ISSN 2684-9267

A study on perception and behavior among chinese urban and rural older adults in the early stage of COVID-19

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ARTICLE INFO

Article history
Received 2022-01-21
Revised 2022-06-17
Accepted 2022-06-30

Keywords
Communication and aging
Media use
Cognitive behavior
Urban and rural differences

ABSTRACT

Based on the comparison of information behavior characteristics and differences of the urban and rural elderly group in the early stage of the COVID-19 pandemic, this study aims to analyzed the questionnaires collected from 980 elderly people. It was found that there were different mechanisms by which media use influenced the protective behaviors of the elderly. Authoritative media is able to directly influence the behavior of the elderly, the information function of social media influences their precautionary measures by affecting their perception, and their social function directly promotes the adoption of protective behaviors by the elderly. There are still significant differences in media use between urban and rural elderly groups. Rural elderly groups rely more on interpersonal networks to seek information and their social circles of WeChat acquaintance are closer. Therefore, health communication research among the elderly needs to further focus on the urban-rural differences in their digital inclusion process.

1. Introduction

According to the Chinese General Social Survey 2017 (CGSS2017) released by the National Survey Research Center at Renmin University of China, traditional media such as TV (81.2%), newspapers (5.1%) and radio (3.0%) are the most important sources of information for the elderly aged 60 and above, with a small number of new media (9.5%) based on the Internet and mobile Internet. However, the sudden outbreak of COVID-19 in 2020 forced many elderly people to "connect to the Internet", and Internet penetration among the elderly has increased significantly [1]. The COVID-19 pandemic accelerates the pace of digital technology utilization [2]. During the social crises, the use of media resources increases as individuals have a high need for information to understand the unstable social situation [3]. Media is a main source for health related information [4], which provides information about the course of the disease, response policies, personal advice for action, a whole range of information that the public desperately needs [5].

The media do not have a uniform influence among older people [6]. The use of TV and radio has a significant positive impact on the subjective well-being of the elderly [7]. Attention to television news and interpersonal discussions were associated with a reduced knowledge gap [8]. Older adults who use social media have better overall health [9], the use of information technology such as mobile phones and computers is a potential way to improve the mental health of the elderly [10]. But the high frequency of media use among older people during the COVID-19 pandemic is a factor in their poor mental health, especially when news comes from unreliable sources [11].

In Chinese society, people tend to seek health information through interpersonal relationships [12]. Social embeddedness, which incorporates interpersonal and community ties, has been proven to be protective during disaster recovery [13]. When the elderly within a community are familiar with each other and trust them, health information is disseminated more quickly, and is received more efficiently [14]. Due to the restrictions on socialization during COVID-19, old people use the Internet more frequently as an alternative means of interpersonal interaction [15]. Social media provides visibility and scalability for news and information [16], changing communication patterns, including health-related communication [17]. Smart phones help more and more old people enter the digital space smoothly [1]. Social media can meet the information, social, and entertainment needs of the elderly [18], the elderly may therefore become increasingly alienated from traditional media channels.

Media use affects the cognition and behavior of the elderly, which in turn has an impact on their health status [19]. The researchers looked at the influence of demographic factors and the various information access channels on the cognition and behavior of the elderly during the COVID-19 pandemic. Some previous studies have concluded that family physicians, television news, and local public health officials are trusted sources of disease information [20]. The elderly with higher level of education are more likely to seek health information from multiple sources, including professionals, newspapers, the Internet, family, and friends. While the elderly with lower level of education tend to rely more on family and friends [21]. Women are more knowledgeable about disease than men [22]. Closer proximity [23], more frequent media use [24] and higher age [25] all lead to higher risk perception. People who are more skilled in the use of Internet technology are more likely to use it to search for health information [13], and the level of health literacy influences the likelihood that people will use the Internet to obtain health information [14]. Individuals with higher ICT skills can use media resources for health purposes and stay healthy during the pandemic [15]. Differences in technology access and dissemination exacerbate urban-rural differences in the Web 2.0 era, which may translate into differences in the level of Internet use and quality of daily life [16].

Based on the above findings, this study chose the early period of the COVID-19 and attempted to explore the cognitive characteristics and behavioral responses of urban and rural elderly groups to the information of the epidemic from the perspective of urban-rural comparison.

2. Method

2.1. Sample Selection

This study was conducted in multiple locations across the country, covering 121 cities in 34 provinces (autonomous regions and municipalities directly under the central government), with Jiangsu Province being the main province (47.2%). The survey was conducted among elderly people aged 60 and above.

The survey was conducted from February 27th to March 8th, 2020. Since the survey was conducted at the time that the COVID-19 situation was severe, the questionnaires were answered online, and the elderly respondents could choose to finish the questionnaires by themselves or by their family members on their behalf. A total of 1027 questionnaires were returned, of which 980 were valid, and the valid sample rate was 95.4%. In this study, SPSS26.0 was used for factor analysis, descriptive analysis, correlation and regression analysis.

2.2. Sample Characteristics

From the statistical results, the gender ratio of men to women among the 980 respondents is about 2:3 (61.8% of women). The age is concentrated in the 60-74 years old (77.2%). The education level mostly is high school and below (73.2%). Most of them live in the city (68.5%), and most of them live with their partners (59.2%) and children's families (47.3%). The basic characteristics of the sample are shown in Table 1.

Table 1. Basic characteristics of respondents

Sample characteristics and assignment		Valid sample size （N=980)	
		Number of people	Ratio(%)
Gender	Male=1	374	38.2
	Female=2	606	61.8
Age	60-64 =1	276	28.2
	65-69 =2	244	24.9
	70-74 =3	237	24.2
	75-79 =4	112	11.4
	80 and above =5	111	11.3
Level of education	Below primary school=1	156	15.9
	Primary school =2	188	19.2
	Junior high school =3	179	18.3
	High school/ Middle specialization school =4	194	19.8
	Junior college =5	148	15.1
	Bachelor and above =6	115	11.7
Residence	Urban areas=1	671	68.5
	Rural areas =2	309	31.5
The people live with （multiple choice）	Husband or wife =1	580	59.2
	Children's families =2	464	47.3
	Parents=3	18	1.8
	Brothers and sisters =4	9	0.9
	Live alone =5	79	8.1
	Other=6	17	1.7

2.3. Measurement of variables

a) Media use

The frequency of media use is scored by using a five-point Likert Scale to determine how often elderly respondents obtain information through each media during the epidemic. Due to the rise of the Internet, the types of media used by the elderly may vary greatly. Therefore, this study considers both traditional media and social media, which includes seven media: newspapers, magazines, television, radio, WeChat, Weibo, websites or news apps. The Cronbach's α is 0.593.

b) Interpersonal and community communication

Interpersonal communication includes communication with family members and friends, and the questions are "How often do you get information about COVID-19 through family members" and "How often do you get information about COVID-19 through friends". For community communication, the question is "How often do you get information about COVID-19 through community propaganda". A five-point Likert Scale is used and the Cronbach's α is 0.764.

c) Epidemic knowledge level

The problem setting of epidemic knowledge level includes the understanding of COVID-19 and the cognition of protective behavior. The measure consists of 5 knowledge questions, and the reverse questions are converted and assign a value of 1-5, and the sum of the scores of the five questions is recorded as the total knowledge score of the epidemic. The higher the final score people get, the higher the knowledge level of the elderly have.

d) Risk perception

In this study, the question "Do you think it is dangerous when someone is infected with New Coronary Pneumonia?" ,"Do you think it is a serious disease when someone is infected with New Coronary Pneumonia? ", "Do you think it is fatal when someone is infected with New Coronary Pneumonia?" are used to investigate the risk perception of the COVID-19 pandemic among the elderly interviewed. The questions are administered on a five-point Likert Scale, and the Cronbach's α is 0.831.

e) Individual behavior

Seven questions are set to examine respondents' personal behavior during the epidemic, including "wash hands frequently", "wear masks properly when going out", "avoid crowded places" and "avoid contacting with patients with flu symptoms or respiratory illnesses such as pneumonia", "be alert to abnormal physical symptoms in yourself and your family", "reduce unnecessary travel and gatherings", "indoor ventilation as much as possible", and the options for the questions are also based on a five-point Likert Scale, and the Cronbach's α is 0.865.

The overall KMO value for epidemic perception and personal behavior is 0.835 and there is a correlation between the variables with a significance of 0.000 (df=45), so the data could be subjected to factor analysis. The 10 factor loading values are higher than 0.7, and the total explainable variance is 61.833%. Overall, the reliability and validity of the scales are more satisfactory and meet the requirements of the questionnaire analysis. More details, seeing in Table 2.

Table 2. Exploratory factor analysis

Questionnaire questions	Risk perception	Individual behavior
Do you think it is dangerous when someone is infected with New Coronary Pneumonia?	0.851	
Do you think it is a serious disease when someone is infected with New Coronary Pneumonia?	0.898	
Do you think it is fatal when someone is infected with New Coronary Pneumonia?	0.834	
Pay attention to personal hygiene and wash hands regularly		0.723
Wear masks properly when going out		0.728
Avoid crowded places		0.737
Avoid contacting with patients with flu symptoms (fever, cough, etc.) or respiratory illnesses such as pneumonia		0.767
Be alert to abnormal physical symptoms in yourself and your family		0.764
Reduce unnecessary travel and gatherings		0.731
Indoor ventilation as much as possible		0.759
Explainable variances （%）	40.314	21.519
Total explainable variances （%）	61.833	

3. Results and Discussion

3.1. Media use and information access of urban and rural elderly

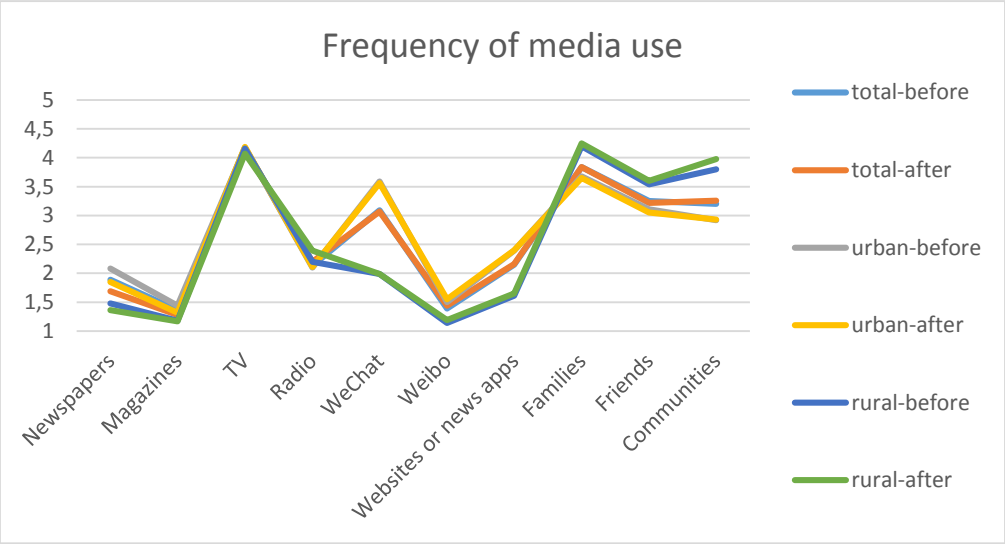

Fig. 1. Comparison of the frequency of media use among the elderly in urban and rural areas before and after the epidemic

Figure 1 reflects the overall situation of media use among urban and rural elderly. From the time dimension, it includes the media use before and after the epidemic, and from the space dimension, it

includes the media use of the elderly in urban and rural areas. Figure 1 shows that there are obvious differences between urban and rural areas in the use of WeChat and radio. This is reflected in the following aspects:

a) The frequency of TV use is high and the gap between urban and rural use is not significant, the difference between urban and rural use of WeChat is large, and there is a large difference in radio use after the epidemic

Table 3. Single factor analysis of variance: media use gap between urban and rural elderly

Test variables	F-value	
	Before the epidemic	***After the epidemic***
Newspaper	62.010***	42.695***
Magazine	30.199***	9.995**
Television	0.156	2.629
Radio	1.474	8.659**
WeChat	257.691***	235.459***
Weibo	34.052***	28.848***
Websites or news apps	68.159***	58.734***
Family members	55.984***	63.241***
Friends	29.458***	43.085***
Communities	118.939***	152.842***

*p<0.05,**p<0.01，***p<0.001

The elderly use television (before the epidemic: 4.17; after the epidemic: 4.15) significantly more often than other media, and there is no significant difference between urban and rural use before and after the epidemic. Significant differences are found in paper reading both before and after the epidemic, with more use by urban elderly. There are significant differences in the use of new media (WeChat, Weibo, websites or news apps) both before and after the epidemic. WeChat (before the epidemic: 3.09; after the epidemic: 3.07) is used significantly more frequently than other new media and only less frequently than the use of television. However, the urban-rural differences in WeChat use are greatest both before and after the epidemic (before: F= 257.691, p<0.001; after: F=235.459, p<0.001), with urban elderly using it much more frequently than rural ones. The elderly also rely more on real-life "network of relationships", that is, relayed by family (before the epidemic: 3.84; after the epidemic: 3.84), friends (before the epidemic: 3.25; after the epidemic: 3.22), and urban or rural community communication (before the epidemic: 3.20; after the epidemic: 3.26). There are significant differences both before and after the epidemic that rural elderly prefer to obtain information from interpersonal communication. The urban-rural difference in the communication channel of community communication is the second only lagging to WeChat. It is worth noting that there is no significant urban-rural difference in radio until the outbreak of the epidemic, and rural elderly obtain information about COVID-19 from radio more often.

b) During the epidemic, there was a decrease in paper reading, an increase in Weibo use, and an increase in radio and community communication in the rural area

Table 4. Paired Sample T test of media use before and after epidemic

Variables	T-value		
	Total	***Urban elderly***	***Rural elderly***
Newspaper	7.940***	7.381***	3.094**
Magazine	4.325***	4.633***	0.258
Television	1.157	-0.279	1.973*
Radio	-2.819**	-0.632	-3.600***
WeChat	1.154	1.359	0.000
Weibo	-3.531***	-2.718**	-2.352*
Websites or news apps	-0.890	-0.321	-1.087
Family members	0.101	1.026	-1.795
Friends	0.995	1.945	-1.333
Communities	-2.513*	-0.414	-4.221***

*p<0.05,**p<0.01，***p<0.001

During the epidemic, newspaper reading (t=7.381, p<0.001) and magazine reading (t=4.633, p<0.001) are significantly lower among the urban elderly, and the frequency of newspaper reading among the rural elderly is also significantly lower than that before the epidemic (t=3.094, p<0.01). The decrease may be due to the severity of the epidemic, and the lag of the paper information can't meet the information needs of the elderly during the epidemic. The frequency of television viewing in the rural elderly group decreases during the epidemic (t=1.973, p<0.05), and the frequency of radio (t=-3.600, p<0.001) and rural community communication (t=-4.221, p<0.001) increases significantly, so it can be inferred that the rural community disseminates information through the radio during the epidemic and has achieved good information dissemination. It is also worth noting that there is a significant increase in the use of Weibo among both urban elderly (t=-2.718, p<0.01) and rural elderly (t=-2.352, p<0.05).

c) The rural elderly group has a closer social circle of WeChat acquaintances

Table 5. Cardinality analysis between residence and the type of WeChat groups get information about COVID-19

	Residence		X^2	P
	Urban Area ***（Column N%）***	***Rural Area*** ***（Column N%）***		
Family Group	357（68.7%）	82（82.0%）	84.279	0.000
Friends Group	398（76.5%）	56（56.0%）		
Classmates Group	272（52.3%）	20（20.0%）		
Neighborhood Group	52（10.0%）	15（15.0%）		
Group Purchase Group	4（0.8%）	6（6.0%）		
Interests Group	72（13.8%）	7（7.0%）		
Other	62（11.9%）	19（19.0%）		

*p<0.05,**p<0.01，***p<0.001

The use of WeChat among the elderly group focuses on acquaintance socialization. 72.4% of the old people get information about COVID-19 through WeChat groups, 69.0% through the direct send by WeChat friends and 70.5% through the WeChat moments. While the proportion through non-acquaintance social channels is lower. 42.3% through WeChat official accounts and 26.6% through the active search.

However, there are still differences between the social circle of acquaintances of urban and rural elderly. The results of the analysis show that the proportion of rural elderly (82.0%) obtained information through the family group Is significantly higher than that of urban elderly (68.7%). While the proportion of information obtained through the friend groups and classmate groups is significantly lower than that of urban elderly group. Moreover, for the social circle of acquaintances, such as family groups, friend groups and classmate groups, the difference in the frequency of information acquisition is greater among rural elderly and is dominated by family groups. The difference is smaller among urban elderly and is dominated by friend groups. It can be seen that the social circle of acquaintances of rural elderly is closer.

3.2. Perception and behavior of urban and rural elderly

d) There are differences in the influence of different media on the knowledge level of COVID-19 in urban and rural elderly groups

Table 6. Multiple linear regression analysis of knowledge level

Predictive variables	**Urban area**		**Rural area**	
	Standardization factor β	***Adjusted R^2***	***Standardization factor β***	***Adjusted R^2***
Module 1		0.025***		-0.003
Gender	-0.035		-0.039	
Age	-0.102*		0.017	
Education level	0.132**		0.065	
Module 2		0.024**		0.021
Newspaper	-0.023		-0.013	
Magazine	-0.041		0.175*	

Television	0.027		0.158**	
Radio	0.016		0.004	
WeChat	0.132**		-0.078	
Weibo	-0.020		-0.067	
Websites or news apps	-0.018		0.052	
Family members	-0.093		0.033	
Friends	-0.089		-0.020	
Communities	0.044		-0.011	
Module 3		0.037***		0.023*
Personal behavior	0.164***		0.173**	
Risk perception	-0.133**		-0.065	

Note: Gender coded as male=1, female=2; age and education coded from lowest to highest
*p<0.05,**p<0.01，***p<0.001

To examine the factors associated with the level of knowledge of the COVID-19 among urban and rural elderly, this study subjected demographic variables, media use, personal behavior, and risk perception to multiple linear regression analysis (as shown in Table 6). Age (β =-0.102) is negatively correlated with the knowledge level of the urban elderly, while the education level (β = 0.132) is positively correlated with the knowledge level of the urban elderly, which means urban elderly with higher education level and younger age has higher level of the COVID-19 knowledge. In contrast, demographic factors have no effect on the rural elderly. In the use of media, WeChat (β = 0.132, $p < 0.01$) has a positive effect on urban elderly's knowledge level. TV (β = 0.158, $p < 0.01$) and magazine reading (β = 0.175, $p < 0.05$) have a positive effect on rural elderly's knowledge level. In addition, the protective behavior of the elderly (β = 0.164, $p < 0.001$) is positively correlated with the knowledge level, while the risk perception of the urban elderly is negatively correlated with the knowledge level (β =-0.133, $p < 0.01$).

e) Interpersonal and community communication have different effects on the risk perception of the epidemic in urban and rural elderly groups

Table 7. Multiple linear regression analysis of risk perception

Predictive variables	**Urban area**		**Rural area**	
	Standardization factor β	***Adjusted R^2***	***Standardization factor β***	***Adjusted R^2***
Module 1		0.054***		0.008
Gender	0.120**		-0.008	
Age	-0.193***		-0.052	
Education level	-0.059		0.104	
Module 2		0.020**		0.037*
Newspaper	-0.037		0.018	
Magazine	-0.011		-0.040	
Television	-0.080*		0.022	
Radio	0.034		-0.038	
WeChat	0.104*		0.159*	
Weibo	-0.046		0.130	
Websites or news apps	-0.053		-0.041	
Family members	-0.070		0.158*	
Friends	0.079		-0.025	
Communities	0.121**		0.044	
Module 3		0.028***		0.037**
Personal behavior	0.134**		0.209***	
Knowledge level	-0.134**		-0.064	

Note: Gender coded as male=1, female=2; age and education coded from lowest to highest
*p<0.05,**p<0.01，***p<0.001

From the regression model (as shown in Table 7), it can be seen that the demographic variables of the urban elderly group are statistically significant. Gender (β = 0.120, $p < 0.01$) is positively associated with the epidemic risk perception in the urban elderly group, with women perceiving the epidemic more significantly than men. Age (β = -0.193, $p < 0.001$) was negatively associated with the risk perception in the urban elderly group, the younger the elderly is, the more they perceive the severity of the epidemic. TV (β = -0.080, $p < 0.05$) is negatively correlated with the perception of the epidemic in the urban elderly group, with the less TV viewing, the more serious the epidemic is perceived. WeChat (urban: β = 0.104, $p < 0.05$; rural: β = 0.159, $p < 0.05$) has a positive effect on the perception of the epidemic among the elderly, that is, the more frequently WeChat was used, the

more serious the risk of the epidemic is perceived. Family communication ($\beta = 0.158$, $p < 0.05$) has a positive effect on the risk perception among rural elderly and community propaganda ($\beta = 0.121$, $p < 0.01$) has a positive effect on the risk perception among urban elderly. Personal behavior (urban: $\beta = 0.134$, $p < 0.01$; rural: $\beta = 0.209$, $p < 0.001$) is positively associated with the risk perception, and education level ($\beta = -0.134$, $p < 0.01$) is negatively associated with urban elderly's risk perception.

f) WeChat and TV have a significant impact on the protective behavior of the elderly, and the impact of radio on the protective behavior is mainly reflected in the rural elderly

Table 8. Multiple linear regression analysis of protective behavior

Predictive variables	Urban area		Rural area	
	Standardization factor β	***Adjusted R^2***	***Standardization factor β***	***Adjusted R^2***
Module 1		0.048***		0.048***
Gender	0.072		0.032	
Age	-0.083*		-0.043	
Education level	0.190***		0.228***	
Module 2		0.073***		0.128***
Newspaper	-0.045		0.127	
Magazine	0.083		-0.139	
Television	0.157***		0.237***	
Radio	-0.020		0.117*	
WeChat	0.228***		0.190**	
Weibo	0.018		-0.061	
Websites or news apps	0.027		0.033	
Family members	0.075		0.117	
Friends	-0.045		-0.072	
Communities	0.017		0.069	
Module 3		0.037***		0.061***
Knowledge level	0.164***		0.166**	
Risk perception	0.133**		0.204***	

Note: Gender coded as male=1, female=2; age and education coded from lowest to highest
*p<0.05,**p<0.01，***p<0.001

The demographic variables are statistically significant in the protective behavior that the elderly had taken. Education level (urban: $\beta = 0.190$, $p < 0.001$; rural: $\beta = 0.228$, $p < 0.001$) was positively correlated with protective behavior of the elderly, the more educated the elderly is, the more focuses the elderly put on the behavior. Age ($\beta = -0.083$, $p < 0.05$) was negatively associated with protective behavior of urban elderly, younger urban elderly being more focused on personal prevention. Media use among the elderly which have a positive effect are television (urban: $\beta = 0.157$, $p < 0.001$; rural: $\beta = 0.237$, $p < 0.001$) and WeChat (urban: $\beta = 0.228$, $p < 0.001$; rural: $\beta = 0.190$, $p < 0.01$). Radio ($\beta = 0.117$, $p < 0.05$) has a positive effect on the behavior of rural elderly, which may be due to the fact that the elderly informed about relevant personal protective behavior through radio in the rural areas during the epidemic. However, both family and close friends' communication have no significant effect on the protective behavior of the elderly in the epidemic, probably due to the reduction of direct correspondence during the epidemic and more interaction through family groups and friend groups (verified from Table 9). In addition, both risk perception (urban: $\beta = 0.133$, $p < 0.01$; rural: $\beta = 0.204$, $p < 0.001$) and knowledge level (urban: $\beta = 0.164$, $p < 0.001$; rural: $\beta = 0.166$, $p < 0.01$) could positively influence the protective behavior of the elderly.

g) Rural elderly's behavior is more likely to be influenced by group messages, and urban elderly trust authoritative media advice more

Table 9. Cardinality analysis of residence and reasons for taking protective behavior

Topic	Options	Residence			X^2	P
		Total	***Urban Area（Column N%）***	***Rural Area（Column N%）***		
Reasons for taking protective behavior	Family advice or supervision	733（74.8%）	458（68.3%）	275（89.0%）	285.067	0.000

Advice from friends, neighbors	269（27.4%）	144（21.5%）	125（40.5%）
News from the Newspaper	140（14.3%）	114（17.0%）	26（8.4%）
News from the magazine	35（3.6%）	27（4.0%）	8（2.6%）
Suggestions made in TV news	724（73.9%）	508（75.5%）	216（69.9%）
Programs in the Spring Festival Gala	113（11.5%）	77（11.5%）	36（11.7%）
Recommendations made in radio news	147（15.0%）	92（13.7%）	55（17.8%）
News from the news sites	153（15.6%）	127（18.9%）	26（8.4%）
Information about the epidemic in WeChat	357（36.4%）	313（46.6%）	44（14.2%）
Information about the epidemic in Weibo	51（5.2%）	41（6.1%）	10（3.2%）
Communities propaganda	484（49.4%）	275（41.0%）	209（67.6%）
Other	39（4.0%）	29（4.3%）	10（3.2%）

As shown in Table 9, the behavior change of the elderly group is most likely to be influenced by family members (74.8%) and television (73.9%), which shows that television is still the authoritative media among the elderly group. In these two media, rural elderly is more likely to be influenced by their family members, while urban elderly trusts the advice of authoritative media more. In addition, friends, neighbors and propaganda in rural communities are more likely to influence the behavior of rural elderly. Urban elderly's behavior is also susceptible to the influence of WeChat messages and propaganda in urban communities, however, the influence of community propaganda on their behavior is not as strong as that on rural elderly. It can be seen that the behavior of rural elderly is more likely to be influenced by group information, while information disseminated through the media is more likely to influence the behavior of urban elderly.

4. Conclusion

In recent years, the elderly is increasingly using digital media in the context of aging + communication + technology (ACT). The information environment of elderly groups under the COVID-19 context has changed significantly, and their information perceptions and behavioral responses to the epidemic urgently need to be reexamined and explored. This study focuses on the information behaviors of urban and rural elderly groups in the early stage of the epidemic and their differences, including media use before and after the epidemic in the temporal dimension and information cognition and behavioral responses of urban and rural elderly groups in the spatial dimension, the following conclusions were drawn.

Firstly, the media use gap between urban and rural elderly groups in a mediated society is still obvious. Overall, TV, WeChat, interpersonal communication and community communication are the most common ways for the elderly to seek information. Paper media and new media are used more among urban elderly groups, while rural elderly groups prefer to use interpersonal networks to seek information, which is a kind of social communication of acquaintances based on geography, kinship and friends. Because of the travel restrictions of the epidemic, this reliance on interpersonal relationships shifted to online, as evidenced by the closer social circle of WeChat acquaintances among the rural elderly group. In addition to its function of providing information during the epidemic, WeChat served the function of maintaining contact between the elderly and their families. Previous studies based on the overall comparison of urban and rural groups have suggested that the gap in social media use between urban and rural areas is the smallest [17], but this study found that there is the largest gap between urban and rural elderly groups in the frequency of using WeChat to obtain information. The rise of China's elderly groups from "digital refugees" to "digital disadvantaged groups" has been achieved through WeChat [18], but research on the elderly still needs to pay attention to the urban-rural differences in their digital integration process.

Secondly, this study found that in the early stage of the epidemic, the influence mechanism or media use on the protective behavior of the elderly in urban and rural areas was different. The

structural impact model of health communication suggests that media communication influences health by raising awareness, focusing on health, highlighting relevant health issues, providing health information, and enhancing health-related knowledge, attitudes, and behaviors [20]. Good communication in "resilient communities" during emergencies can minimize the spread of negative public opinion and the accumulation of negative emotions [21], and radio as a "loud speaker" played an important role in this rural communication and had a positive impact on the protective behavior of the elderly. Community communication in urban areas promotes the perceived seriousness and encourages protective behaviors among the elderly. The use of WeChat both directly motivated the elderly to adopt protective behaviors and influenced their perceptions of the severity and danger of the epidemic, which in turn motivated them to take protective behaviors. Television viewing directly influenced the elderly's protective behaviors.

This study connects media, perception and behavior. Authoritative media can directly influence the elderly's behavioral responses. The information function of social media makes the elderly aware of the seriousness of the epidemic by influencing their perceptions and thus taking protective behaviors, and the social function (family, friend groups, etc.) can directly promote the elderly to take protective behaviors.

The study reveals that the similarities and differences in media contact, message perceptions, and behavioral responses between urban and rural elderly groups in Chinese early stages of the COVID-19 pandemic. The comparative perspective helps to further refine the digital challenges faced by different elderly groups, which in turn suggests different paths we can take to enhance the effectiveness of health communication in relevant social interventions.

Acknowledgment

The paper is funded by the National Social Science Fund Project "Internet Social Support for New Urban Migrants under the Background of New Urbanization" (Project No.17BXW105) and the "Qing Lan Project" of Jiangsu university.

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