

# How the sharing physical activity experience on social network sites(SNS) improves residents' social connectedness during isolation: the multiple mediating effects of positive self-presentation and positive feedback

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## Research

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# Abstract

## *Background*

In the context of the COVID-19 pandemic, physical activity cannot continue to play a role in promoting interpersonal relationships and enhancing social connectedness. People's contact with the outside world has turned to SNS. During isolation, whether sharing physical activity experience on SNS can enhance individual social connectedness and its mechanism. The objective of the present study was to examine the associations between sharing physical activity experience on SNS, positive self-presentation, positive feedback and social connectedness during isolation.

## *Methods*

Based on the physical activity experience sharing scale, social connectedness scale, positive self-presentation scale and online positive feedback scale, 460 valid questionnaires were collected online from 31 provinces, municipalities and autonomous regions in China. A series of multiple linear regression models were established to study the relationship between variables, and the bootstrap confidence interval was selected to test the mediating effect.

## *Results*

During isolation, sharing physical activity experience is positively associated with social connectedness ( $b = 0.308, p < 0.001$ ), it is also positively associated with positive self-presentation ( $b = 0.956, p < 0.001$ ) and positive feedback ( $b = 0.421, p < 0.001$ ). In addition, it is verified that positive self-presentation has a significant positive impact on positive feedback ( $b = 0.563, p < 0.001$ ). Positive self-presentation ( $b = 0.331, P < 0.001$ ) and positive feedback ( $b = 0.311, P < 0.001$ ) are positively associated with social connectedness. Finally, it was verified that sharing physical activity experience indirectly through positive self-presentation ( $b = 0.316, 95\% \text{ CI: } [0.180, 0.463]$ ) and positive feedback ( $b = 0.131, 95\% \text{ CI: } [0.063, 0.207]$ ) also had a significant impact on social connectedness, respectively. and indirectly through the mediation chain of online positive self-presentation and positive feedback ( $b = 0.167, 95\% \text{ CI: } [0.088, 0.251]$ ) also has a significant impact on social connectedness.

## *Conclusions*

During the COVID-19 pandemic, sharing physical activity experience on SNS can create a positive, healthy and energetic personal image, gain recognition from others, and establish new interpersonal relationships. At the same time, in addition to advocating home-based exercises, governments should encourage residents to share content of home-based exercise or virtual sports on SNS.

## Introduction

Physical activity not only have the function of enhancing people's physical health, but also have the function of promoting people's socialization, as well as enhancing the social connectedness between

people[1]. For example, the government improves the social connectedness between indigenous people and new immigrants by encouraging residents to engage in physical activities, which can often have a positive impact on residents' mental health, local education, employment increase, and crime reduction[2]. Social connectedness is a multi-dimensional structure, which plays an important role in promoting people's happiness, self-esteem and confidence[3]. Besides, physical activity can enhance friendship between people and strengthen interpersonal relationship. However, with the outbreak of the new coronavirus pneumonia at the end of 2019, governments of various countries quickly enacted restrictions on activities, socializing, and gatherings[4]. Nevertheless, a series of restrictions and isolation measures have turned the busy urban streets and squares into ghost towns[5]. It has also plunged global physical activity into unprecedented chaos. Most of the organized and commercial fitness activities have been suspended, and residents can only exercise at home or perform virtual sports. Movement restrictions and changes have affected the relationship between people and others, between individuals and society, and continuous isolation will lead to distancing between people and society[6].

In the context of the COVID-19 pandemic, physical activity cannot continue to play a role in promoting interpersonal relationships and enhancing social connectedness. However, with the continuous extension of social evacuation and blockade orders, people's contact with the outside world has turned to Social Network Sites (SNS), thus communicating with others through online entertainment, leisure and sports activities[7]. According to statistics, during the COVID-19 outbreak, SNS usage increased by 61%[8]. From February 2020 to March 2020, global usage of Facebook and Instagram increased by more than 40%. During this period, the amount of messaging on Facebook, Messenger, WhatsApp and Instagram increased by 70%, and the rate of utilization of local SNS (such as, WeChat and Weibo) in China increased by 58%[9]. As a result of this, people have found that in this public health emergency, the use of SNS is the best way to promote the healthy behavior of residents, especially when home exercise information is shared and discussed through SNS, which will reduce residents' negative emotions and social distancing caused by social isolation, and enhance the relationship between people and Society[10]. At present, it is more common to publish and share information about personal home exercise and virtual sports on SNS (for example, home exercise clock in, online school physical education courses, and e-sports game records), and people are also keen to discuss these issues on SNS. It is precisely because of this sharing physical activity experience that the social connectedness between people is re-established[4]. Therefore, in the context of the unprecedented impact of the COVID-19 pandemic on the social connectedness of residents, it is very important to explore the relationship between sharing physical activity experience on SNS and social connectedness. In addition, it is particularly important to re-establish social connectedness by sharing physical activity experience on SNS.

The formation of social connectedness depends on social interaction. The so-called social interaction refers to the many daily communication activities that people constantly carry out with each other, such as pleasing others, saying hello, learning to communicate, etc. Social interaction is formed when actions are directed towards others and have relationships with other members of society[11]. It happens that physical activity can enhance social interaction and strengthen social connectedness[12]. Due to the

impact of the COVID-19 pandemic, offline physical activity exchange was replaced by sharing physical activity experience online. Online physical activity experience interaction can also enhance the social connectedness among residents[4]. This kind of offline to online conversion has resulted in people no longer needing to "go down to the playground in person" to achieve the social connectedness of physical activity. Residents only need to do physical exercise or virtual sports at home, and then share and discuss in SNS to enhance their social connectedness with others. Meanwhile, as one of the virtual stage to show the user's self, SNS can help people deliver timely information and maintain social contact, thereby providing a new platform for people to show themselves. The establishment of "sports-loving", "e-sports master", "fitness expert", "body management master" and other images can obtain more positive feedback from others[13]. Online positive feedback is the most important form of communication in online social interaction. It is mainly manifested in the timely positive affirmative evaluation given to each other in the process of online interaction[14]. At present, the research is not clear. What is the relationship between sharing physical activity experience on SNS and online positive self-presentation and positive feedback in the period of home isolation? Do you also know whether online positive self-presentation and positive feedback can still affect social connectedness? Is there any correlation between the four?

Therefore, in this study, we focus on residents who have had sharing physical activity experience on SNS during the period of home isolation. Most previous studies investigated various aspects of the frequency of use of SNS, and did not care about the impact of the content of SNS's publication, sharing and discussion on mental health, social connectedness, etc[15]. This study emphasizes the role of sharing physical activity experience on SNS and social connectedness among residents in the period of home isolation, and makes contributions to the exploration of related theories about the relationship between the two. As a relevant factor in the establishment of social connectedness of SNS, this article also helps us to understand the positive self-presentation and positive feedback of SNS. The purpose of this study is to promote residents' cognition of home physical activity, and hope that they can share physical activity experience on SNS, as well as actively discussing and forwarding them online. This will not only help the sports industry alleviate the impact of the pandemic, but also help residents develop their own mental health and strengthen social connectedness.

## Theoretical Background

### Sharing physical activity experience on SNS during isolation

With the rapid development of SNS (such as Facebook, Instagram, WeChat, and Weibo) people have been given more opportunities for self-expression and social interaction, which has resulted in rich user-created content[16]. Powerful SNS resources bring opportunities for physical activity informatization, and SNS and physical activity information can form an organic unity. Sharing physical activity experience on SNS mainly refers to the acquisition and exchange of sports knowledge (involving education, culture, competition and other physical science and technology knowledge), sports topics, sports consumption and other related information through SNS[17].

During the COVID-19 outbreak, governments around the world strongly recommend that the public stay at home and maintain regular physical activity and daily exercise in a safe home environment[18]. Residents can establish a positive image of sunshine and health through sharing physical activity experience on SNS, so as to produce social influence[19]. During this period, the government or sports organizations also use this time to promote residents' home-based exercise through SNS channels. For example, the Australian Olympic Committee encourages residents to participate in physical activities at home through SNS, and invites professional athletes to provide suggestions and demonstrations for home-based exercise by producing and disseminating a series of home sports videos, which will be released on multiple social media platforms[20]. Some scholars believe that encouraging residents to take photos and upload their own home exercise or virtual sports can achieve an inspiring effect[21].

At present, there are few studies on sharing physical activity experience on SNS in isolation period. Some studies focus on sports challenge behavior in SNS, and believe that besides the fitness function, it can change the residents' sports consumption concept and provide opportunities for enterprises and social organizations[21]. At the same time, some studies think that SNS provides a kind of virtual space for fans, which is a place of participation and dialogue. The COVID-19 outbreak limits the interaction between sports organizations and fans, and in such a virtual space, sports organizations can re-establish contact with fans, and fans from all over the world can have daily discussions about their favorite sports teams through online communication[22]. This study happened to analyze the relationship between sharing physical activity experience on SNS and social connectedness from the perspective of fans. However, this study only stays in theory and does not carry out empirical research. During the isolation period, more and more people rely on SNS to find and share health information. Besides, sharing physical activity experience on SNS, as a signal to show their own health status, also has the function of alleviating social distancing[23]. In a few words, the current research on sharing physical activity experience on SNS in the period of isolation almost starts from the perspectives of government, sports organizations and enterprises. Discussing sharing physical activity experience on social online helps to strengthen their ties with the public, and alleviate the adverse impact of COVID-19 on sports events or sports industry. However, they all ignore that sharing physical activity experience on SNS can also directly affect the social connectedness between people.

### **Personal social connectedness during isolation**

Social connectedness is defined as the subjective awareness of being in close relationships with the social world[24]. It covers the quantity, quality, frequency, type and network structure of the relationship between individuals and friends, family, and the community[25]. In the existing studies, it is generally believed that personal social connectedness is affected by the change of personal living environment and group effect[26]. Based on the core definition of "sense of belonging and interpersonal relationship" in previous studies, the social connection in this study is defined as the intimacy and sense of belonging with friends, family, and the community in the home environment during isolation.

In past studies, it is generally believed that SNS can promote people's social connectedness. People use SNS to keep in touch with family and close friends[27]. A study on the use of SNS by adolescents showed that "active" use of SNS was more effective than "passive" use of SNS in maintaining friendship between friends and strengthening social ties[28]. In the study of adult samples, we found that using the Internet for communication (other than for work purposes) can reduce loneliness in adults, which generally comes from social distancing[29]. It is generally believed that people who use SNS to maintain existing social relationships have stronger social adaptability and less loneliness[30].

At present, COVID-19 has become a major global public health crisis. Although isolation policy can reduce the risk of infection, it may have negative effects due to social distancing. Some studies believe that social isolation makes people feel socially alienated, which leads to increased loneliness and more fragility in the heart[31]. In order to prevent the spread of disease, people may lack social connectedness because they cannot go to places where they normally gather (for example, schools, bars, community centers, churches, shopping malls, parks, etc)[32], especially those who have no pro-social behavior. The greater the impact of social isolation is, the more serious the lack of social connectedness[33]. Studies have found that SNS can reduce these risks. There is a positive correlation between the use of information and communication technology (ICT) and social connectedness; however, there are still doubts about the source or content of the exchange of information[34]. Therefore, this study considers whether sharing in SNS, as a physical activity that can promote personal health, can promote people's communication in SNS during isolation, thereby consolidating social connectedness.

### **Positive self-presentation in SNS**

The concept of self-presentation is based on symbolic interactionism, which refers to the efforts of individuals to show themselves and influence others in order to make others look at themselves based on their wishes[35]. Specifically, self-presentation refers to the behavior of individuals to convey self-information to others, aimed at constructing, maintaining, and modifying their own public image[36]. Positive self-presentation refers to the selective presentation of information that can establish a positive image of oneself. This presentation strategy can improve individual self-esteem, positive emotions and life satisfaction[37]. With the increasing popularity of SNS, SNS plays a central role in personal self-expression and social relationship management[38]. As a supplementary way of communication to the existing relationship in real life, the non-immediacy of online communication enables individuals to have maximum control over self-display and expression, thereby making SNS an ideal platform for self-presentation[39]. SNS not only provides the function of maintaining and developing interpersonal relationship, but also allows users to upload information on their home page, such as uploading photos, sharing status, posting logs and other functions[40]. Online positive self-presentation based on SNS, as a form of self-expression used by individual SNS, can enable individuals to shape a positive social image on the network according to their own advantages[41].

After the COVID-19 outbreak, the use of SNS has experienced an explosive growth, and people are establishing contact and interaction with others by using a series of SNS software[7]. However, the

COVID-19 pandemic may have changed people's preferences for self-presentation on SNS, making it more common to discuss a person's health and preventive behavior. As a result, sharing this kind of information is beneficial to the public interest and is a socially recognized behavior[7]. For example, athletes spread positive information through SNS, encourage residents to engage in appropriate physical activity at home, check in for daily home sports, and analyze sports information through SNS to enhance social connectedness, thereby establishing a positive image of athletes[7]. In other words, after the outbreak of COVID-19, people's positive self-presentation content on SNS has new preferences, and sharing physical activity experience on SNS has become more common.

## **Positive feedback in SNS**

Positive feedback is one of the most important forms of social support in SNS. It is mainly manifested in the timely positive affirmative evaluation of the other party during the online interaction process[14]. Specifically, it refers to the supportive response received by individuals when they post status, photos and other personal information in social applications, online friends' attention, concern or acceptance of comments, "like" and other behaviors[42]. Some studies have shown that positive feedback, as an online social support, helps to improve the individual's social adaptability and social connectedness[43]. In the study of a sample of Chinese students, the number of positive comments received on the SNS page will adjust the relationship between self-disclosure and social capital on SNS[42]. It is worth noting that some studies have shown that participants with positive self-perception will seek more positive feedback than those with negative self-perception[44]. For example, adolescent girls focus on personal body image, while girls with better body shape and more participation in physical activity are more eager to receive approval from others or other forms of positive feedback[45]. Affected by the COVID-19 social distance restrictions in various countries, for some people, in order to avoid getting negative feedback on SNS, they choose more cautious online self-presentation. This also leads to positive self-presentation and more positive feedback[7].

## **Model development, variables, and hypotheses**

Inside out and outside in: How the COVID-19 pandemic affects self-disclosure on SNS

In the era of SNS, everyone becomes the producer, disseminator and receiver of information. The information sharing function of SNS has made it increasingly become as one of the main channels of user information production and release[46]. In the study of online sharing behavior on SNS, enhancing social connectedness is the main motivation for sharing behavior, especially when sharing some physical activity information[47]. In addition, physical activity is inseparable from the information sharing function of SNS[6]. With the outbreak of COVID-19, under the restriction of isolation policy, more and more people choose to exercise at home, and people hope to alleviate the negative impact of COVID-19 through exercise[48]. At the same time, the frequency of sharing and discussing home exercise and virtual activities on SNS has become increasingly frequent[49]. Governments of various countries actively encourage residents to exercise at home, and also to share and discuss related physical activities online[20]. Combined with previous research results, sharing information and participating in interaction

on SNS can enhance social connectedness. During the outbreak, more and more people take sharing physical activity experience on SNS as a signal to show their health status[23]. Besides, there exists a relationship between physical activity and social connectedness[50]. Therefore, it is considered that during the isolation period, sharing physical activity experience on SNS has a positive impact on residents' social connectedness (H1a).

Preliminary research indicates that self-presentation may be an important antecedent and consequence of physical activity[51]. It is also a positive personal image to present because people usually want others to see them in an ideal way[52]. Affected by COVID-19, more and more people show their home exercise results or scores of virtual sports on SNS. They regard it as an act of showing their own health and being proactive, which will be recognized by others and is a kind of positive self-presentation[7]. Therefore, it is assumed that residents sharing physical activity experience on SNS during the isolation period can obtain positive self-presentation on SNS (H1b).

Previous studies have confirmed that students with high athletic ability can improve their well-being by receiving positive feedback, and it has been put forward that receiving positive feedback is also one of the intrinsic motivations of physical activity[53]. In addition, some studies have shown that sharing information about health behaviors on SNS can receive positive feedback from others, and at the same time, can also create a positive image in others' mind[54]. Therefore, it can be considered that residents sharing physical activity experience on SNS during the home isolation period can obtain positive feedback from others on SNS (H1c).

H1a Sharing physical activity experience on SNS during the home isolation period directly and positively predicts social connectedness.

H1b Sharing physical activity experience on SNS during the home isolation period directly and positively predicts online positive self-presentation.

H1c Sharing physical activity experience on SNS during the home isolation period directly and positively predicts positive online feedback.

SNS has greatly changed the way people communicate, connect and express themselves. SNS encourages users to show the most positive aspects of their lives. Their motivation is to gain virtual recognition from friends and relatives through likes and comments[55]. Some studies have found that most elderly groups are willing to extend and augment their interpersonal relationships in reality through self-presentation and interpersonal interaction on SNS[56]. This shows that individuals in SNS can create a satisfactory and ideal self-image with the help of positive self-presentation, thereby getting rid of the social distress in real social interactions and enhancing social connectedness[57]. Therefore, it is assumed that positive self-presentation on SNS can enhance the social connectedness (H2a) among residents during isolation. In the process of using SNS, under the influence of social approbation and motivation to control the outcome of the interaction, people will try to keep the image consistent with the social image, in order to obtain others' praise and pleasant evaluation. Empirical studies show that when

individuals present information related to themselves through self-presentation, they encourage others to give feedback. In the process of presentation and feedback, the two formed a good relationship, and deepened the good interpersonal relationship in the process of repeated circulation[14]. Therefore, it is assumed that positive self-presentation on SNS can obtain positive feedback from others (H2b). Online positive feedback means that individuals obtain positive feedback from others in the interpersonal interaction of SNS and contribute to positive social interaction, such as positive comments, replies, likes, and so on. Studies have shown that SNS promote interpersonal communication and maintain peer relationships among adolescents through positive feedback, which is an important factor in improving the quality of friendship[58]. Online positive feedback on SNS can have a positive impact on personal offline intimacy[59]. Therefore, it can be considered that online positive feedback has a significant positive predictive effect on social connectedness (H3).

H2a During the home isolation period, online positive self-presentation directly and positively predicts social connectedness.

During the H2b home isolation period, online positive self-presentation directly and positively predicts positive online feedback.

H3 During the home isolation period, online positive feedback directly and positively predicts social connectedness.

In the social pension theory, it is pointed out that the establishment or development of "disclosure-feedback-relationship" is the basic process to promote the establishment and development of interpersonal relationship[60]. Individuals can express themselves through information transmission, and getting positive feedback from others will deepen interpersonal relationships between people. Specifically, individuals can post, share, and discuss positive information related to themselves in SNS, thereby showing a positive image and friends giving positive feedback on the posted information. When individuals receive positive feedback from their friends, they will enhance their social connectedness between themselves and their friends[61]. During pandemic, everyone is keen to discuss a person's health status and preventive behavior. It is generally recognized that sharing such information is beneficial to the public interest, which is a behavior that can be recognized by others[7]. In particular, the World Health Organization and governments at all levels of countries for home physical activity have recommended that daily exercise in a safe home environment is an important strategy for healthy living[7]. Residents are encouraged to share home-based exercise or virtual sports on SNS[20]. According to the social penetration theory, SNS will classify people who have the same pursuit of health into one category; in this way, sharing physical activity experience on SNS will form a new social interaction, and such group of people will think that sharing physical activity experience can promote self-presentation, where this positive form of self-presentation can be recognized by others and promote the establishment of interpersonal relationship (H4). Meanwhile, they also consider that sharing physical activity experience can obtain positive feedback from others, such that they can also gain the recognition of others and promote the establishment of interpersonal relationship (H5). Relying on the logical assumption of

"disclosure-feedback-relationship" in social penetration theory, during the isolation period, sharing physical activity experience on SNS can not only promote self-presentation, but also obtain more friendly and supportive comments or responses, and strengthen the intimate relationship between individuals (H6).

H4 During the home isolation period, positive self-presentation played a mediating role between sharing physical activity experience on SNS and social connectedness.

H5 During the home isolation period, positive feedback played a mediating role between sharing physical activity experience on SNS and social connectedness.

H6 During the home isolation period, positive self-presentation and positive feedback played a chain-like mediating role in the mechanism of sharing physical activity experience on SNS and social connectedness.

## Methods

### Procedure and sample

Since the outbreak of COVID-19 in China, in order to stop the rapid spread of the virus, all provinces and cities in China have successively launched the first level emergency response plan (starting on January 29, 2020 and ending on May 2, 2020, lasting for 94 days), requiring residents to stay at home and reduce travel. During this period, Chinese people's social software appeared in the "home school physical education", "home sports clock in", "sports-related information about the benefits of physical exercise for the pandemic prevention", "e-sports games", "online sports events", and other sports related personal status. As of July, China has basically controlled the pandemic situation in its own country. After the first-level response of the emergency plan was lifted, most residents could better face the life after the end of the pandemic. According to the latest editorial published by "The Lancet" on July 24, dealing with the new pandemic situation requires open collaboration among countries. China has basically controlled the pandemic situation in its own country, so other countries can learn from China's successful experience in this regard[62]. Therefore, this study selects Chinese residents as the research subjects to explore the impact of sharing physical activity experience on SNS on personal social connectedness during the period of home isolation.

This study was conducted in July 2020. The survey respondents used the convenience sampling of non-probability sampling, and simultaneously used the Internet for distribution. Questionnaires were distributed (<https://www.wjx.cn/>) and spread through social software. The first page of the questionnaire informed participants that the survey was anonymous and used for research purposes only. Finally, 506 data were collected from 31 provinces and cities in China, except Tibet, Qinghai, and Taiwan. Then, by filling in the time, answering logic and two lie detection questions, 46 pieces of data were deleted out of a total of 460 copies, and the effective recovery rate was 90.90%

Interviewees were asked about sharing physical activity experience on SNS, positive self-presentation, positive feedback, and social connectedness during the home isolation period. Meanwhile, the information about the respondents' gender, age, household income, education level, employment status, marital status, home ownership, BMI and other information were recorded. The majority of the respondents were male (55.0%), below 30 years old (55.9%), household income below 100,000 (39.8%), bachelor's degree (34.3%), employed (74.6%), Unmarried (61.3%), home ownership (87.0%), and standard body shape (75.9%).

## Measures and variables

This study explored the impact of sharing physical activity experience on SNS, positive self-presentation, and positive feedback on residents' social connectedness during the period of home isolation, and whether there was a mediating role between positive self-presentation and positive feedback. Therefore, based on previous experience, this study developed a scale survey process in accordance with standardized procedures. Since the survey was conducted in China, the scale was translated into Chinese in accordance with the reverse translation procedure[63]. The content validity of the items in the scale for measuring each construct was evaluated by four scholars and three research assistants. They need to evaluate the content and comprehensibility of the measurement items, and then propose items that need to be re-edited and improved to enhance their clarity, readability, and content effectiveness. The expert group also needs to determine whether there is redundancy between items, and proposes to improve the quota entries of each construct. Then, to test the tool, a pilot test was first carried out from 15 to July 20, 2020 on a group of 50 SNS platform users, between the ages of 18 and 50 years old, in China. The purpose of the pre-survey is to try to improve the problem, delete indeterminate or unclear items, refine the survey content and structure, and preliminarily verify the reliability and validity of the scale.

In order to measure residents' sharing physical activity experience on SNS during the period of home isolation, this study used the actual travel experience sharing scale for reference[47]. It contains four items, each with a frequency of 0 indicating "almost no", and a frequency of 5 indicating "more than one use/share per exercise". The scale was originally designed to measure the actual experience sharing behavior of respondents on each trip. Therefore, this study will revise the scale based on the sharing physical activity experience on SNS of residents in the period of home isolation, but only modify the context. The confirmatory factor analysis showed better fitting indices,  $\chi^2 = 7.046$ ,  $df = 2$ ,  $\chi^2/df = 3.523$ , RMSEA = 0.074, GFI = 0.993, NFI = 0.989, IFI = 0.992, TLI = 0.976, CFI = 0.992.

In order to measure the sense of social connectedness of residents in the period of home isolation, this study used the social connectedness scale. The scale used a 5-point Likert scale to measure, with 1 indicating "strongly disagree" and 5 indicating "strongly agree". It contains eight items; the lower the score is, the stronger the sense of social connectedness, and the higher the score is, the weaker the sense of social connectedness. These items describe the general emotional distance between oneself and others[64]. The scale looks at social connectedness from the perspective of self-psychology and studies

how to adapt to changes in life. The reliability and validity of the questionnaire has been verified many times in previous studies[65].

In order to measure the positive self-presentation of sharing physical activity experience on SNS during the period of home isolation, this study adopted the Positive Self-Presentation Scale[37], which contains six items and uses a 5-point Likert scale to measure, with 1 indicating "completely non-compliance", and 5 indicating "full compliance". The self-presentation strategy scale developed by the original scale in the study of Facebook measures the degree to which individuals present their positive aspects selectively on SNS. In many previous studies of Chinese samples, the confirmatory factor analysis showed good fitting index, and the standardized factor load of each item was greater than 0.5 and less than 0.9, indicating good aggregation validity[66,67].

In order to measure the positive feedback of sharing physical activity experience on SNS during the home isolation period, this study used the online positive feedback scale for reference[42]. The scale measures the frequency of positive feedback from individuals after presenting information on SNS. It contains five items and uses a 5-point Likert scale (1="never", 5="frequently"). The scale focuses on the frequency rather than the level of positive feedback, because it is difficult for the general public to judge the level of positive feedback; that is, it is difficult to judge whether the comments of friends are mild positive feedback, moderate positive feedback or strong positive feedback. Therefore, based on the actual situation of sharing physical activity experience on SNS during the period of home isolation, this study will revise the scale and modify its circumstances and context. The confirmatory factor analysis showed better fitting indices,  $\chi^2 = 25.146$ ,  $df = 5$ ,  $\chi^2/df = 5.029$ , RMSEA = 0.094, GFI = 0.979, NFI = 0.978, IFI = 0.983, TLI = 0.965, CFI = 0.983.

## Data analysis

Data analysis was conducted in three parts. First, the quality of the measurement model was evaluated by checking the reliability and validity of each construct in two steps[68]. Cronbach's alpha was used to check the internal consistency of each construct, and the results showed that the reliability was at an acceptable level. Then, confirmatory factor analysis was carried out to check the overall aggregate validity of the scale, and the score information of each construct was counted. Afterwards, considering the need for intermediary testing and the comparison between the coefficients of the ologit model caused by the heterogeneity of variance, the dependent variable social connectedness was regarded as a continuous variable, and a series of multiple linear regression models (OLS models) were established with sharing physical activity experience on SNS, positive self-presentation, and positive feedback to perform statistical tests on the aforementioned hypotheses. Finally, the Bootstrap confidence interval was selected to test the mediating effect of positive self-presentation and positive feedback variables, and we also used the bootstrapping method (5000 iterations) with 95% bias-corrected confidence intervals[69].

## Results

## Assessment of the psychometric properties of the measures

Table 2 lists the mean, standard deviation, item-total correlation, Cronbach's alpha value, average variance extracted (AVE) value, and composite reliability of each construct (CR), in which the reverse question has been re-scored. Table 2 shows that Cronbach's alpha values range from 0.79 to 0.92, and all constructs exceed the threshold of 0.75, indicating that the internal consistency between each scale is acceptable[70]. CFA was performed to analyze the goodness of fit of the constructs used in the model: sharing physical activity experience, social connectedness, positive self-presentation, and positive feedback. The fitting indexes of the final confirmatory factor analysis model were better,  $\chi^2 = 461.575$ ,  $df = 224$ ,  $\chi^2/df = 2.061$ , RMSEA = 0.048, GFI = 0.913, NFI = 0.949, IFI = 0.973, TLI = 0.969, CFI = 0.973. The CR values for all the constructs ranged from 0.81 to 0.92, which exceeded the threshold value of 0.70[71]. The standardized factor load of each item was greater than 0.5 and less than 0.9. Also, the AVE values from all constructs ranged from 0.50 to 0.60, which exceeded the minimum criterion of 0.50[72]. This shows that there is a better convergent validity.

## Assessment of the hypothesized relationships

### Modeling strategy

As mentioned above, considering the need for intermediary testing and understanding the impact of sharing physical activity experience on SNS on the social connectedness of residents during the isolation period, the independent variables sharing physical activity experience, the dependent variable social connectedness, the positive self-presentation and positive feedback of the intermediate variable were regarded as the overall continuous variable, thereby discussing regardless of dimensions. Subsequently, a series of multiple linear regression models were established to statistically test the aforementioned hypotheses. The model results are shown in Table 3.

### Main effects

In order to examine the role of sharing physical activity experience on SNS, online positive self-presentation and positive feedback on social connectedness during the period of home isolation, Model 1 was constructed and used as the benchmark for subsequent modeling. Model 1 only studied the positive relationship between sharing physical activity experience on SNS and residents' social connectedness in the period of home isolation, thus Hypothesis 1a is established. Model 2 and Model 3 preliminarily tested the effect of online positive self-presentation and positive feedback on social connectedness during the period of home isolation. Model 2 adds an online positive self-presentation of antecedent variables on the basis of Model 1. The results show that online positive self-presentation has a significant impact on social connectedness during the home isolation period. For every additional score of online positive self-presentation, residents' social connectedness increased by 0.428 units. Considering that the highest score assigned by the scale is 5 points, the increase is relatively large, thus Hypothesis 2a is established. Model 3 adds online positive feedback of antecedent variables on the basis of model 1. The results show that online positive feedback has a significant impact on social connectedness during the period of home

isolation. For every additional score of online positive feedback, residents' social connectedness increased by 0.421 units, which is also a large increase, thus Hypothesis 3 is established.

In addition, in order to further test the relationship between variables, a multi-level regression analysis was carried out for each variable. As shown in Table 4, sharing physical activity experience has a significant positive impact on social connectedness during the home isolation period ( $b = 0.308$ ,  $p < 0.001$ ), thus Hypothesis 1a is further verified; sharing physical activity experience has a significant positive impact on online positive self-presentation ( $b = 0.956$ ,  $p < 0.001$ ), thus Hypothesis 1b is verified; sharing physical activity experience has a significant positive impact on online positive feedback ( $b = 0.421$ ,  $p < 0.001$ ), thus Hypothesis 1c is verified. In Table 4, it is also verified that online positive self-presentation has a significant positive impact on online positive feedback ( $b = 0.563$ ,  $p < 0.001$ ), thus Hypothesis 2b is established. At the same time, Hypothesis 2a ( $b = 0.331$ ,  $p < 0.001$ ) and Hypothesis 3 ( $b = 0.311$ ,  $p < 0.001$ ) were verified again. Combining the results in Tables 3 and 4, the mediating role of online positive self-presentation and positive feedback was preliminarily tested.

### **Mediation effects**

The previous paper preliminarily tested the mediating role of health values between the amount of physical activity and well-being in the period of home isolation. According to the mediating effect analysis procedure, the mediating effect was further divided based on Hayes' Model 6 and bootstrap method[73]. This method calculates the direct effect coefficient and the indirect effect coefficient of the intermediary through repeated re-sampling of the original sample, and uses the confidence interval to test whether the coefficient of the mediating effect is significant. The test results are shown in Table 5.

The previous article and verification of sharing physical activity experience are important predictors of social connectedness. The results showed that under the influence of chain mediation, sharing physical activity experience directly ( $b = 0.308$ , 95% CI: [0.172, 0.403]) had a significant impact on social connectedness. At the same time, sharing physical activity experience indirectly through positive self-presentation ( $b = 0.316$ , 95% CI: [0.180, 0.463]) and positive feedback ( $b = 0.131$ , 95% CI: [0.063, 0.207]) also had a significant impact on social connectedness. Therefore, during the period of home isolation, positive self-presentation and positive feedback played a partial mediating role in the mechanism of sharing physical activity experience on SNS on social connectedness.

Since the study model is a chain-type multiple mediation model, involving an interactive relationship between two mediating variables, the multiple mediating variables show sequential characteristics, forming the intermediary chain, so further discussion and verification are needed. First, in Model 4 of Table 3, on the basis of Model 1, online positive self-presentation and positive feedback of the antecedent variables were added at the same time. The results show that positive self-presentation and positive feedback concurrently have a significant impact on social connectedness. Meanwhile, the coefficient of sharing physical activity experience in Model 4 can be seen to have decreased by 0.453 units compared to Model 1, which was still statistical Significant in the sense. This shows that after adding the online positive self-presentation and positive feedback of the antecedent variable, the positive effect of sharing

physical activity experience on the social connectedness of residents during the isolation period still exists, and the effect is slightly reduced, thus Hypothesis 6 is initially established. After further verification through the bootstrap method, sharing physical activity experience indirectly through the mediation chain of online positive self-presentation and positive feedback ( $b=0.167$ , 95% CI: [0.088, 0.251]) also has a significant impact on social connectedness.

## Discussion

Through sharing physical activity experience on SNS[74], social connectedness[74], positive self-presentation [37, 7] and positive feedback[75], the study was conducted. This study found that during the outbreak of COVID-19, Chinese residents were able to break social isolation and alleviate social distancing through sharing physical activity experience on SNS. The current international new crown pandemic situation is becoming more and more serious, which challenges the traditional public health management concept and mechanism. Many previous studies have described the effects of physical activity on physical and mental health, but very few studies have elaborated on the social function of physical activity in the pandemic situation[48]. Therefore, this study links sharing physical activity experience, positive self-presentation, positive feedback, and social connectedness, which is tested in the context of COVID-19 in China, and provides a “Chinese case” for promoting the response to catastrophic public health challenges.

The research results show that sharing physical activity experience on SNS can penetrate all the relationships among model structures, thus proving that physical activity still has socialization function during isolation period[1], and sharing physical activity experience can have a great impact on residents' social connectedness[50]. SNS have the function of maintaining and developing interpersonal relationships. In the inter-research, it is proposed that users post and share personal status on their own SNS, so as to better present a positive social image in front of others[40]. However, due to the stimulation of the pandemic situation, people's preference for self-presentation on SNS has been changed, and people prefer to establish their positive social image by transmitting a healthy and energetic state or behavior[76]. Our research just confirmed this hypothesis, and more and more people gain positive self-presentation on SNS by showing the results of home-based exercises or the scores of virtual sports on SNS. Meanwhile, this study also confirmed that the desire for positive feedback is one of the intrinsic motivations for most people to participate in physical activity[53]. However, sharing information about healthy behaviors on SNS will indeed obtain positive feedback from others[54]. Taking motivation as the starting point, this study explains the connection between sharing physical activity experience, positive self-presentation and positive feedback, and expands the relevant theories of SNS research.

With the development of SNS, people are more willing to extend and augment their interpersonal relationships in reality through self-presentation and positive interpersonal interaction on SNS[56]. SNS can help individuals get rid of the social distress in real social interactions[57]. Particularly during the pandemic, people will try their best to keep the image consistent with the social image in order to obtain praise and pleasant comments from others, thereby alleviating the impact of social isolation[7]. This

study validates the previous research from an empirical perspective[59]. At the same time, it also verified that the positive self-presentation of individuals on SNS can obtain positive feedback. People can form a good relationship in the process of positive self-presentation and positive feedback, and deepen the good interpersonal relationship in the process of forming this relationship[14].

The model validation shows that residents can establish positive self-image and obtain positive feedback from others through sharing physical activity experience, thereby enhancing social connectedness. This result verifies that individuals can reveal and present themselves through information transmission, and obtain positive feedback from others, which will deepen the interpersonal relationship between people[61]. The mediating role of positive self-presentation and positive feedback in sharing physical activity experience and social connectedness is explained. During the isolation period, sharing physical activity experience can satisfy personal online positive self-presentation. Therefore, people who are keen on pursuing health and vitality will form new social interactions, thereby breaking the social connectedness barrier caused by social isolation[7]. In addition, sharing physical activity experience often obtains praise from others or other forms of positive feedback. People are always accustomed to seeking perfect body shape, and a healthy body and an energetic personal social status can often obtain positive feedback[45]. Especially in the context of COVID-19 social distancing restrictions, the online status related to health, vitality and pandemic prevention makes it easier to obtain positive feedback, resulting in online interaction[61]. In previous studies, it was known that positive self-presentation and positive feedback would also form a causal relationship[14], which was also tested in this study, and the chain mediated effect of the two was also verified in this study. Different from the results of previous studies[60], during the COVID-19 outbreak, positive self-presentation is more conducive to shaping a positive image. Although the real negative information may be hidden, it is more conducive to the establishment of social relationships, judging from the situation at that time[7]. Consistent with previous studies, self-presentation was positively correlated with positive feedback[14]. Positive feedback, as the main form of emotional support in the network environment[75], is more likely to be praised[42], and according to the logic of "disclosure-feedback-relationship", positive feedback from online friends can also enhance social connectedness between people[60]. Therefore, in addition to advocating home physical activity during the COVID-19 pandemic, governments at all levels should encourage residents to share home exercises or virtual sports on SNS[20].

## Limitations And Future Research Directions

The first is the problem of sample selection. In this study, the convenience sampling of non-probability sampling was used. Although we tried expanding the geographical area as much as possible, the samples still do not represent the study population, which may lead to problems related to statistical sample bias or selection bias. The sample size should be considered in accordance with the acceptable level of significance, power of the study, expected effect size, underlying event rate in the population, and standard deviation in the population[77]. Therefore, future research can consider the sample size from the above aspects using larger data to prove the significant correlation of the research content. However, due to the fact that only Chinese samples are used in this study, more cross-cultural and cross-border

samples are still needed to join the study. The model proposed in this study needs to be further tested in more geographic locations to determine the universality of the results.

The second is the issue of references. At present, there are not enough literatures related to the research topic of sharing physical activity experience on SNS. In the review of literature, there are not many literatures that can provide theoretical basis for the research topic, which is not conducive to the development of a new research framework.

In addition, the methods, tools, and techniques of data collection are limited. This study used the Internet to distribute questionnaires, resulting in the analysis and discussion of time cross-sectional data. However, in view of the fact that the current pandemic situation in China has basically stabilized, the respondents can only be guided to recall, but then again Internet questionnaires cannot provide face-to-face guidance, leading to possible deviations in data collection. At the same time, the problem of excessive use of mobile phones was ignored in the design of the study, thus social isolation and increased Internet usage may breed anxiety and depression[78].

Finally, although this study collected information on respondents' gender, age, household income, education level, employment status, marital status, home ownership, BMI, etc., it also found that BMI and education level have an impact on social connectedness, but the reason cannot be explained due to space limitations. It is recommended that the above information be used as a moderating variable in future research to study the relationship between sharing physical activity experience on SNS and social connectedness.

## **Conclusion**

This study provides empirical evidence that during the isolation period, residents sharing physical activity experience on SNS can establish a positive social image and obtain positive feedback from others, thereby enhancing social connectedness. This study highlights the importance of sharing physical activity experience on SNS and provides suggestions for facilitating the response to catastrophic public health challenges. In addition to home-based exercise or virtual sports, residents should also participate more in discussions on related topics on SNS. During the COVID-19 pandemic, sharing physical activity experience on SNS can create a positive, healthy and energetic personal image, gain recognition from others, and establish new interpersonal relationships. At the same time, in addition to advocating home-based exercises, explaining the skills of home-based exercise and related courses, governments at all levels in various countries advocate that people should exercise at home, and encourage residents to share the content of home-based exercise or virtual sports on SNS. For example, organizing fitness challenges and home exercise competition. Through these forms, people can be helped to get rid of the dilemma of isolation and eliminate the impact of COVID-19 on people to a greater extent.

## **Declarations**

## Author Contributions

Y.Z. and Z.R. contributed to the conception of the study. Y.Z. collected and organized the data. Y.Z. and Z.R. contributed significantly to analysis and manuscript preparation. Y.Z. performed the data analyses and wrote the manuscript. Y.M., X.W. and M.Z. helped perform the analysis with constructive discussions. Z.R. is responsible for the overall project.

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No potential conflict of interest was reported by the author(s).

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## Tables

**Table 1.** Descriptive statistical results of demographic characteristics

Variable	Mean or percentage (standard deviation)	Variable	Mean or percentage
<b>Gender</b>		<b>Age</b>	
Male	55.0%	High (below 30 years old)	55.9%
<b>Household income</b>		<b>Education level</b>	
Annual income below 100,000	39.8%	Junior college and below	33.5%
Annual income of 100,000-200,000	34.6%	Bachelor's degree	34.3%
Annual income above 200,000	25.7%	Postgraduate and above	32.2%
<b>Marital status</b>		<b>BMI</b>	
Unmarried	61.3%	Standard body shape (18.5-23.9)	75.9%
<b>Employment status</b>		<b>Home ownership</b>	
Employed	74.6%	Yes	87.0%

**Table 2.** Reliability analysis results of each item in the scale

	Mean	SD	CITC	$\alpha$	AVE	CR
<b>Sharing physical activity experience</b>	3.60	0.79		0.79	0.50	0.81
Every time I do physical activity, I share photos.	3.66	1.00	0.84**			
Every time I do physical activity, I share videos.	3.29	1.09	0.85**			
Every time I do physical activity, I share Wechat moments, Weibo, QQ space, etc.	3.39	1.07	0.84**			
Every time I do physical activity, I share my feeling on Keep, HotBody, FitTime Instant Exercise, Fittime Ruijian Times or other websites.	4.05	0.88	0.59**			
<b>Social connectedness</b>	2.36	0.74		0.92	0.60	0.92
I feel disconnected from the world around me.	2.32	0.93	0.80**			
Even around people I know, I don't feel that i really belong.	2.42	0.93	0.82**			
I feel so distant from people.	2.37	0.93	0.81**			
I have no sense of togetherness with my peers.	2.37	0.98	0.82**			
I don't feel related to anyone.	2.32	0.90	0.82**			
I catch myself losing all sense of connectedness with society.	2.33	0.93	0.81**			
Even among my friends, there is no sense of brother/sisterhood.	2.34	0.89	0.81**			
I don't feel I participate with anyone or any group.	2.39	0.87	0.78**			
<b>Positive self-presentation</b>	3.65	0.74		0.88	0.55	0.88
I post photos that only show the active and healthy side of me.	3.72	0.93	0.81**			
I selectively post photos in which I do physical activity.	3.68	0.92	0.78**			
I only write messages that portray my health and pleasure regardless of my actual feelings.	3.54	0.97	0.77**			
I use smiling emoticons (i.e., smiley: 😊) a lot in the messages related to physical activity I write regardless of my actual feelings.	3.60	0.95	0.81**			
I avoid writing about negative things that happen to me when I update my status related to physical activity.	3.68	0.93	0.79**			

When I update my status related to physical activity, I only reveal positive feelings.	3.71	0.89	0.79**			
<b>Positive feedback</b>	3.67	0.77		0.88	0.60	0.88
Every time I share photos about physical activity on SNS, many friends will give good replies, such as: really beautiful, really handsome, really healthy, awesome, etc.	3.70	0.93	0.84**			
Every time I post an idea about physical activity on SNS, I get replies from many friends.	3.58	0.94	0.81**			
When I post some physical activity on SNS that makes me proud or happy (such as body shape, competition results), many friends will give blessings through reply	3.72	0.93	0.82**			
Every time I post some physical activity on SNS, I encounter something interesting or funny, and many friends will reply to express their interest.	3.63	0.94	0.83**			
Every time I ask a question about physical activity on SNS, many friends will answer my question through reply, expressing their concern for me.	3.71	0.91	0.83**			

Note: \*\*\* indicates that the correlation is significant on the 0.01 level.

**Table 3.** The impact of personal sports and leisure sharing behavior on social connectedness during home isolation

Variable	Model 1	Model 2	Model 3	Model 4
Sharing physical activity experience	0.776 <sup>***</sup>	0.441 <sup>***</sup>	0.417 <sup>***</sup>	0.323 <sup>***</sup>
Positive self-presentation		0.428 <sup>***</sup>		0.260 <sup>***</sup>
Positive feedback			0.421 <sup>***</sup>	0.292 <sup>***</sup>
Gender				
Female	0.004	0.010	-0.010	-0.002
BMI				
Standard Body Shape	0.249 <sup>***</sup>	0.010 <sup>**</sup>	0.171 <sup>**</sup>	0.135 <sup>*</sup>
Overweight	0.001	0.021	0.005	0.016
Age				
High (above 29 years old)	0.008	0.010	0.005	0.007
Household income				
Annual income of 100,000-200,000	-0.026	-0.017	-0.033	-0.026
Annual income above 200,000	-0.005	-0.003	-0.007	-0.005
Education level				
Undergraduate	-0.060 <sup>+</sup>	-0.049	-0.046	-0.044
Graduate or above	-0.029	-0.017	-0.016	-0.012
Employment status				
Employed	-0.017	-0.001	0.000	0.005
Marital status				
Married	-0.000	0.0049	-0.008	-0.003
Home ownership				
Yes	0.041	0.0213	0.036	0.025
City	Controlled	Controlled	Controlled	Controlled
Sample size	460	460	460	460
R <sup>2</sup>	0.863	0.876	0.877	0.880

Note: In order to save table space, the standard error is not given; \*\*\* means  $P < 0.001$ , \*\* means  $P < 0.01$ , \* means  $P < 0.05$ , + means  $P < 0.1$ ; the reference item of gender in the model is "male", the reference item

of BMI is "underweight", the reference item of age is "over 30 years old", the reference item of household income is "below 100,000", the reference item of education level is "below undergraduate", the reference item of employment is "not employed", the reference item of marital status is "unmarried", and the reference item of home ownership is "No".

**Table 4.** Verification of the relationship between variables

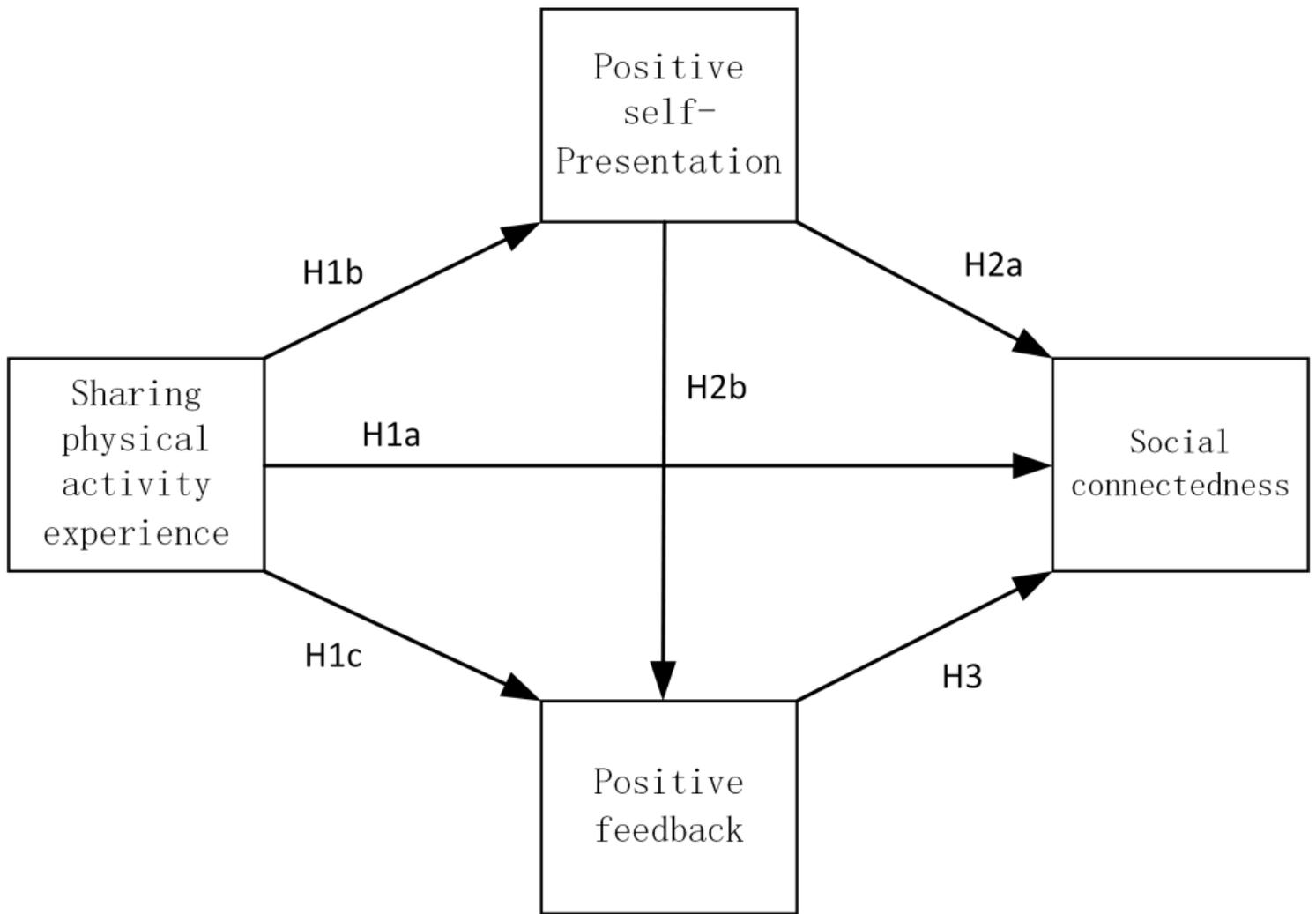
DV	IVs	B	S.E.	t-value	P-value	95% Confidence interval		Hypothesis
						LLCI	ULCI	
SP	PA	0.956	0.013	69.312	0.000	0.862	0.913	H1b(S)
	R <sup>2</sup>	0.913	F= 4804.163, P< 0.001					
SF	PA	0.421	0.036	11.487	0.000	0.338	0.477	H1c(S)
	SP	0.563	.038	15.378	0.000	.512	.662	H2b(S)
	R <sup>2</sup>	0.947	F= 4055.764, P< 0.001					
SC	PA	0.308	0.059	4.884	0.000	0.172	0.403	H1a(S)
	SP	0.331	0.069	4.829	0.000	0.197	0.468	H2a(S)
	SF	0.311	0.068	4.380	0.000	0.165	0.434	H3(S)
	R <sup>2</sup>	0.878	F= 1088.452, P< 0.001					

Note: DV "dependent variable", IVs "independent variable", B "Standardized coefficients", PA "sharing physical activity experience", S "Support", SP "positive self-presentation", SF "positive feedback", SC "social connectedness", the following are the same.

**Table 5.** Regression Coefficients of the Mediation Model

Path	B	Bootstrap S.E.	95% Confidence interval		Hypothesis
			LLCI	ULCI	
PA→SP→SC	0.316	0.073	0.180	0.463	H4(S)
PA→SF→SC	0.131	0.037	0.063	0.207	H5(S)
PA→SP→SF→SC	0.167	0.041	0.088	0.251	H6(S)

## Figures



**Figure 1**

Conceptual mediation model and hypotheses