ORIGINAL RESEARCH

Residents' WeChat Group Use and Pro-Community Behavior in the COVID-19 Crisis: A Distal Mediating Role of Community Trust and Community Attachment

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Background: During the ongoing COVID-19 pandemic, the resident's WeChat group has created a new material foundation for dialogue to occur and become a powerful platform for resident communication. This study explores the mechanism behind and the effects of residents' WeChat group use on residents' community trust, community attachment, and pro-community behavior.

Methods: An online survey questionnaire was used for data collection. The authors collected data from 500 commercial housing community residents in Wuhan, China, and analyzed the data using SPSS 26.0 and Mplus 8.3 software.

Results: This study's findings uncover that (1) residents' usage of WeChat groups has a statistically significant and positive impact on their community trust, community attachment, and pro-community behavior; (2) community trust and community attachment both play a mediating role in the mechanism behind residents' usage of WeChat groups in improving pro-community behavior; and (3) the transmission and united effects between community trust and community attachment form a distal mediating role.

Conclusion: The model systematically and comprehensively reveals the internal mechanism behind residents' adoption of pro-community behavior. Community managers can actively participate in the resident's WeChat group to ensure the dissemination of positive information in the community; enhance residents' awareness of risk, community trust, and belonging; and cultivate community resilience. At the same time, community managers should also fully recognize the important transformative roles that community trust and community belonging play between the use of WeChat groups by residents and the formation of pro-community behavior. Community managers should actively establish a warm and trusting community culture, strive to create a community atmosphere with a sense of belonging, make residents develop emotional attachment to the community, and then form behavior that is beneficial to the community, greatly enhancing the resilience and self-management of the community in disaster situations.

Keywords: COVID-19, residents' WeChat group use, pro-community behavior, community attachment, community trust

Introduction

The outbreak of COVID-19 in December 2019 has rapidly spread to the China, seriously hindering the development of the social economy and impacting the general public's normal lives. Facing a fast-spreading pandemic with a wide range of influence, governments' ability to prevent and control the spread and maintain social governance has been challenged at all levels. As for the importance of community, China maintains the importance of "mutual assistance": "a good neighbor is more precious than a house worth a million" and "a far-off relative is not as helpful as a near neighbor". In contemporary society, the focus of social governance has shifted to the community level; 650,000 urban and rural communities, which constitute the basic units of current national governance, working at the grassroots level have

become the first line of pandemic prevention and control. Furthermore, these communities have provided the most effective defense line for maintaining external prevention and internal non-proliferation.

The concept of community is diverse and can be divided into "regional community" and "relational community".[1] The concept of "community" in Chinese and Western countries is not equivalent. The community in the Chinese context only refers to "regional community", which mainly consists of the residential area under the jurisdiction of the residents' committee in the city, sometimes reaching further to include the village community. At present, the types of urban communities in China can be divided into employer communities, traditional neighborhood communities, commercial housing communities, "village into residence" communities, and mixed communities. With the acceleration of urbanization and housing commercialization in China, the commercial housing community has gradually become the most important type of urban community. As a micro social public governance space, the commercial housing community usually involves multiple stakeholders, such as the residents' committee, owners' committee, property companies, and residents. Among them, residents are undoubtedly the most critical and widespread power in the process of community governance. Zhao and Zhang reveal that active and effective resident participation provides an important basis for improving community governance.[2] However, current residents lack a strong sense of community and willingness to participate in the community, thus making it difficult to form a binding community.

As far as China is concerned, this phenomenon can be explained by the following three aspects. Firstly, at the institutional level, China's grass-root society is shaped and maintained by three mechanisms, namely, the state's leadership, community cooperation, and community self-maintenance.[3] The strong administrative leadership leads to the weakening of the basic functions of communities, where residents only consider their own needs and interests. Secondly, on the cultural level, the subject consciousness in traditional Chinese culture and the awareness of the "private citizen" have restrained resident initiative to participate in community public affairs. Additionally, traditional Chinese culture restrains human relations to five types: monarchs and ministers, fathers and sons, brothers, couples, and friends, lacking a swarm consciousness that extends beyond personal goals. Finally, on the individual level, existing studies have confirmed that community residents with a similar background, such as similar income, education, and occupation, have stronger community attachment than those without.[4] Compared with previous urban grassroots social management based on the "employer system" and the acquaintance society, the heterogeneous relationship network embedded among the residents of modern commercial housing communities, as well as the differences in population structure, social capital, and other factors, make the relationships between residents unfamiliar and alienated, and community residents indifferent to community public affairs.[2]

In response to risks and disasters, individual power is always limited. With the outbreak of the COVID-19 pandemic and the normalization of prevention and control measures, community residents have integrated to form risk community, security community, community with a shared future, trust community, emotional community, and moral community.[5] Within this particular circumstance, communities must enhance community attachment, build a common community, and empower residents to better recover from trauma. "Communication Infrastructure Theory" attests that a community must have a strong "storytelling network" in which residents, community media, and community organizations can encourage each other to actively and effectively cultivate community attachment, collective effectiveness, and individual participation.[6] Unlike previous neighborhood networks formed through physical contact and face-to-face communication, online communities such as residents' WeChat groups have eroded time and space limitations, allowed many-to-many interactions, and increased information dissemination speeds; these features form the fundamental components of a new type of neighborhood storytelling network,[7] significantly reducing the cost of sharing information and opinions among neighbors, increasing opportunities for communication and exchange between neighbors, and providing new channels for residents to consider and engage with community affairs.[8]

During the pandemic, the isolation of physical space has resulted in the interruption of real-world communication channels; the availability and accessibility of online networks have made online channels a key pathway for information and resource dissemination.[9,10] According to the survey report on public cognition and information communication of "novel coronavirus pneumonia" 2020 released by the State Information Center, WeChat (62%) has surpassed TV (52%), Weibo (40%), news websites (36%), and newspapers/magazines (12%) to become the most important channel for the public to obtain information about the COVID-19 pandemic.[11] The resident's WeChat group has become a core tool for communities to reach residents during the epidemic, connecting the community network in a peer-to-peer manner, maintaining and shaping the operation of the community with virtual power.[12] This platform not only strengthens the

emotional link and resonance between residents, helping to eliminate anxiety and loneliness, but also provides a convenient communication space for residents' public opinion supervision, community discussion of pandemic prevention and control, and the group purchase of living materials. These actions bring the "discrete" community together again and enable mutual assistance between community neighbors. However, previous studies on media effectiveness in risk and crisis situations have focused on social media sites such as Facebook and Twitter,[13,14] lacking specific attention towards private social interactions. Due to insufficient data and research attention, and despite social messaging networks such as Telegram, WeChat, and WhatsApp supporting millions of active users and enabling versatility in building social networks, there is relatively little research exploring social messaging networks;[15] furthermore, there is a lack of specialized research on homeowner WeChat groups. Additionally, previous studies on the effectiveness of media use have predominantly focused on the self-protection behavior and intention of individuals in crisis situations,[16–18] but have not yet explored the altruistic behavior of community residents. In addition, studies have shown that the relationships and interactions among community residents vary depending on the type of residential community,[19–21] and previous studies on communities have not distinguished between types of communities in detail. The commercial housing community has gradually become the main type of community in the city. It is a community of strangers that is formed by the development and construction of commercial housing. The relationship between residents is based on property rights and common residence. There is a lack of certain kinship, consanguinity, and industrial ties. Collective consciousness and intimacy are scarce.[22] In addition, the commercial housing community has a large population mobility and faces many difficulties in organization and mobilization, making the formation of collective action[23] and governance difficult. Therefore, the study of commercial housing communities has practical significance. As the COVID-19 pandemic in Wuhan broke out earlier, was sealed and controlled for a longer time, and had a larger impact, Wuhan presents a representative setting for the research object of this topic. Therefore, to supplement the research on the behavior of homeowners in WeChat groups and commercial housing communities, this study focuses on the commercial housing community in Wuhan, advances the concept of "pro-community behavior" in the context of the unprecedented COVID-19 pandemic, and attempts to examine the effect mechanism between the use of residents' WeChat groups and pro-community behavior, to address how to manage commercial housing communities and strengthen community resilience when facing major public health emergencies in the future.

Theoretical Framework and Hypotheses

Resident WeChat Group Use and Community Trust

Trust is an important topic in the field of sociology. Blau described trust as the basic factor of stabilizing social relations, which is indispensable in the modern age.[24] However, current studies have not formed a consensus on the connotation of trust. One view is that trust is expressed by an individual's behavior; this view is mostly used to study the relationship between direct interactive behavior and is mostly measured by behavior indicators. Another view considers trust to involve the giver's positive expectation of the addressee's possible behavior.[25] As the measurement index of the former is highly dependent on a specific situation, once separated from the set situation, the trust of individual behavior is difficult to be measured.[26] Therefore, community trust in this study mainly refers to the trust of residents living in the community towards other residents and community organizations.

Specifically, community trust can be divided into neighborhood trust and organizational trust. Studies have shown that neighborhood trust is different from general trust, which is more vulnerable to the influence of group identity, group relationship, neighborhood interpersonal interaction, residents' experience in the community, and residence time.[27] Due to the spatial isolation caused by the pandemic, the resident's WeChat group has become a mutual aid platform between residents. Residents enthusiastically provide assistance according to their own resources to achieve cooperation and mutual benefit. The storytelling aspect of the resident's WeChat group has changed the isolated neighborhood relationship, closed the emotional distance between residents, strengthened the community's group identity, and further increased the residents' neighborhood trust. Organizational trust refers to the confidence in the professional knowledge and technical ability of an organization and its members, and an expectation of an organization to have a sense of responsibility and morality; organizational trust is based on performance.[28] During the pandemic period, community organizations frequently released pandemic information and community prevention and control measures through the

residents' WeChat group. Community organizations presented the merits of community grassroots staff, demonstrating the sense of responsibility and professional ethics of community organizations and staff, and effectively enhancing residents' recognition of community organizations and staff, to improve residents' trust in community organizations. Previous studies have also found that media use can significantly affect social trust.[29] Therefore, we propose the following hypothesis:

H1: The use of the resident's WeChat group has a positive effect on residents' community trust.

Residents' WeChat Group Use and Community Attachment

This study's understanding of community attachment is derived from work by Tönnies. When Tönnies introduces the concept of community, he mentions attachment but does not clearly define community attachment. Maslow provides a definition of attachment, proposing that attachment is a basic psychological and social need of human beings.[30] Community attachment refers to the psychological needs of the residents in the community for certain recognition, love, and attachment to the community region and group. Previous studies have found a positive correlation between residents' social relations, community participation, community satisfaction, and community attachment.[31,32] However, in the modern commercial housing community, the residents are composed of "strangers" without the natural basis of blood and geography,[33] which does not easily produce spontaneous attachment.

The gradual increase of the embeddedness of new media in the community has a profound impact on the daily life and communication mode of the community. In particular, WeChat, which is used by more than half of Chinese community residents, has greatly reduced the cost of communication between residents. As the main life service platform of the community, resident WeChat groups play an important role in forming a "community bond". Furthermore, residents can freely discuss the trivia of daily life within the resident's WeChat group, such as the transfer of idle goods and community life information, which helps to expand the social relations between neighbors and improve the "weak relations" of neighbors. Additionally, the resident's WeChat group facilitates residents' supervision of community public affairs and assists in community management, effectively increasing residents' participation in the community.

Lewin divides individuals' activities within groups into active participation and triggered participation, attesting that individuals who involve with active participation change their attitudes and behaviors faster and more obviously.[34] During the pandemic, residents have become a community of common destiny, making residents more actively participate in community public affairs through the resident's WeChat group. Residents receive encouragement, sympathy, help, and other support in the process of online interaction. The deep involvement of residents' emotions and actions not only makes residents feel belonging to, identity with and feel attachment towards the community but also more willing and active to tell community stories in the resident's WeChat group. This storytelling further promotes the change of attitude and emotion of other residents. Accordingly, we hypothesize the following:

H2: The resident's use of WeChat group has a positive effect on residents' community attachment.

Residents' WeChat Group Use and Pro-Community Behavior
Direct Promotion Effect of Residents' WeChat Group Use on Pro-Community Behavior

Wispe first proposed the term "prosocial".[35] Prosocial behavior refers to the positive behavior that individuals show in the process of social communication, which is beneficial to others and society, and can promote friendly and harmonious relationships. The common manifestations of prosocial behavior include help, self-sacrifice, comfort, donation, cooperation, and sharing.[36] Traditionally, prosocial behavior research focuses more on the characteristics of "altruism", but Batson and Ahmad attest that prosocial behaviors encompass both pure altruism and ego altruism.[37] Due to COVID-19's high infectivity rates and difficulty to be identified,[38] one of the basic methods to curb the spread of the pandemic is home quarantine. When serious, communities can be placed in lockdown, making community residents integrate as a common community to reduce risk and creating an unprecedented form of "connection". During the pandemic period, a number of pro-community behaviors emerged in the community, including pure altruistic behaviors such as providing information support, emotional comfort, and material help. Additionally, altruistic behaviors that included egoism were expressed, such as residents actively making suggestions for the prevention and control of the pandemic in the community and building a safe community life, both of which helped individuals and community groups to manage

the difficulties of the pandemic. In view of this, this study comprehensively measures pro-community behavior arising from pure altruism and ego altruism.

According to Bourdieu, society is composed of various fields.[39] If we regard WeChat groups as a specific field, then the structural characteristics, interactive relationships, and opinions expression among users will affect or even change the implicit attitudes and explicit behaviors of individuals in the field.[40] During the pandemic, the resident's WeChat group served as a gathering platform for the community. On the one hand, residents could share their suffering and news of disasters to other residents by sending messages in the WeChat group. The negative state relief hypothesis proposes that, when witnessing the suffering of others, individuals' memory of suffering and emotional empathy are activated, and, accordingly, their prosocial motivations to help others are stimulated.[41] Ciaramicoli also attests that empathy can provoke altruistic behavior.[42] On the other hand, according to the imitation theory, humans tend to imitate other people's behaviors and speech styles.[43] Nook et al believe that when an individual observes the prosocial behavior of people around them, driven by imitation motivation, the individual involuntarily imitates their peers and then behaves in a similar prosocial manner.[44] Nook et al further declare that the generation of an individual's prosocial behavior is not only a simple imitation of others' behavior but also the recognition and acceptance of others' prosocial motivation, so as to change their attitude.[44] Bandura and Walters use the concept of social learning theory, dividing individual learning into direct experience learning and indirect experience learning: indirect experience learning is the process of acquiring behavior by observing the behavior of the demonstrator.[45] Residents or community organizations present merits emerging in the process of community anti-pandemic through the resident's WeChat group, providing examples and role models for other residents to learn and imitate. Specially, residents greatly recognize and accept this altruistic behavior in their deep heart, so as to provoke their pro-community motivation. Existing studies have shown that the use of new media can strengthen individual participation in environmental protection. In terms of WeChat use, research shows that the public's attention to the pandemic information on WeChat can positively promote altruistic behaviors, including compliance and mutual assistance.[28] Accordingly, we hypothesize the following:

H3: The resident's WeChat group use has a positive effect on residents' pro-community behavior.

Mediating Effect: Community Trust and Community Attachment

In addition to direct effects, the use of residents' WeChat groups may also indirectly promote pro-community behavior by activating residents' community trust and community attachment. Trust serves as the intrinsic lubricant for community development and residents' pro-sociality. Christian and Richman demonstrate that the enhancement of trust increases individuals' prosocial behavior.[46] In the context of a public health crisis, social trust can promote coordination and cooperation among residents, and residents can actively mobilize other residents within their intimate relationships to engage in self-protection.[47] Putnam believes that people who trust others are willing to participate in more voluntary activities, make more charitable donations, and engage more frequently in political and community organizations.[48] Kyei-Poku and Ivy also highlight that interpersonal trust is conducive to the prosocial nature of individuals.[49] As a mutual aid platform for residents during the pandemic, the resident's WeChat group has increased the frequency of interaction between residents and community organizations, enhanced residents' community trust, and encouraged residents to engage in pro-community behavior: for example, actively cooperating with community work and providing help and encouragement to groups in trouble. Therefore, the use of residents' WeChat groups can promote residents' pro-community behavior by enhancing community trust. In view of this, we propose the following hypothesis:

H4: Community trust plays a positive mediating role between residents' WeChat group use and pro-community behavior.

The emotional response is an important factor in generating motivation to help others. Community attachment is the emotional connection of residents to their community and other residents; individuals with stronger community attachment tend to integrate more into their community. Devi et al found a significant positive correlation between community attachment and prosocial behavior.[50] When individuals initially enter the community, they lack emotional ties with the community and have a low sense of community attachment. With the increase of living time and interaction frequency, individuals gradually establish relatively stable social relationships and emotional connections with other residents. In this process, individuals achieve community attachment, regard themselves as a member of the community, and consciously restrict their behavior according to the norms of the community.[51] The outbreak of the pandemic has
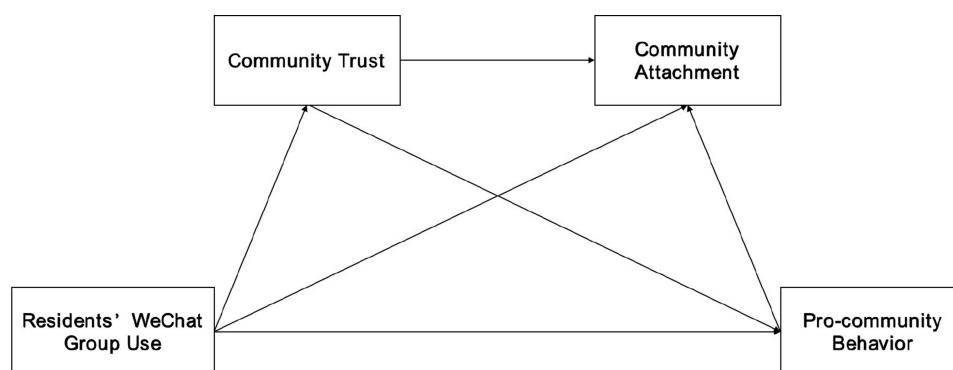
Figure 1 Research model.

intensified the mutual needs in the community. Individuals with stronger attachment needs are more inclined to cooperate with others facing social difficulties.[52] Therefore, the use of residents' WeChat groups can promote residents' pro-community behavior by enhancing their community attachment. In view of this, we hypothesize the following:

H5: Community attachment plays a positive intermediary role between residents' WeChat group use and pro-community behavior.

Mischel and Shoda proposed the cognitive-affective system theory of personality (CAPS) and combined cognition and emotion into the personality system, which helps to comprehensively and dynamically explain the complex social behavior of individuals.[53] The CAPS theory illustrates that external situational features can activate individuals' cognitive and emotional factors, and then determine individuals' behavior choices.[53] Community trust is a cognitive process that involves residents' positive expectations for other residents and community organizations, which belongs to the internal cognitive unit of individuals. Community attachment is the emotional state of residents, which belongs to the internal emotional unit of individuals. Wu highlights that cognition is difficult to transform into action without emotional participation.[54] In the context of the pandemic, the resident WeChat group fully demonstrated the importance of mutual assistance and the sense of responsibility of community organizations and grassroots staff towards residents; formed many positive evaluations and perceptions; and improved the residents' community trust. This positive cognition increases residents' recognition of and attachment to their community, promotes residents to actively practice pro-community behavior in their daily life, and contributes residents' strength to the development of the community. In view of this, we hypothesize the following:

H6: Community trust and community attachment play a chain intermediary role between residents' WeChat group use and pro-community behavior; residents' WeChat group use can enhance residents' community attachment by improving residents' community trust, thus affecting residents' pro-community behavior.

This hypothesis finalizes our research model, which we illustrate in Figure 1. Figure 1 represents the variables and their relations as proposed by the six hypotheses.

Research Methods
Sample and Procedure

The participants of this study are residents of commercial housing communities who reside in Wuhan, China. Due to the impact of COVID-19, the management of commercial housing communities in Wuhan is relatively strict, and it is difficult for us to conduct offline questionnaires. In May and June 2022, we commissioned Research Factory, a professional online survey company, to conduct an online survey in Wuhan, China. An online survey, as a structured method, can overcome time and space constraints with limited field efforts and fewer human errors, especially during the COVID-19 pandemic, when samples are hard to assess.[55] Respondents were randomly recruited from the paid sampling service provided by Research Factory. Research Factory is one of the largest platforms for collecting online survey data in China. After completing the online survey, respondents can receive a certain amount of compensation, and a total of 1156 samples were obtained during the survey period.

To obtain a valid sample, we firstly set two questions to screen for the respondents' permanent residence and community type. When completing the online questionnaires, the screening of permanent residences was checked against participants' IP addresses. In the preliminary data screening, 648 questionnaires were considered invalid. Additionally, eight responses were excluded because the respondents chose the same option for all items, indicating a lack of seriousness. We ultimately obtained a total of 500 valid survey questionnaires, with an effective response rate of approximately 43.25%. The scale items in this study are 21. The qualified sample size was n = 500, which is sufficient to constitute a sufficiently valid data set due to meeting the criteria of at least 10 responses per item.[56] Therefore, 500 surveys were chosen as the final sample for the present study. As the Kaiser-Meyer-Olkin Measure of Sampling Adequacy value is 0.966, which is greater than the required 0.7, this sample is considered statistically adequate for estimating the results. Furthermore, this test shows high significance at the 1% level (p-value = 0.000, <0.01), indicating the suitability and adequacy of the sample.

According to the characteristics of the effective sample (Table 1), the proportion of males and females in the 500 respondents is relatively balanced with 272 males, accounting for 54.4%, and 228 females, accounting for 45.6%. The age distribution is concentrated in 26–30-year-olds and 31–45-year-olds, accounting for 35.4% and 53.8% respectively. During the pandemic, residents in these age groups are the most active groups in community participation. In terms of

Table 1 Respondents' Demographics (N = 500)

Variable	Category	Frequency	Percentage (%)
Gender	Male	272	54.4
	Female	228	45.6
Political stand	CCP member	132	26.4
	Non-CPC member	368	73.6
Education level	Junior high school and below	1	0.2
	High school/ secondary vocational school	28	5.6
	Higher Vocational College	114	22.8
	Undergraduate	329	65.8
	Graduate and above	28	5.6
Age	18–25	28	5.6
	26–30	177	35.4
	31–45	269	53.8
	46–60	26	5.3
Monthly income (RMB)	1000 Yuan and below	2	0.4
	1001–3000 Yuan	6	1.2
	3001–5000 Yuan	45	9
	5001–7000 Yuan	173	34.6
	7001–10,000 Yuan	128	25.6
	10,001–15,000 Yuan	115	23
	15,001–30,000 Yuan	28	5.6
	Above 30,001 Yuan	3	0.6

(*Continued*)

Table 1 (Continued).

Variable	Category	Frequency	Percentage (%)
Years of residence	1–3	16	3.2
	3–5	158	31.6
	5–7	143	28.6
	7 and more than years	183	36.6

education level, the respondents mostly attend higher vocational colleges and undergraduate colleges, accounting for 22.8% and 65.8% respectively. About 71.4% of the respondents have a bachelor's or graduate degree or above, demonstrating a higher education level. Politically, 26.4% are members of the Chinese Communist Party (CCP) and 73.6% are non-CCP members. In addition, 89.4% of the respondents' average monthly income exceeds 5000 yuan. In terms of the respondents' years spent living in the current community, 1–3 years, 3–5 years, 5–7 years, and more than 7 years account for 3.2%, 31.6%, 28.6%, and 36.6%, respectively.

Variable Measurement
Use of Resident's WeChat Group
The questionnaire asks how often the respondents engage in the following behaviors through the resident's WeChat: (1) the frequency of reporting noncompliance issues to the property or other community neighbors and making appeals (such as wearing masks in public places, avoiding gathering); (2) the frequency of obtaining information regarding topics such as notice and group purchase of living materials; (3) the frequency of recording, encouraging, and praising the good merits emerging in the process of community anti-pandemic measures (such as hard-working community staff and touching moments of mutual assistance); (4) the frequency of seeking help (such as information help-seeking and psychological counseling). The respondents' response options range from "never" (code 1) to "always" (code 5), adopting a five-point Likert scale. In this study, the four items were averaged to establish a comprehensive index of "residents' WeChat group use". The higher the index, the more frequently the resident WeChat group is used by the respondents.

Pro-Community Behavior
The following five items were designed to measure pro-community behavior: (1) cooperating with the requirements for entering and leaving the community, such as temperature detection, showing a health code, and wearing a mask; (2) providing timely information support and emotional encouragement to individuals or families in need of help in the community; (3) assisting individuals or families in need of help in the community, such as purchasing and distributing living supplies for neighbors in quarantine, delivering express delivery and urgent medicine, and helping the elderly; (4) volunteering for community services (for example, serving as the "building manager" of the community building, coordinating the group purchase of the community, and organizing nucleic acid testing); and (5) actively making suggestions for improving community pandemic prevention and control management. The respondents' response options range from "never" (code 1) to "always" (code 5), adopting a five-point Likert scale. In this study, five items were averaged to establish a comprehensive index of "pro-community behavior".

Community Attachment
We made minor changes to Gui and Huang's[57] items to suit the context of the measurement of community attachment. The items include the following: (1) community makes me feel like home; (2) I like my community; (3) I feel very proud when telling others where I live; (4) I will feel sorry if I have to move away from my current community; (5) I am very interested in what happened in the community; (6) I am willing to tell and forward the anti-pandemic stories of the community and the merits in daily life; and (7) I care about what others think of my community. The respondents' response options range from "highly disagree" (code 1) to "highly agree" (code 5), adopting a five-point Likert scale. In

this study, the seven items were aggregated and averaged to establish a comprehensive index of "community attachment". The higher the index, the stronger the respondents' community attachment.

Community Trust

We made minor revisions to Gui and Huang's[57] items measuring community trust. The items include the following: (1) I trust the community residents' committee very much; (2) I trust the community residents' committee very much; (3) I trust the residents of my community; (4) I am very careful when dealing with other community residents; (5) I believe I can enjoy all kinds of resources and welfare of the community together with other community residents. The respondents' response options range from "highly disagree" (code 1) to "highly agree" (code 5), adopting a five-point Likert scale. In this study, five items were averaged to establish a comprehensive index of "community trust".

Control Variables

Gender (0 = female, 1 = male), age, education level, political outlook (0 = non-members of CCP, 1 = members of CCP), personal monthly income, and community residence years were included in the study model as control variables.

Data Analysis Strategy

This study analyzed the collected data using SPSS 26.0 and Mplus 8.3. Firstly, we conducted descriptive statistical analysis to gain a deeper understanding of the demographic characteristics of the respondents, and then calculated Cronbach's α to measure the reliability of each variable. To examine the relationship between each variable, Pearson's correlation and confirmatory factor analyses were performed. Additionally, we conducted a global test, based on structural equation models, on the proposed analysis framework, using Mplus 8.3 software based on maximum likelihood estimation. Subsequently, we conducted a linear regression analysis using the least squares method to test the impact of WeChat group usage by homeowners on community trust, sense of community belonging, and pro-community behavior, and completed the testing of relevant research hypotheses. Finally, Hayes' PROCESS macro models 4 and 6 were applied to confirm the mediating effect and the partial mediating effect.[58] To verify statistical significance, 5000 samples were extracted and analyzed using the bootstrapping method, and a 95% confidence interval was applied.

Results
Correlation Analysis of Variables

Table 2 shows the mean, standard deviation, and correlation coefficients of the four variables. In terms of the mean, the frequency of residents' WeChat group use and pro-community behavior is relatively high. According to the results of data analysis, the resident's WeChat group use is positively correlated with pro-community behavior (r = 0.750, $p < 0.01$); the use of residents' WeChat group is positively correlated with community trust (r = 0.580, $p < 0.01$) and community attachment (r = 0.551, $p < 0.01$); pro-community behavior is positively correlated with community trust (r = 0.663, $p < 0.01$) and community attachment (r = 0.686, $p < 0.01$); and there is a positive correlation between community attachment and community trust (r = 0.723, $p < 0.01$). These findings provide preliminary data support for the hypothesis verification of subsequent studies.

Table 2 Mean, SD, Correlation and Discriminant Validity

Variable	Residents' WeChat Group Use	Community Trust	Community Attachment	Pro-community Behavior
Residents' WeChat group use	**0.761**			
Community trust	0.580**	**0.728**		
Community attachment	0.551**	0.723**	**0.779**	
Pro-community behavior	0.750**	0.663**	0.686**	**0.765**
Mean	3.753	4.124	4.217	3.966
SD	0.843	0.657	0.684	0.786

Notes: **Refers that the correlation is significant; the value bold at the diagonal is the square root of the average variance extracted (AVE) values.

Validity and Reliability

In this study, Mplus 8.3 software was used to test the measurement (outer) model for item and scale reliability, discriminant validity, and multicollinearity for common method bias (CMB). Table 2 shows that the four variables significantly correlate with each other ($p < 0.01$). In addition, the absolute values of the correlation coefficients are greater than 0.5 and less than the square root of the corresponding AVE, demonstrating a certain correlation between the potential variables and a certain degree of discrimination, indicating that the scale data has good discriminant validity.

Confirmatory factor analysis was used to verify the factor structure of the set of observed variables.[59] The four-factor model (no combined factors), the hypothesized model established in this study, was compared with one-factor, two-factor, and three-factor models. Table 3 presents the results of these analyses. The hypothesized model established in this study indicated a good fit to the data (x^2/df = 2.166, RMSEA = 0.048, CFI = 0.967, TLI = 0.963, SRMR = 0.036) compared to alternative models.[60,61]

Table 4 shows that the standardized factor load of each item corresponding to each potential variable of the resident's WeChat group use, community trust, community attachment, and pro-community behavior is greater than 0.5, and is

Table 3 Model Fitting (N = 500)

Model	x^2	df	x^2/df	RMSEA	CFI	TLI	SRMR
Four factor model	396.415	183	2.166	0.048	0.967	0.963	0.036
Three factor model	432.624	186	2.326	0.051	0.962	0.958	0.036
Two factor model	990.395	188	5.268	0.092	0.878	0.864	0.069
Single factor model	1297.509	189	6.865	0.108	0.831	0.812	0.073
Reference value	–	–	1~3	<0.05	>0.9	>0.9	<0.05

Notes: Four factor model refers to the hypothetical model; three factor model refers that community trust and community attachment are combined into one factor; two factor model refers that the three variables of community trust, community attachment, and pro-community behavior are combined into one factor; single factor model refers that four variables are combined into one factor.

Table 4 Analysis of Aggregate Validity and Reliability

Construct	Item	Factor Loading	Cronbach's α	CR	AVE
Residents' WeChat group use	1	0.730	0.846	0.846	0.579
	2	0.783			
	3	0.782			
	4	0.746			
Community trust	1	0.717	0.817	0.847	0.531
	2	0.778			
	3	0.796			
	4	0.805			
	5	0.505			
Community attachment	1	0.779	0.908	0.915	0.607
	2	0.782			
	3	0.807			
	4	0.751			
	5	0.763			
	6	0.783			
	7	0.789			
Pro-community behavior	1	0.651	0.872	0.875	0.585
	2	0.775			
	3	0.808			
	4	0.813			
	5	0.767			

significant at the level of $p < 0.001$, indicating that the items corresponding to each potential variable are highly representative. In addition, the average variance extraction (AVE) of each latent variable was greater than 0.5, indicating that the four scales performed well in aggregate validity. Furthermore, the combined reliability (CR) of the four variables is greater than 0.8, and the Cronbach's α is greater than 0.7, implying that the internal consistency of the questionnaire is high, and each variable has good reliability.

Common Method Deviation Test

Due to the same data collection methods, the characteristics of the research itself, the respondents' reaction bias, and other factors, common method variation (CMV) was generated.[62] This causes common method bias (CMB) and affects the validity of the measurement.[63,64] To ensure the accuracy of the research conclusion, we have taken several steps to solve the potential CMB. First, we used anonymous questionnaires, and informed participants about the purpose of the study in detail. Second, we used different types of response scales (highly agree–highly disagree; always–never). Third, we collected data in two stages to avoid respondents' tendency to associate variables in the study.[65] Fourth, we used the test of multicollinearity through the variance inflation factor (VIF) as a comprehensive procedure for checking if CMB may be a threat.[66] The VIFs were lower than 5.0, indicating that CMV in the data was not detected as CBM.[67] Finally, we compared the correlation coefficients between the latent variables, finding the correlation coefficients to be less than 0.8, which further shows the data quality of this survey is good and a lack of serious issues with CMB.

Hypothesis Test
Direct Effect Test

According to Table 5, the use of residents' WeChat groups has a positive impact on pro-community behavior (β = 0.701, $p < 0.001$); the higher the frequency of residents' WeChat group use, the more often residents practice pro-community behavior, suggesting that H3 is supported. Additionally, residents' WeChat group use has a positive impact on community trust (β = 0.452, $p < 0.001$) and community attachment (β = 0.426, $p < 0.001$); the higher the frequency of residents' residents' WeChat group use, the stronger their perceived community trust and community attachment, suggesting that H1 and H2 are supported. In addition, education level in demographic variables can significantly predict pro-community behavior (β = 0.119, $p < 0.01$), community trust (β = 0.159, $p < 0.001$), and community attachment (β = 0.120, $p < 0.01$);

Table 5 OLS Regression Analysis of Pro-Community Behavior, Community Trust, and Community Attachment (N = 500)

Variable	Pro-Community Behavior	Community Trust	Community Attachment
Resident WeChat group use	0.701***	0.452***	0.426***
	(0.027)	(0.031)	(0.033)
Gender	0.001	−0.117*	−0.130**
	(0.049)	(0.049)	(0.049)
Age	−0.018	−0.021	−0.017
	(0.040)	(0.039)	(0.040)
Education level	0.119**	0.159***	0.120**
	(0.040)	(0.041)	(0.040)
Political stand	−0.035	−0.053	−0.027
	(0.053)	(0.057)	(0.055)
Personal monthly income	−0.063*	−0.019	−0.016
	(0.025)	(0.022)	(0.023)
Years of residence	0.004	−0.011	−0.022
	(0.027)	(0.029)	(0.029)
Intercept	1.196***	1.986***	2.373***
	(0.284)	(0.270)	(0.281)
R^2	0.575	0.370	0.330

Notes: *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$; robust standard error is shown in brackets.

gender can significantly negatively predict community trust (β = −0.117, p < 0.05) and community attachment (β = −0.130, p < 0.01), which indicates that female participants demonstrated stronger community trust and community attachment than male participants; personal monthly income only significantly negatively predicts pro-community behavior (β = −0.063, p < 0.05).

Mediating Effect Test

We used the bootstrap method to test the mediating effect of community trust and community attachment on the use of WeChat groups and the pro-community behavior of residents. The test results (Table 6) show that, in the first mediation path, the use of residents' WeChat groups has a significant positive mediating effect on pro-community behavior through community trust (β = 0.185, 95% CI [0.133, 0.241], excluding 0), and the mediating effect value was 26.50%, suggesting that H4 was supported. In the second mediation path, the use of residents' WeChat groups also has a significant positive mediating effect on pro-community behavior through community attachment (β = 0.203, 95% CI [0.151, 0.264], excluding 0), and the mediating effect value was 29.08%, suggesting that H5 was supported.

Chain Mediated Effect Test

We used Model 6 of SPSS 26.0 as the chain mediation and adopted the bootstrap method to test the chain mediation effect of community trust and community attachment. The test results (Table 7) show that (1) the resident's WeChat group use → community trust → community attachment → pro-community behavior (β = 0.142, 95% CI [0.024, 0.096], excluding 0), indicating that the chain mediating role of this path is positively significant; the use of owner WeChat group can enhance community attachment by improving residents' community trust, thus affecting residents' pro-community behavior. (2) Residents WeChat group use → community attachment → community trust → pro-community behavior (β = 0.030, 95% CI [−0.009, 0.070], including 0), indicating that the chain mediation effect of this path is not significant. Overall, it is assumed that H6 is supported.

Table 6 Mediating Effect Test Between Community Trust and Community Attachment

Mediation Path	Effect	Effect Value	Standard Error	95% CI		Mediation Effect Value
				Lower Limit	Upper Limit	
X→M₁→Y	Total effect	0.698	0.028	0.643	0.753	–
	Direct effect	0.513	0.031	0.451	0.575	73.50%
	Indirect effect	0.185	0.028	0.133	0.241	26.50%
X→M₂→Y	Total effect	0.698	0.028	0.643	0.753	–
	Direct effect	0.495	0.029	0.437	0.552	70.92%
	Indirect effect	0.203	0.028	0.151	0.264	29.08%

Notes: X indicates the use of the resident's WeChat group, Y indicates pro-community behavior, M_1 indicates community trust, and M_2 indicates community attachment.

Table 7 Chain Mediation Effect Test Between Community Trust and Community Attachment

Mediation Path	Effect	Effect value	Standard Error	95% CI	
				Lower Limit	Upper Limit
X→M₁→M₂→Y	Total effect	0.698	0.028	0.643	0.753
	Direct effect	0.482	0.030	0.422	0.542
	Chaining effect	0.142	0.024	0.096	0.190
X→M₂→M₁→Y	Total effect	0.698	0.028	0.643	0.753
	Direct effect	0.482	0.030	0.422	0.542
	Chaining effect	0.030	0.020	−0.009	0.070

Discussion and Conclusion

As one of the most important new community media in the network era, the resident WeChat group is widely used in urban commercial housing communities and plays a critical role in community development and governance. This study uses a questionnaire survey of Wuhan commercial housing community residents to explore the mechanisms behind and the effects of residents' WeChat group use on residents' community trust, community attachment, and pro-community behavior during the COVID-19 pandemic. The findings are discussed separately below.

Firstly, we found that the use of residents' WeChat groups of residents can enhance their community trust and community attachment. This finding echoes the "contact hypothesis", "quality of interaction", and "shared valent event hypothesis" proposed by McMilla and Chavis;[68] that is, more frequent interaction between individuals encourages closer relationships; additionally, the more important the shared event is to those involved, the greater the community bond. For example, there appears to be significant bonding among people who experience a crisis together.[69,70] In contrast to the regional nature of general natural disasters, the extraordinary public health events caused by COVID-19 constituted transboundary and global risks between different regions and countries.[71] This situation determines that every person and organization involved in a public health event becomes stakeholders.[72] During the COVID-19 pandemic, community residents experienced COVID-19 together in the same physical field. Due to retail closures and disease control management, it became difficult for residents to obtain living materials. Long-term isolation also led to increasing mental distress. Common material and spiritual needs provided community residents with opportunities for exchanges and communication, and contact was more frequent than before the epidemic. The resident's WeChat group played an important role in the communication behavior during this period, becoming the main tool for communication among community residents; many new interpersonal interactions occurred online, where individuals could spontaneously participate in community assistance and public affairs, which dramatically expanded the scope of mutual familiarity, resulting in community trust and community attachment.

Secondly, we found that the more frequently residents use WeChat groups, the more they can promote pro-community behavior. This finding is similar to previous research results.[28,73] For individuals to enact their potential to help others, it is important for them to have positive role models.[74] Witnessing moral behavior can provide a positive emotional response, which is a key component of moral elevation. Moral elevation gives rise to the desire to be a better person,[75,76] which motivates people to do good things for others, even for strangers.[75–78] During the COVID-19 pandemic, countless acts of moral beauty were performed everywhere.[79] Kind and brave behaviors are not uncommon in communities. Residents seek help through residents' WeChat groups, group purchase daily necessities, and receive positive responses and help from others. Moreover, these helpful, kind, and loving behaviors are forwarded and shared through homeowner WeChat groups. These examples of information and story sharing are mapped onto group members' brains. "Mirror neurons" in the brain recreate role models' actions for group members, allowing group members to perceive the experience of others in a mirrored way, generate empathy, and further perform altruistic behavior;[54] "mirror neurons" also provide residents with an internal imitation network, which allows them to learn from and imitate role models, and then promote pro-community behavior.

Finally, we found that community trust and community attachment play a positive mediating role between residents' WeChat group use and pro-community behavior. This research result verifies the broaden-and-build-theory, which suggests that positive emotions can help expand people's attention to others and stimulate their efforts in prosocial behavior.[80] During the COVID-19 pandemic, the residents' WeChat group not only played the role of environmental monitoring (sharing pandemic trends inside and outside the community), helped contact residents and coordinate community residents' pandemic prevention and fighting strategies through knowledge dissemination (sharing valuable epidemic prevention experience and knowledge), but also affected residents' perception, judgment, and evaluation of events by highlighting and emphasizing certain specific facts and values.[81,82] Community managers frequently posted the kind and brave anti epidemic behaviors of community organizations, grassroots workers, and community residents through the resident's WeChat group, in contrast to the dangers outside, making the community a space that enabled residents to feel warm, comfortable, and safe. People supported, relied on, and trusted each other, which created positive emotions that helped stimulate residents' pro-community behaviors. In addition, residents established relatively stable social relations and emotional connections with other residents by actively participating in community public affairs

through the residents' WeChat group. The deep involvement of residents' emotions and actions created a strong community attachment and promoted more pro-community behavior.

In addition, community trust and community attachment played a chain intermediary role between residents' WeChat groups and pro-community behavior. Previous studies mostly focused on the mediating effect of a single variable and seldom considered the progressive chain effect of the mediating effect of cognition and emotion. In the specific context of the COVID-19 pandemic, trust became a crucial strategy and a simplified strategy for complex social environments.[83] Although the use of residents' WeChat groups can promote pro-community behavior, residents' emotional attachment to the community is difficult to generate without the foundation of trust.

Research Implications

From a theoretical perspective, this study establishes an integrated model of residents' WeChat group use, community trust, community sense of belonging, and pro-community behavior. This model helps to more systematically and comprehensively reveal the internal mechanism behind residents' adoption of pro-community behavior, thus deepening and expanding the theoretical perspective of research on the effectiveness of WeChat group use in crisis situations. In addition, previous studies have mostly focused on the mediating role of variables alone. This study not only verified the independent mediating role of community trust and community belonging between the use of residents' WeChat groups and pro-community behavior, but also validated the effectiveness of the cognitive-affective system theory in explaining the chain mediation between residents' WeChat group use and pro-community behavior, using community trust as "cognition" and community belonging as "emotion", further analyzing the internal mechanism of the use of owners' WeChat groups to promote pro-community behavior, which provides a useful reference for improving community risk communication and crisis governance.

When a major public emergent event occurs, the resilience of the community and the adaptation of the community system are crucial. In the Chinese context, mutual assistance between neighborhoods is the basic system to consolidate the resilient governance of communities.[84] Therefore, the results of this study provide indications of potential practical implications. Firstly, community managers can actively participate in the residents' WeChat group to ensure the dissemination of positive community information and enhance residents' awareness of risk community, community trust and sense of belonging, to cultivate community resilience. At the same time, community managers should fully recognize the important transformative role of community trust and community belonging between the use of WeChat groups by residents and the formation of pro-community behavior; actively establish a warm and trusting community culture; and strive to create a community atmosphere with a sense of belonging. A community that relies on emotional support is a true, lasting, and solid community. Without trust and a sense of community belonging, it is difficult to have long-term, sustainable pro-community behavior. As is well known, heartwarming content depicting human connections and love is often inspiring.[85] Community managers or community residents can share more stories of kindness and mutual help behaviors in the community on the residents' WeChat group, to encourage residents to expand the empathy circle of residents to include the perspective of others.[86] Therefore, residents can experience emotional attachment to the community and then form behavior that is conducive to the community, greatly improving the community's resilience and self-management in disaster situations.

Limitations and Future Lines of Research

This study suffered from certain limitations that can be addressed in follow-up studies. Firstly, the measurement of residents' WeChat group use only considers the frequency of engagement, ignoring the use duration and participants' initiative to engage. Subsequent research should measure residents' WeChat group use behavior more comprehensively and multi-dimensionally, to better understand the influence mechanism of residents' WeChat group use in the community trust, community attachment, and pro-community behavior. Secondly, the survey sample of this study is limited. Future research can further expand the survey area of data, adopt continuous tracking surveys, and utilize observational data to better reflect the residents' WeChat group use behavior and improve the validity of the research conclusion. Additionally, we cannot further explore and infer the causality of the results due to the interference of endogeneity, and thus explicit research on this issue is expected in the future.

Data Sharing Statement

All data analyzed are included in the paper.

Ethical Approval

Ethical approval was obtained from the Institutional Review Committee of School of Journalism and Information Communication, Huazhong University of Science and Technology, Wuhan, Hubei Province, China. All procedures performed in studies involving human participants followed the ethical standards of the institutional and/or national research committee and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

Informed Consent

Informed consent was obtained from all individual participants included in the study. Respondents' participation was completely consensual, anonymous, and voluntary.

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Disclosure

The authors declare no competing interests.

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