our key independent variables are "Use internet", "Frequency", 5 indicators for devices, and 5 indicators for activities. We also have several control variables. The final sample size is 4590.

1) Total pain

Data of the answers from participants were collected from the research data of China Health and Retirement Longitudinal Study, CHARLS. Participants were asked to choose between "yes" or "no" in nine different questions of body parts which are feeling pain. The nine activities are "Shoulder", "Arm", "Wrist", "Fingers", "Back", "Waist", "Buttocks", "Leg" and "Neck". We calculated an index of the total pain based on the original nine measures. The final variable we use ranges from 0 to 9.

2) Lonely

Data of the answers from participants were collected from the research data of China Health and Retirement Longitudinal Study, CHARLS. Participants were asked to choose how they feel lonely between "Rarely or none of the time", "Some or a little of time," "Occasionally or moderate amount of time," "Most or all of the time." We recoded this variable into a numeric variable ranging from 1 to 4.

3) Use internet (Whether use internet)

Data of the answers from participants were collected from the research data of China Health and Retirement Longitudinal Study, CHARLS. Participants were asked whether they used the internet in the past months. This variable is in binary, with "yes" measured by 1 and "no" measured by 0.

4) Frequency (Frequency of using the Internet)

Data of the answers from participants were collected from the research data of China Health and Retirement Longitudinal Study, CHARLS. Participants were asked to choose their operating frequency of the Internet within a month from "Almost daily", "Almost every week" or "Not regularly". We labeled these three choices into 3 kinds of Category variables, which were symbolized as "1", "2" and "3" separately. We summarized the number of people in each category.

5) Desktop, Laptop, Tablet, Cellphone, Other tool (Devices used to access the Internet)

Data of the answers from participants were collected from the research data of

China Health and Retirement Longitudinal Study, CHARLS. Participants were asked to choose between "yes" or "no" in five different questions of tools used to access the Internet. The five tools are "Desktop Computer", "Laptop Computer", "Tablet Computer", "Cellphone", "Another tool". We labeled these five choices into 5 binary variables, with "1" representing using the certain device and "0" representing not using the device.

6) Chatting, Reading, Watching, Games, Money, Other act (Internet using activities)

Data of the answers from participants were collected from the research data of China Health and Retirement Longitudinal Study, CHARLS. Participants were asked to choose between "yes" or "no" in six different questions of activities used on the Internet. The six activities are "Chatting", "Reading News", "Watching Videos", "Playing Games", "Money Management" and "Others, Please Specify". We labeled these six choices into 6 binary variables.

7) Vchildren (Frequency of Visiting of a Child)

Data of the answers from participants were collected from the research data of China Health and Retirement Longitudinal Study, CHARLS. Participants were asked to choose their frequency of visiting the elderly between "Almost Every day", "2 - 3 times a week, once a week, Every two weeks", "Once a month, Once every three months", "Once every six months, Once a year" and "Almost Never". We labeled these five choices into 5 kinds of Category variables, which were symbolized as "1", "2", "3", "4" and "5" separately. We summarized the number of people in each category.

8) Cchildren (Frequency contacting of a child)

Data of the answers from participants were collected from the research data of China Health and Retirement Longitudinal Study, CHARLS. Participants were asked to choose their frequency of contacting the elderly between "Almost Every day", "2 - 3 times a week, once a week, Every two weeks", "Once a month, Once every three months", "Once every six months, Once a year" and "Almost Never". We labeled these five choices into 5 kinds of Category variables, which were symbolized as "1", "2", "3", "4" and "5" separately. We summarized the number of people in each category.

9) Age

This variable reflects the real age of each respondent. It is a numeric variable.

10) Gender

This is a binary variable, with 1 measuring male and 0 measuring female.

The descriptive results of all variables can be found in Table 1 and Table 2. Table 1 shows the result of the full sample, while Table 2 shows the result of the subsample, which only includes internet users.

2.2. Methods

First, we use quantitative method to investigate how internet use would affect seniors in China. To begin with, we run multiple regression models in the full

Table 1. Full sample result.

Variables	Statistics
Age	69.54
Gender	0.5179
Use_internet	0.0573
Lonely	1.791
Total_pain	2.042
Cchildren	
Almost Daily	13.55%
2 or 3/week to 1/2 weeks	61.18%
1/1 - 3 months	15.03%
1/6 months	1.70%
Never	8.54%
Vchildren	
Almost daily	23.46%
2 or 3/ week to 1/2 weeks	31.55%
1/1 - 3 months	24.60%
1/6 months	18.26%
Never	2.13%

a. Sample of CHARLS in 2018.

Table 2. Subsample result.

Variables	Statistics
Age	65.82
Gender	0.6066
Frequency	
Almost_daily	86.21%
Almost_every_week	7.21%
Not_regularly	6.58%
Desktop	0.2022
Laptop	0.05643
Tablet	0.0768
Cellphone	0.9028
Other_tool	0.007837
Chatting	0.6003
Reading	0.8229
Watching	0.6442
Gaming	0.2555
Money	0.07053
Other_act	0.1191
Lonely	1.33
Total_pain	1.382

b. Subsample of CHARLS in 2018.

sample to examine whether internet use affects seniors' physical and mental health, measured by body pain and loneliness, respectively. Then we run multiple regression models in the subsample, which only include seniors who use internet. In this step, we examine how internet use frequency, devices, and activities influence seniors' physical and mental health.

Second, we use qualitative interviews to research individual experiences about using the internet. We interviewed 6 seniors and asked them about their using habits, online activities and reflections on internet and social networks.

3. Results

The results section encompasses both quantitative and qualitative methodologies.

3.1. Results of Quantitative Study

In our quantitative analysis, we explored four regressions: one on body pain and one on loneliness using the full sample, and two more on body pain and loneliness within a subsample.

3.1.1. Regression on Body Pain Using Full Sample

Three models were developed to investigate the relationship between internet usage and pain index among seniors. The results are shown in Table 3. The first model included only the independent variable "use_internet", which had a coefficient of −0.597 and a significance level of 0.001. This indicates that seniors who used the internet in the past month had, on average, a 0.597-point lower total pain index score than those who did not.

In the second model, gender and age were added as control variables to model (1). The results showed that male and older participants had lower pain index scores, and seniors who used the internet had a 0.514-point lower total pain index score than non-netizen seniors.

Model (3) added two more control variables, measuring the frequency of meetings, and contacting children. After controlling all other variables, "use_internet" had a coefficient of −0.495 at a significance level of 0.01. This indicates that, on average, seniors who used the internet had a 0.495-point lower total pain index score than those who did not, even after accounting for the frequency of meeting and contacting children.

3.1.2. Regression on Loneliness Using Full Sample

Three models were developed to investigate the relationship between internet usage and loneliness index among seniors. The results are shown in Table 4. The first model included only the independent variable "use_internet", which had a coefficient of −0.387 and a significance level of 0.001. This indicates that seniors who used the internet in the past month had, on average, a 0.387-point lower loneliness index score than those who did not.

In the second model, gender and age were added as control variables to model

Table 3. Relationship between variables in three models and pain index among seniors.

	Dependent variable: total_pain		
	(1)	(2)	(3)
use_internet	−0.597***	−0.514***	−0.495***
	(0.161)	(0.158)	(0.159)
age		−0.015**	−0.012*
		(0.005)	(0.006)
gender		−1.211***	−1.288***
		(0.073)	(0.073)
children 2 or 3/week to 1/2 weeks			0.164
			(0.110)
children 1/1 - 3 months			0.302*
			(0.139)
children 1/6 months			0.490
			(0.299)
children never			0.027
			(0.163)
vchildren 2 or 3/week to 1/2 weeks			0.220*
			(0.101)
vchildren 1/1 - 3 months			0.212*
			(0.108)
vchildren 1/6 months			0.307**
			(0.118)
vchildren never			0.105
			(0.262)
Constant	2.076***	3.747***	3.208***
	(0.039)	(0.378)	(0.417)
Observations	4590	4590	4590
R^2	0.003	0.061	0.064

Note: ⌗ $*p < 0.05$, $**p < 0.01$, $***p < 0.001$.

(1). The results showed that male and younger participants had lower loneliness index scores, and seniors who used the internet had a 0.328-point lower loneliness index score than non-netizen seniors.

Model (3) added two more control variables, measuring the frequency of meetings, and contacting children. After controlling all other variables, "use_internet" had a coefficient of −0.287 at a significance level of 0.001. This indicates that, on average, seniors who used the internet had a 0.287-point lower loneliness index score than those who did not, even after accounting for the frequency of meeting and contacting children.

Table 4. Relationship between variables in three models and loneliness index among seniors.

	Dependent variable: lonely		
	(1)	(2)	(3)
use_internet	−0.387***	−0.328***	−0.284***
	(0.073)	(0.072)	(0.072)
age		0.008***	0.007**
		(0.002)	(0.003)
gender		−0.308***	−0.314***
		(0.033)	(0.033)
children 2 or 3/week to 1/2 weeks			0.098*
			(0.050)
cchildren 1/1 - 3 months			0.251***
			(0.063)
children 1/6 months			0.374**
			(0.136)
cchildren never			0.347***
			(0.074)
vchildren 2 or 3/week to 1/2 weeks			0.0004
			(0.046)
vchildren 1/1 - 3 months			0.130**
			(0.049)
vchildren 1/6 months			0.125*
			(0.054)
vchildren never			0.029
			(0.120)
Constant	1.813***	1.399***	1.275***
	(0.017)	(0.173)	(0.190)
Observations	4590	4590	4590
R^2	0.003	0.061	0.064

Note: ⊡ $*p < 0.05$, $**p < 0.01$, $***p < 0.001$.

3.1.3. Regression on Body Pain Using Subsample

Five models were developed to investigate the relationship between internet usage and pain index among seniors. The results are shown in **Table 5**. The first model included only the independent variable "Frequency" which had a coefficient of 0.825 and a significance level of 0.01. This indicates that seniors who used the internet almost every week had, on average, a 0.825-point higher total pain index score than those who used the internet nearly daily.

In the second model, gender and age were added as control variables to model

Table 5. Relationship between variables in five models and pain index among seniors.

	Dependent variable: total_pain				
	(1)	(2)	(3)	(4)	(5)
Frequency: almost every week	0.825*	0.801*	−0.797*	0.837**	0.824**
	(0.319)	(0.314)	(0.313)	(0.315)	(0.316)
Frequency: not regularly	0.266	0.283	0.200	0.356	0.262
	(0.332)	(0.328)	(0.327)	(0.332)	(0.333)
age		−0.010	0.003	−0.011	0.000
		(0.016)	(0.016)	(0.016)	(0.162)
gender		−0.762***	−0.734***	−0.730***	−0.717***
		(0.166)	(0.167)	(0.175)	(0.176)
desktop			−0.325		−0.264
			(0.221)		(0.238)
laptop			−0.593.		−0.583
			(0.353)		(0.354)
tablet			−0.903**		−0.834**
			(0.318)		(0.321)
cellphone			0.027		−0.099
			(0.303)		(0.313)
chatting				0.323.	0.275
				(0.175)	(0.180)
reading				0.172	0.163
				(0.227)	(0.229)
watching				−0.227	−0.244
				(0.178)	(0.180)
games				−0.351.	−0.203
				(0.186)	(0.196)
money				−0.229	−0.099
				(0.318)	(0.327)
Constant	1.305***	2.474*	1.700	2.408*	1.877
	(0.089)	(1.035)	(1.12)	(1.069)	(1.146)
Observations	638	638	638	638	638
R^2	0.011	0.044	0.068	0.058	0.075

Note: ⌨ *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

(1). The results showed that male and older participants had higher pain index scores, and seniors who used the internet almost every week had a 0.801-point higher total pain index score than those who used the internet almost daily.

Model (3) added four more variables measuring the tools to get access to the Internet. After controlling for all other variables, "frequency" had a coefficient of −0.797 at a significance level of 0.05. This indicates that, on average, seniors who used the internet almost every week had a 0.797-point lower total pain index score than those who used the internet almost every day. Meanwhile, the coefficient of "tablet" is −0.834 with a significant level of 0.01, which means that seniors who use tablet for internet activities on average have 0.834-point lower total pain index score.

Model (4) added five more variables, measuring the activities of using Internet. After controlling for all other variables, "frequency" had a coefficient of 0.837 at a significance level of 0.01. This indicates that, on average, seniors who used the internet almost every week had a 0.837-point higher total pain index score than those who use the internet almost daily. However, there is no proof that a specific internet using activity affects the body pain experienced by seniors.

Model (5) is the full model including all variables. After controlling for all other variables, "frequency" had a coefficient of 0.824 at a significance level of 0.01. This indicates that, on average, seniors who used the internet almost every week had a 0.824-point higher total pain index score than those who did not.

3.1.4. Regression on Loneliness Using Subsample

Table 6 shows 5 models examining how specific Internet usage behavior influence in feeling of loneliness among Chinese aging population. Model (1) shows that the independent variable "frequency" does not have a statistically significant influence on loneliness.

In model (2), age and gender variables are added on top of model (1). However, none of the coefficient shows statistical significance.

In model (3), variables reflecting different devices are added on top of model (2). But still, there are no coefficients showing significance.

In model (4), variables measuring online activities are added to the model. According to the results, only "reading" significantly decreased the loneliness score by an average of 0.19 point, which means that seniors who used internet to read news feel less lonely compared to those who did not read news online.

In model (5), all variables are included in the data to show the relationship between them and loneliness. Consistent with the results of previous models, "reading" is the only variable showing a statistically significant relationship with loneliness.

3.2. Results of Qualitative

The qualitative studies with these six older individuals provide insights into their phone usage and perceptions of the internet during the pandemic. Overall, the

Table 6. Relationship between variables in five models and loneliness index among seniors.

	Dependent variable: lonely				
	(1)	(2)	(3)	(4)	(5)
Frequency: Almost every week	−0.06	−0.06	−0.06	−0.07	−0.07
	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)
Frequency: Not regularly	0.17	0.18	0.18	0.19	0.19
	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)
age		0.01	0.01	0.01	0.01
		(0.01)	(0.01)	(0.01)	(0.01)
gender		−0.04	−0.03	0.004	0.01
		(0.06)	(0.06)	(0.06)	(0.06)
desktop			0.02		0.02
			(0.08)		(0.09)
laptop			−0.13		−0.13
			(0.13)		(0.13)
tablet			0.12		0.10
			(0.11)		(0.12)
cellphone			−0.01		0.01
			(0.11)		(0.11)
chatting				0.04	0.04
				(0.06)	(0.180)
reading				−0.19*	−0.18*
				(0.08)	(0.08)
watching				0.011	0.11
				(0.06)	(0.06)
games				0.02	0.01
				(0.07)	(0.07)
money				0.22	0.22
				(0.11)	(0.12)
Constant	1.33***	0.85*	0.93*	0.78*	0.82*
	(0.03)	(0.37)	(0.40)	(0.38)	(0.41)
Observations	638	638	638	638	638
R^2	0.004	0.01	0.01	0.02	0.03

Note: ☒ *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

participants spend varying amounts of time on their phones daily, engaging in different kinds of activities such as reading news, watching health-related content, and communicating through WeChat. Most of our participants state that they have watched short videos on WeChat or Ticktock. They have been using the internet for different durations, ranging from 3 - 4 years to 20 years. While some participants feel that the pandemic had little impact on their phone usage and the distance between people, others experienced increased phone usage and a slightly greater perceived distance due to reduced communication. However, most participants believe that the internet, overall, has brought people closer together during the pandemic, facilitating communication and providing convenience in various aspects of their lives.

4. Discussion and Conclusion

4.1. Discussion

Several benefits of our research are worth mentioning. First, we have used a database with high percentage of the Chinese population for our quantitative research, which makes the outcome more representative and persuasive. Secondly, we have included both quantitative research and qualitative research. Qualitative research reveals the elderly's opinion on the internet which is not included in the quantitative research, and it also reveals a more specific detail about how exactly the internet has benefited the elderly.

Several limitations of our search are worth mentioning. First, the variables in our model are limited, we can take other factors into consideration and discover their relationship in our model. Our second limitation is the limited number of samples in our qualitative research. The data only demonstrates a small proportion of the population and might not consider the population in the rural area. Therefore, the samples might not be representative enough. Finally, our data cannot discover any causation between variables, which does not benefit much to the future application of tackling the elderly's loneliness and mental health.

Our research, grounded in the evolving landscape of technology and its impact on various age groups, particularly focused on seniors in China—a demographic often overlooked in digital adaptability studies. This choice of focus aligns with the global trend of aging populations and the increasing pervasiveness of the internet in daily life. Our study's progress unfolded through a mixed-methods approach, uniquely combining the breadth of quantitative analysis with the depth of qualitative insights, offering a holistic view of how internet usage impacts senior citizens' physical and mental health.

The quantitative results, derived from a substantial database representing a high percentage of the Chinese senior population, indicate a clear association between internet usage and reduced physical pain and loneliness. This finding is significant in illustrating the potential of the internet as a tool for enhancing the quality of life among seniors. On the other hand, the qualitative component of our research added a layer of subjective experiences, unveiling the seniors' pers-

pectives on internet use. These narratives brought to light the nuances of how the internet serves not just as a means of communication but as a gateway to information, social interaction, and emotional support, especially critical during the COVID-19 pandemic.

From our analysis, it emerges that the internet, often perceived as a domain of the young, holds substantial benefits for the older generations, challenging the stereotype of technology being out of reach for seniors. This study advocates for the need to view internet accessibility and digital literacy among seniors not just as a convenience but as a crucial element in improving their overall well-being. Moreover, the contrasting effects of several types of internet use (such as reading news versus other activities) on seniors' health underscore the importance of tailored digital content and applications suited to the elderly's needs and preferences.

While our research provides compelling evidence on the positive effects of internet use among seniors, it is also crucial to acknowledge its limitations. The limited scope of variables in our model suggests the potential for a more comprehensive analysis, incorporating factors like socio-economic status, education level, and urban-rural divide, which could further elucidate the relationship between internet use and health outcomes. Additionally, the small sample size in our qualitative research may not fully capture the diversity of experiences among China's senior population, particularly those in rural areas. This gap signals a need for more extensive, diverse, and inclusive research in future studies.

4.2. Conclusion

In our full-sample quantitative research, the data has suggested that internet users scored a lower total pain index than those who do not use the internet. This can be explained by elderly people who can afford the internet have a better economic condition than those who cannot. Therefore, internet users have better access to healthcare and are affordable to medication. Secondly, the internet allows users to know healthcare knowledge and provide treatment with a doctor online as stated in Lolich et al. (2019). Thirdly, using the internet can help people to get rid of malign addiction. A study shows that on social media, one person quitting tobacco would often cause the whole community to quit tobacco as well because reading about other people successfully quitting tobacco gives motivation to people to quit it.

More specifically in our first finding, the data suggests using different devices also affects the user's total pain index. Especially for tablets, it showed the strongest and the most meaningful relationship where elderlies using a tablet has a much lower total pain index than those who do not use the internet. This might be because tablets have a larger screen than phones so they are easier to read and are more flexible with using positions so the user can get in a comfortable position and avoid pain. This could be backed up by articles that technology reduces psychological distress (Thurnheer et al., 2018; Burns-Nader et al., 2017).

The second finding from our quantitative research is that seniors who use the internet to read news have a lower loneliness index than their counterparts who do not read news online. The existence of social media highly contributes to this finding, especially during epidemics. In a recent study, over half (51%) of people say technology has provided a solution during times when they felt lonely, which enables them to make new friends, receive support and advice, as well as read positive comments online (Heathman, 2019).

In our qualitative research, the result also suggests that the use of the internet can alleviate the level of loneliness of the elderly. According to our interviews, the elderly mentioned that during the epidemics, they spent significantly more time on the internet for entertainment and contact with friends and family which helped them to feel connected.

The qualitative research also reveals that not only the purpose of using the internet varies, the daily average time, the starting time of using the internet, and the level of knowing how to use the internet varies, and their opinions on the internet vary as well.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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