Reducing HIV Public Stigma Through News Information Engagement on Social Media: A Multi-Method Study of the Role of State Empathy

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Abstract

Media exposure and news frames have been shown to influence on public stigma and discrimination. However, the mechanisms potentially resulting in HIV public stigma are not fully understood. The purpose of this research was to explore the positive role of state empathy in reducing HIV public stigma through news information engagement. The first cross-sectional study explored the relationships between news information engagement, state empathy, and HIV public stigma. A group of college students (N = 408) were invited to complete self-report measures. The results indicated that state empathy mediated the relationship between news information engagement and HIV public stigma. The follow-up experimental study examined whether reading different news, operationalized as news information engagement on social media, increased or reduced state empathy, which in turn would affect HIV public stigma. The second group of participants (N = 120) was randomly assigned to three experimental conditions (positive, neutral, and negative news). State empathy, HIV public stigma, and HIV/AIDS scientific knowledge were assessed at 20-day intervals to establish the baseline and evaluate post-experiment levels. Significant differences were observed in the three experimental groups. The results suggest that news information engagement is beneficial in reducing HIV public stigma by cultivating state empathy. News articles with positive descriptions and HIV/AIDS scientific knowledge articles reported on social media can be used to develop interventions for reducing public stigma.

Editorial Record

Introduction

HIV public stigma is defined as prejudiced, stereotyped, and discriminatory attitudes exhibited by the public towards people living with HIV/AIDS (PLWHA; Earnshaw & Chaudoir, 2009). PLWHA are often alienated by family members, lose friendships, and are prevented from maintaining a stable income and conventional social status (Bogart et al., 2008; Earnshaw et al., 2013). Many studies have shown that HIV public stigma is the main impediment to PLWHA seeking active treatment (Smith et al., 2008), and it is the major obstacle to HIV prevention (Abdool Karim, 2011; Sengupta et al., 2011). Turan et al. (2017) investigated 1,356 women living with HIV/AIDS and concluded that in the medical environment, perceived discrimination from uninfected people aggravated their depressive symptoms and adversely affected antiretroviral therapy adherence. Therefore, the exploration of effective approaches to reduce HIV public stigma is crucial.

Social media (e.g., *Twitter* and *Weibo*) are important platforms by which individuals access information and gain knowledge that affects their cognition, emotion, and behaviour (Kim et al., 2016; Oliver et al., 2012). The related behaviours of reading, posting/re-posting, and commenting on posts are generally defined as news information engagement (Alt, 2015). Ma (2017) pointed out that in-depth comments about mental illness on social media tend to be objective and contain scientific information, which helps participants to improve their health literacy and reduce mental illness stigma overall. Kerr et al. (2015) tested the changes in HIV public stigma among African-American adolescents who had participated in a media intervention. Their results indicated that the intervention had a short-term but significant benefit in addressing reduced stigma. Nevertheless, the mechanism should be explored further.

The Role of Empathy

The influence of news information engagement on stigma can be partly explained by the perception-action model (PAM) for empathy (Preston & de Waal, 2002) and the empathy-altruism hypothesis (Batson et al., 1991). The PAM explains the mechanisms of individual empathy development from the perspective of cognitive neuroscience (Preston & de Waal, 2002). According to this model, the emotional state of the object automatically activates similar emotions in the subject when attention is paid to it. This shared emotional experience, in which one person comes to feel a similar emotion to another, is known as state empathy (Preston & de Waal, 2002; Shen, 2010). A systematic review of the development of empathy among adolescents suggests that media exposure is a social factor that significantly influences the levels of empathy expressed by adolescents (Silke et al., 2018). James et al. (2017) implied that the results related to empathy in the digital media life of youth are shaped by types of digital media engagement and experience in media contexts. For instance, Alloway et al. (2014) found that some social media activities—such as sharing links, viewing, and commenting on news information content—enhanced a user's ability to develop empathic responses. In terms of long-term effects, Vossen and Valkenburg (2016) using two surveys of 942 Dutch teenagers—with a one-year interval—demonstrated that social media engagement significantly increased adolescents' cognitive and affective empathy over time.

The empathy-altruism hypothesis further indicates that similar feelings and caring emotions of empathy are the driving force in developing beneficially altruistic cognitions and behaviours towards marginalized groups (Batson et al., 1997; Persson & Kajonius, 2016). Evidence demonstrated that empathy plays an active role in reducing HIV public stigma (Lin et al., 2012; Olapegba, 2010). Lin et al. (2012) evaluated empathy level and avoidance attitudes towards PLWHA among 1,760 health service providers in 40 hospitals in China. A linear regression showed that the empathy level of health service providers played a crucial role in providing quality services and reducing HIV public stigma. Hecht et al. (2022) found that higher levels of empathy elicited by the media stimulus about mental illness resulted in a reduction of mental health stigma. Similarly, Tippin and Maranzan (2019) randomly divided 303 university students into an intervention group—who viewed a photovoice-based anti-stigma intervention video that focused on the recovery of patients—and a control group—who viewed a control video that did not reference any aspect of mental health. The results indicated that watching anti-stigma videos on a media platform reduced public stigma towards people with a mental illness, and empathy mediated the above relationship. Combining the perception-action model for empathy and the empathy-altruism hypothesis, as well as the empirical literature, the present study proposed Hypothesis 1:

H1: State empathy will mediate the relationship between news information engagement and HIV public stigma.

The Role of News Frame

Both negative descriptions and positive descriptions of HIV/AIDS and PLWHA have been noted on social media (Gao et al., 2013; Stevens & Hull, 2013). Considering the potential of social media and news coverage to influence public attitudes, negative descriptions are usually expected to lead to the maintenance and aggravation of discrimination and stigma, whereas positive descriptions are associated with an increased likelihood of anti-stigma comments and are beneficial in improving the stigma environment (Gwarjanski & Parrott, 2018). The news frame is a widely used theory to explain the impact of news on the way audiences think and on their attitudes to issues (Matthes, 2009; Van Gorp & Vercruysse, 2012). Framing theory originated from Goffman's "Frame Analysis", defined as the cognitive structure used to interpret and understand the external objective world (Goffman, 1974). A frame is a narrative that concentrates on certain aspects of an issue while ignoring others (Entman, 2010; Vyncke & van Gorp, 2018); in other words, news frames influence audiences' factual judgments, value judgments, and attitude attribution towards news events and news figures.

A systematic review of the impact of news coverage of mental illness-related stigma found that negative descriptions—namely stigmatizing frames—that included anecdotes of danger and violence to others, exaggerated the social stigma environment (Ross et al., 2019). Conversely, positive descriptions comprising stories of recovery and treatment—namely, anti-stigmatizing frames—challenged stigma (Ross et al., 2019). Corrigan et al. (2013) conducted a randomized controlled trial to test the effect of news frames on participants' mental illness stigma and affirming attitudes. A total of 151 participants were randomly assigned to three groups. Each participant read a positive mental illness news story focusing on recovery, a negative mental illness news story focusing on the failed mental health system and related violence, or a control article about maintaining healthy dental habits. The results showed that the negative frames were associated with an increase in stigmatizing comments and a decrease in affirmative comments, whereas the positive frames challenged the legality of stigma by promoting social equity and personal empowerment.

In the current study, we operationalized news information engagement on social media into reading HIV/AIDS-related news with diverse news frames: namely, anti-stigmatizing frames with positive descriptions, stigmatizing frames with negative descriptions, and neutral news without stigmatized information and with a positive or negative valence. More importantly, we will argue that diverse news frames (i.e., positive, neutral, and negative descriptions of HIV-related news articles) differ in their impact on state empathy and HIV public stigma. Hence, three hypotheses were further developed:

H2: Reading HIV-related news with positive descriptions will increase state empathy and decrease HIV public stigma.

H3: Reading HIV-related news with negative descriptions will decrease state empathy and increase HIV public stigma.

H4: State empathy and HIV public stigma will not change significantly after reading neutral news articles.

The Present Study

It should be noted that some of the aforementioned studies have focused on mental health-related public stigma. Though indirectly, this stigma also provided inspiration for the present research on HIV-related issues. While there are commonalities in the drivers of the stigmatisation process among multiple public stigmas associated with HIV, mental illness, and other health conditions, the heterogeneous nature of stigma requires a further understanding of the potential mechanisms of stigma reduction in cross domains (Casados, 2017; Stangl et al., 2019). Specifically, HIV infection is more likely to pose a threat to interpersonal interactions, which limits the applicability of intervention strategies across different kinds of stigmas (Casados, 2017; Pachankis et al., 2018).

Considering this, it is particularly urgent to understand the potential mechanisms of the impact of news information engagement and news frames on state empathy and HIV public stigma. Through a cross-sectional investigation (Study 1) and an experimental study (Study 2), the current multi-method study shed light on how and why news information engagement and news frames influence HIV public stigma.

Study 1: Investigation of the Mediation Role of State Empathy

The first study was a cross-sectional investigation conducted with 408 college students. Data were collected through self-reported measures, which assessed news information engagement, state empathy, and HIV public stigma. To test H1, we constructed a mediation model to examine whether state empathy mediated the relationship between news information engagement and HIV public stigma.

Methods

Data Collection and Participants

Participants were recruited from three Chinese universities using a computer-assisted, self-administered questionnaire collection platform (https://www.wjx.cn/). Data were collected by creating links on social media platforms (e.g., *WeChat* and *Tencent QQ*). Only the age and gender of participants were gathered outside of personal privacy information (name, university, and major). The informed written consent of the participant was given by selecting an "agree" button before the submission of the questionnaire. Participants were informed that they could withdraw from the study at any time. The Human Subjects Ethics Sub-Committee of School of Sociology, Wuhan University approved this study, and the approved protocol was strictly followed. The data were collected from May to July, 2018.

The inclusion criteria of the participants were as follows: a) over 18 years of age, b) ability to understand and respond to a Chinese questionnaire, c) heterosexual, and d) uses smartphones and social media apps (e.g., *WeChat* and *Weibo*) as major sources of news information. The exclusion criteria were as follows: a) participation in other, similar studies (survey and cognitive interview), b) member of the HIV charity club in college, and c) majoring in infectious disease epidemiology. The resultant sample used in the present study included 408 college students (male: *n* = 144, 35.29%; female: *n* = 264, 64.71%). The mean age was 20.55 years (*SD* = 2.107, ranging from 18 to 28).

Measures

News Information Engagement. Three items were adapted from Alt's (2015) study to measure the frequency and depth of reading HIV/AIDS-related news or obtaining HIV/AIDS-related information when using social media sites. The three items were *Reading news and information updates via social media sites, such as HIV/AIDS-related news or information*, *Responding to news or information (by liking, commenting, and forwarding) via social media sites, such as HIV/AIDS-related news or information*, and *Sharing news alerts via social media sites, such as HIV/AIDS-related news or information*. Participants were required to indicate frequency on a five-point Likert scale (1 = *never*; 5 = *always*). A higher score indicated more frequent social media engagement in HIV/AIDS-related topics and news. In the current sample, Cronbach's α was .79.

State Empathy. The 12-item State Empathy Scale developed by Shen (2010) was used to measure the level of state empathy during the communication process via affective, cognitive, and identification dimensions. The sample items were *I experienced the same emotions as the characters when watching this message (Affective Empathy)*, *I can see the character's point of view (Cognitive Empathy)*, and *I can relate to what the character was going through in the message (Associative Empathy)*. These items were evaluated by a five-point Likert scale (1 = *not at all*; 5 = *completely*). A high score indicated the participant's high-level state of empathy. A study by Shen (2010) found the factor loadings ranged from .72 to .92 in student and public samples, and the reliability for the whole scale was .93 and .92 in two samples. In the current sample, Cronbach's α was .88.

HIV Public Stigma. The 12-item Personal Stigma Scale developed by Visser et al. (2008) was used to measure the personal stigma of uninfected community members. The scale included two factors: interpersonal distancing, and blame and judgment. The sample items were *If I was in public or private transport, I would not like to sit next to someone with HIV (Interpersonal Distancing)* and *People with HIV should be ashamed of themselves (Blame and & Judgement)*. Participants were asked to indicate their level of agreement on 12 items on a four-point Likert scale (1 = *strongly disagree*; 4 = *strongly agree*), with low scores representing low HIV public stigma. The internal consistency was acceptable for the HIV public stigma measure (Cronbach's α = .87); the factor loadings were

greater than 0.64 in a community sample of Visser et al.'s (2008) study. In the current sample, Cronbach's α was .90.

Results

Description and Correlation Analysis

Descriptive statistics, specifically, the mean and standard deviation of each variable, are displayed in Table 1. HIV public stigma was negatively associated with news information engagement ($r = -.174$, $p < .001$) and state empathy ($r = -.258$, $p < .001$). Moreover, news information engagement was positively related to state empathy ($r = .372$, $p < .001$).

**Table 1.** *Bivariate Correlations, Descriptive Statistics and Cronbach's α for Variables in Study 1 (N = 408).*

Variable	1	2	3	*M*	*SD*	Cronbach's α
1 News information engagement	—			10.804	1.942	.792
2 State empathy	.372***	—		42.022	5.846	.883
3 HIV public stigma	−.174***	−.258***	—	22.868	5.519	.901

Note. ***$p < .001$(two-tailed).

Mediation Role of State Empathy

The mediation model was tested through the PROCESS macro for SPSS (Hayes, 2013). By using Model 4 of PROCESS, news information engagement and HIV public stigma were specified as independent and dependent variables, respectively, and empathy was set as the mediator. A total of 10,000 bootstrap samples were set to create 95% bias-corrected and accelerated confidence intervals (CIs) to examine indirect effects. The 95% CI did not include zero, indicating significance at the .05 level. The summary of the statistics of the mediation effect test is shown in Figure 1. The direct effect of news information engagement on HIV public stigma was not significant, Effect = −.257, 95% CI [−.545, .032]. The results also showed that the indirect effect of news information engagement on HIV public stigma transmitted through state empathy was significant, Effect = −.237, 95% CI [−.381, −.118]. By confirming H1, state empathy mediated the relationship between news information engagement and HIV public stigma, which explained the 25.475% variance of HIV public stigma.

Figure 1. *PROCESS Results for Mediation Model Unstandardized Coefficients in Study 1 (N = 408).*

Indirect effect = -.237, 95% CI = [-.381, -.118]

State empathy

1.120***

-.212***

Direct effect = -.257, 95% CI = [-.545, .032]

News information engagement

HIV public stigma
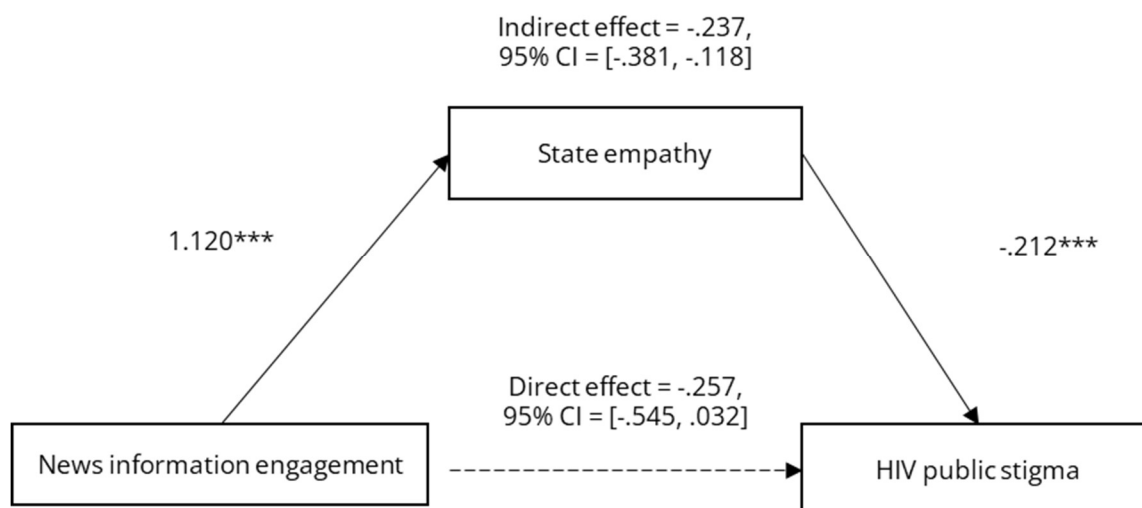
Note. ***$p < .001$; The dashed line is not statistically significant.

Study 2: Experiment in Increasing State Empathy

The second study was an experiment that operationalized news information engagement on social media as a news reading activity. A total of 120 participants were divided into three groups to read news with different frames through a social media platform. Hence, this experiment was designed to examine Hypotheses 2, 3, and 4.

Methods

Experimental Material Development

The potential news articles were posted by the official *Sina Weibo* account of *Beijing News*, which has 40.13 million followers as of February 2020. It is one of the most influential newspapers in Mainland China.

A research team, comprising two assistant professors and three master students, was led by a social work professor in the selection of news articles. The following strategies were adopted to identify appropriate news articles: a) the keyword "HIV/AIDS" was used to select posts from 2009 to 2018, given that the first HIV/AIDS-related news article in *Beijing News* was reported in 2009, b) themes that did not focus on HIV/AIDS facts and characters were excluded, c) images and video news were excluded, and d) news articles were commented and reposted more than 100 times. A total of 40 news articles were eventually included.

Ten postgraduate students majoring in journalism were invited as independent coders, to classify the 40 news articles into positive, neutral, or negative categories. They were trained as to the protocol. The criteria for article classification were as follows: a) positive news with an anti-stigmatizing frame: positive descriptions of the treatment and recovery of PLWHA, positive descriptions of personal qualities and behaviours of PLWHA, information about major advances and breakthroughs in HIV medical science, and positive comments that directly challenge stigma or call for less discrimination, b) negative news with a stigmatizing frame: negative descriptions of PLWHA, such as immoral and unclean, and descriptions of PLWHA who are a danger to public order— maliciously spreading HIV, or causing harm to others, and c) neutral news: single descriptions of HIV knowledge without either potentially stigmatizing or anti-stigmatizing information, and objective statements about the current status of HIV infection in China. After the coding was completed, we conducted a Kappa test on the categorical data for each of the two coder groups. The values of Kappa (ranging from .667 to 1.000, $p < .001$) indicated an acceptable high level of coding consistency. Considering that reading or dwell time is a key engagement metric, we selected easy-to-understand news articles and kept the total Chinese character account of the experimental material to approximately 2,500 to ensure a consistent level of news engagement in each group. Finally, three articles per category were identified as experimental material. For illustration, the details were summarised in the Appendix.

Participants and Procedures

Participants were recruited from a public elective course at a Chinese university. The researcher explained the theme of the study in class. G*Power version 3.1.9.7 was used to calculate the required sample size. An analysis of variance (ANOVA) model using F-test was selected with the following parameters: repeated-measures, within-between interaction, effect size = .25, α = .05, power = .95, number of groups = 3, and number of measurements = 2 (Faul et al., 2009; Kang, 2021). The results indicated that the minimum total sample size was 66. The criteria for recruitment were the same as for Study 1. Finally, a total of 120 undergraduates (male: n = 37, 30.83%, female: n = 83, 69.17%) agreed to participate in the present study. The mean age was 19.60 years (SD = 0.999, ranging from 17 to 22). Firstly, on November 1, 2018, they were invited to complete a series of variable tests to determine the scores baseline. At the beginning of the questionnaire, we again briefly introduced the theme of our study. After a 20-day interval, we sent experimental materials via an online link to participants' personal social media platforms based on smartphones. The participants' reading time was automatically recorded by the system. After reading the news articles, participants were invited to immediately complete the same questionnaire package as the pre-test, through a URL. Ethics approval was obtained from the Human Subjects Ethics Sub-Committee of School of Sociology, Wuhan University. The approved protocol was strictly followed.

Measures

In Study 2, we used the same measurement tools as for Study 1, including the State Empathy Scale, the International AIDS Questionnaire-Chinese Version (IAQ-C), and the HIV Public Stigma Scale (See the Measures section of Study 1 for details). The internal consistencies for these scales based on the sample (both for pre-test and post-test measures) are good (ranging from .667 to .888; see Table 2). Subsequently, we measured the participants' HIV/AIDS knowledge level.

HIV/AIDS Knowledge Questionnaire. The IAQ-C was used to measure HIV/AIDS scientific knowledge among college students (Davis et al., 1999). Three subscales were used to measure participants' HIV/AIDS scientific knowledge. They consisted of 14 items, including transmission myths (e.g., HIV/AIDS can be spread through coughing and sneezing), personal risk (e.g., HIV/AIDS only affects drug users, prostitutes, and homosexuals), and facts (e.g., Condoms will decrease the risk of HIV/AIDS transmission). The questionnaire asked participants to indicate their level of agreement (1 = *strongly disagree*; 5 = *strongly agree*). In a study by Davis et al. (1999), the total scores on the 18-item scale had a Cronbach's α of .76. Some of the items had to be reverse scored. A higher score indicates greater HIV/AIDS scientific knowledge. In the current sample, Cronbach's α was .89.

Table 2. *Descriptive Statistics of the Variables and Cronbach's α of Scales Based on the Sample in Study 2 (Both for Pretest and Post-Test Measures; N = 120).*

Variable	Group	Baseline		Posttest	
		M (SD)	Cronbach's α	M (SD)	Cronbach's α
State empathy	Positive group	40.225 (3.893)	.667	45.550 (6.453)	.888
	Neutral group	39.925 (5.553)	.813	42.575 (5.477)	.847
	Negative group	41.225 (6.062)	.873	35.875 (4.931)	.713
HIV/AIDS scientific knowledge	Positive group	54.775 (6.359)	.773	56.875 (6.749)	.718
	Neutral group	53.750 (7.099)	.817	60.550 (5.813)	.822
	Negative group	55.825 (5.349)	.676	54.700 (5.090)	.676
HIV public stigma	Positive group	23.700 (4.692)	.852	19.250 (4.770)	.861
	Neutral group	25.500 (4.145)	.808	22.100 (5.207)	.886
	Negative group	24.350 (4.330)	.834	27.150 (3.393)	.721

Results

Reading Time Effect

The one-way ANOVA was conducted among the three groups to examine the time effect on reading and comprehension. The results showed no significant difference (*F* = .794, *p* = .454) among the positive (*M* = 244.425, *SD* = 9.361), negative (*M* = 246.050, *SD* = 7.910), or neutral group (*M* = 246.800, *SD* = 8.516).

Repeated Measures ANOVA

Means and standard deviations of state empathy, HIV/AIDS scientific knowledge, and HIV public stigma at baseline and post-test are listed in Table 2. Figures 2, 3, and 4 present the trends of the three variables in the pre- and post-test. A 3 (group: positive, negative, and neutral) × 2 (time: baseline and post-test) repeated-measures ANOVA was used to conduct an efficacy analysis. State empathy, HIV/AIDS scientific knowledge, and HIV public stigma were set as dependent variables at two time points (with-subject factor) and three groups (between-subject factor) as independent variables. The simple effects tests were performed with the SPSS General Linear Model, using the Estimated Marginal Means option.

The main time effects, main group effects, and time × group interaction effects among three groups on three dependent variables are presented in Table 3. For state empathy, a repeated-measures ANOVA showed that the main time effect was not significant (*F* = 2.287, η_p^2 = .019, *p* = .133), but the main group effect (*F* = 9.732, η_p^2 = .143, *p* < .001) and time × group interaction effect (*F* = 30.714, η_p^2 = .344, *p* < .001) were statistically significant. For HIV/AIDS scientific knowledge, the main group effect was not significant (*F* = 1.286, η_p^2 = .022, *p* = .280), but the main time effect (*F* = 24.479, η_p^2 = .173, *p* < .001) and time × group interaction effect (*F* = 19.295, η_p^2 = .248, *p* < .001)

were statistically significant. For HIV public stigma, the main time effect ($F = 20.809$, $\eta_p^2 = .151$, $p < .001$), main group effect ($F = 11.595$, $\eta_p^2 = .165$, $p < .001$), and time × group interaction effect ($F = 37.576$, $\eta_p^2 = .391$, $p < .001$) were statistically significant.

Table 3. *Effect Size and Repeated-Measures Analyses of the Variables in Experimental Groups for Intervention Effectiveness Analysis in Study 2 (N = 120).*

Variable	Group	Main time effect		Main group effect		Time × Group interaction effect	
		F	η_p^2	F	η_p^2	F	η_p^2
State empathy	Positive group						
	Neutral group	2.287	.019	9.723***	.143	30.714***	.344
	Negative group						
HIV/AIDS scientific knowledge	Positive group						
	Neutral group	24.479***	.173	1.286	.022	19.295***	.248
	Negative group						
HIV public stigma	Positive group						
	Neutral group	20.809***	.151	11.595***	.165	37.576***	.391
	Negative group						

Note. ***$p < .001$; Time = tests of within-subjects effects; Group = tests of between-subjects effects; Time × Group = the interaction effects between time and group.

Table 4 presents the results of the pre-test and post-test of between-group differences (simple effects of a group) on three dependent variables across three groups. The results indicated no significant difference in the pre-test of three dependent variables across three groups ($F < 1.721$, $p > .183$). Nevertheless, all three dependent variables showed significant differences in the post-test ($F > 9.969$, $p < .001$). For state empathy, significant differences were found among the three groups. The difference between the positive and negative groups was the largest (MD = 9.675, $p < .001$) and was greater than the difference between the neutral and negative groups (MD = 6.700, $p < .001$). The difference between the positive and neutral groups was the smallest (MD = 2.975, $p = .060$). For HIV/AIDS scientific knowledge, no significant difference was found between the positive and negative groups (MD = 2.175, $p = .279$). However, the difference between the neutral and negative groups (MD = 5.580, $p < .001$) was greater than that between the positive and neutral groups (MD = −3.675, $p = .019$), and both differences were significant. For HIV public stigma, significant differences were found between each of the three groups. The difference between the positive and negative groups (MD = −7.900, $p < .001$) was greater than that between the neutral and negative groups (MD = −5.050, $p < .001$) and between the positive and neutral groups (MD = −2.850, $p = .017$).

Table 5 displays the results of simple effects of time that tested the within-group differences. As proposed in H2, after reading positive news, state empathy significantly increased ($F = 28.229$, $p < .001$; MD = −5.325, $p < .001$), HIV public stigma was reduced ($F = 48.473$, $p < .001$; MD = 4.450, $p < .001$), and HIV/AIDS scientific knowledge slightly increased ($F = 5.357$, $p = .022$; MD = −2.100, $p = .022$). However, the change after intervention was less than for the former two. As proposed in H3, after the negative group read negative news, state empathy was significantly reduced ($F = 28.495$, $p < .001$; MD = −5.350, $p < .001$), whereas HIV public stigma increased ($F = 19.191$, $p < .001$; MD = −2.800, $p < .001$). No significant change was observed in HIV/AIDS scientific knowledge ($F = 1.538$, $p = .217$; MD = 1.125, $p = .217$). Thus, H2 and H3 were supported. However, our experimental results did not support H4. HIV/AIDS scientific knowledge changed most notably ($F = 56.174$, $p < .001$; MD = −6.800, $p < .001$) in the neutral group. Participants' state empathy slightly increased ($F = 6.991$, $p = .009$; MD = −2.650, $p = .009$) and HIV public stigma reduced ($F = 28.297$, $p < .001$; MD = 3.400, $p < .001$) after the reading of two news articles with HIV/AIDS scientific knowledge.

Table 4. *Simple Effects Analysis of Group for Testing Specific Between-Group Differences Separately for the Positive Group, the Negative Group, and the Neutral Group in Study 2 (N = 120).*

	State empathy		HIV/AIDS scientific knowledge		HIV public stigma	
	Pretest	Post-test	Pretest	Post-test	Pretest	Post-test
Tests of Within-Subjects Effects	$F(2,117) = .672$	$F(2,117) = 30.713^{***}$	$F(2,117) = 1.081$	$F(2,117) = 9.969^{***}$	$F(2,117) = 1.721$	$F(2,117) = 31.287^{***}$
Pairwise Comparisons						
Positive group vs. Neutral group	MD = 0.300	MD = 2.975	MD = 1.025	MD = −3.675*	MD = −1.800	MD = −2.850*
Positive group vs. Negative group	MD = −1.000	MD = 9.675***	MD = −1.050	MD = 2.175	MD = −0.650	MD = −7.900***
Neutral group vs. Negative group	MD = −1.300	MD = 6.700***	MD = −2.075	MD = 5.850***	MD = 1.150	MD = −5.050***

Note. $^{*}p < .05$, $^{***}p < .001$; MD = Mean Difference.

Table 5. *Simple Effects Analysis of Time to Estimate Within-Group Differences in Study 2 (N = 120).*

Group	Time	Test	State empathy	HIV/AIDS scientific Knowledge	HIV public stigma
Positive group	T1 vs. T2	Tests of Within-Subjects Effects	$F(1, 117) = 28.229^{***}$	$F(1, 117) = 5.357^{*}$	$F(1, 117) = 48.473^{***}$
		Pairwise Comparisons	MD = −5.325***	MD = −2.100*	MD = 4.450***
Neutral group	T1 vs. T2	Tests of Within-Subjects Effects	$F(1, 117) = 6.991^{**}$	$F(1, 117) = 56.174^{***}$	$F(1, 117) = 28.297^{***}$
		Pairwise Comparisons	MD = −2.650**	MD = −6.800***	MD = 3.400***
Negative group	T1 vs. T2	Tests of Within-Subjects Effects	$F(1, 117) = 28.495^{***}$	$F(1, 117) = 1.538$	$F(1, 117) = 19.191^{***}$
		Pairwise Comparisons	MD = 5.350***	MD = 1.125	MD = −2.800***

Note. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$; T1 = Pre-test; T2 = Post-intervention test, MD = Mean Difference.

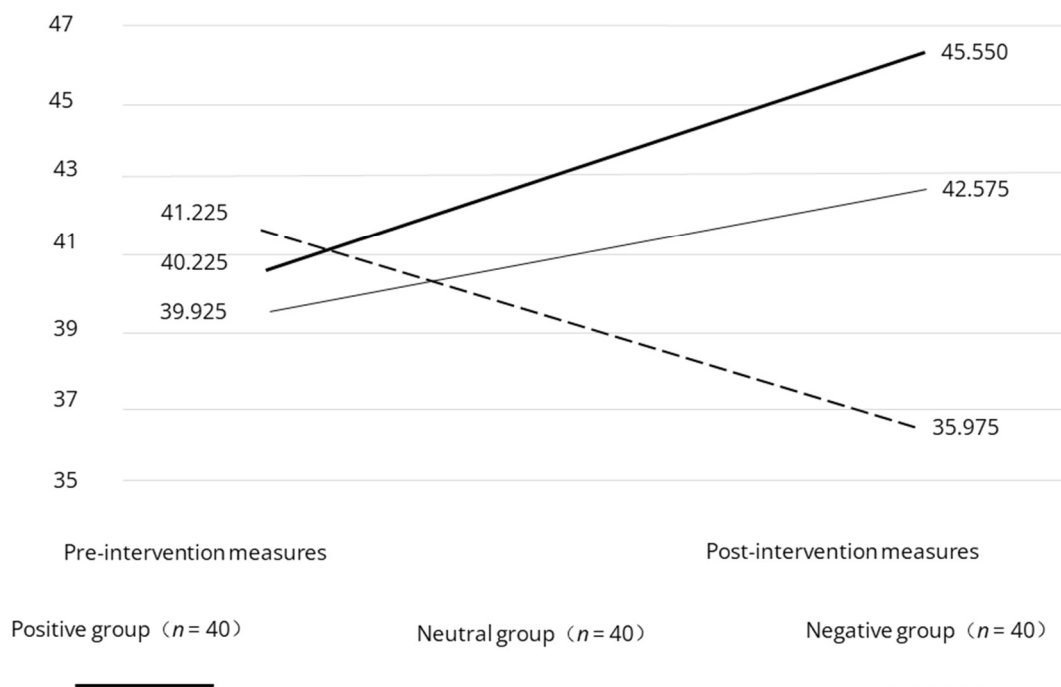**Figure 2.** *Levels of State Empathy in the Experimental Conditions at Two Time Points in Study 2.*

Positive group（*n* = 40）　　　Neutral group（*n* = 40）　　　Negative group（*n* = 40）

Figure 3. *Levels of HIV/AIDS Scientific Knowledge in the Experimental Conditions at Two Time Points in Study 2.*
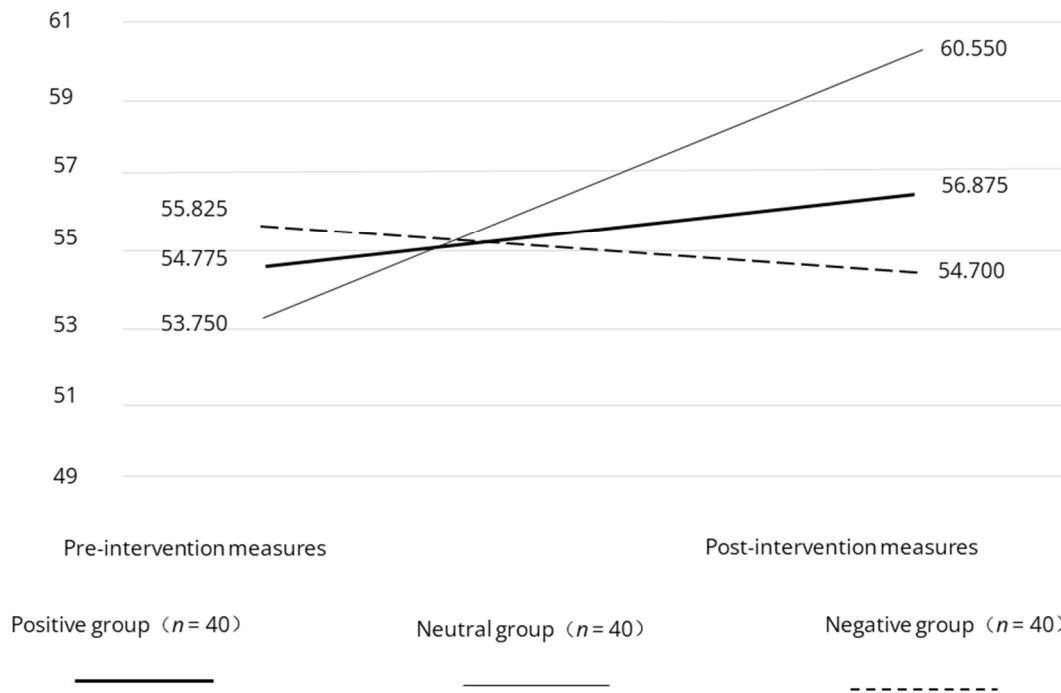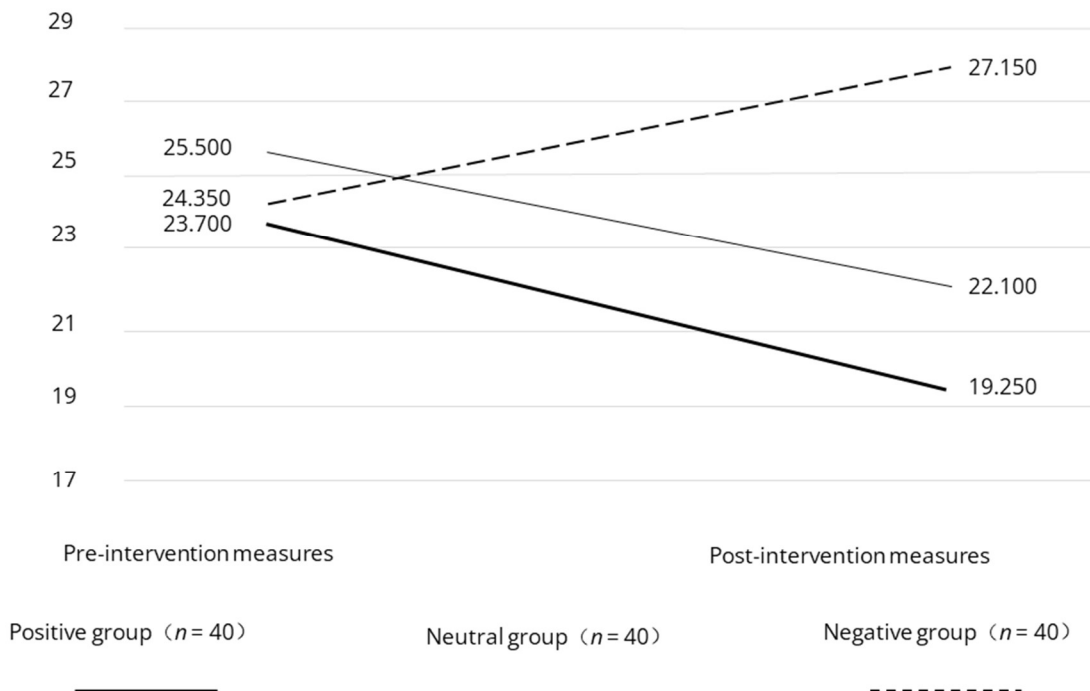

Figure 4. *Levels of HIV Public Stigma in the Experimental Conditions at Two Time Points in Study 2.*

Discussion

Using cross-sectional and experimental designs, the present research shows that state empathy is a mediator between news information engagement and HIV public stigma. Moreover, the reading of positive stigma-challenging news significantly increases state empathy and reduces HIV public stigma. This multi-method study sheds light on "why" and "how" news information engagement on social media influences HIV public stigma. Previous studies demonstrated the positive roles of social media in reducing public stigma towards mental illness (e.g., Naslund et al., 2016), the present one further extends its application to HIV public stigma.

Our findings clearly support the empathy-altruism hypothesis, which suggests that individuals exposed to the experiences of marginalised groups will display empathic responses and favourable attitudes (Batson et al., 1997). Our empirical results reveal the potential mechanisms of state empathy on reducing stigma elicited by reading HIV-related news articles. Furthermore, our work also fills a gap in the literature by extending the understanding of state empathy for the stigmatized group in two ways that previous research has not. First, as Casados (2017) pointed out, stigmas are heterogeneous, and the effect of any one intervention strategy might not be generalized from one stigma to another. We found that anti-stigmatizing frames with positive descriptions stimulate state empathy and contribute to HIV public stigma reduction, suggesting that state empathy is an important factor and effective tool for developing HIV public stigma intervention programs. In addition, this study tackles the question of whether non-narrative, neutral news articles initiate state empathy. Oliver et al. (2012) noted that, compared to reading non-narrative news articles, the participants who read narrative news articles with positive descriptions generated greater empathy and more favourable attitudes towards the stigmatized groups. The present study showed that neutral news about scientific HIV/AIDS knowledge might help to eliminate misunderstandings about HIV/AIDS and slightly improve state empathy; this may be related to the improvement of cognitive empathy, which refers to knowing, understanding, and adopting the opinions of others (Shen, 2010). Foster et al. (2018) demonstrated that individuals with higher levels of education were more likely to master mental illness-related scientific knowledge, and their empathy level was, consequently, considerably improved; this led to a reduction in prejudice and discrimination against those with mental illness. Our findings support the positive correlation that suggests that scientific knowledge contributes to the improvement of state empathy.

The results of this study reveal that news articles contribute to the reduction of HIV public stigma by increasing anti-stigmatizing frames with more positive and neutral descriptions, and that effort should be made to reduce stigmatizing frames (Corrigan et al., 2013). Furthermore, positive descriptions and neutral descriptions with scientific knowledge are often accompanied by more affirmative and stigma-challenging comments from readers and encourage readers to actively interact and share on social media, which may help reveal the potential role of social media in reducing stigma (Ross et al., 2019). Thus, the results of this study can serve as a direction for news coverage frames and content, and can offer guidance to journalists, such as to intersperse narrative storytelling news articles with scientific HIV/AIDS content; add positive anti-discrimination statements to neutral news, which promotes scientific HIV/AIDS knowledge and describes the current status of HIV infection; and to reduce negative discourse that tends to cause bias and stereotypes towards PLWHA. This type of coverage can be developed with the cooperation of government organizations, news agencies, and journalists—the goal being to reduce discrimination and stigma against PLWHA and improve the social stigma environment (Ross et al., 2019).

Users encounter news articles in many different ways. However, social media platforms promote more incidental, but potentially more shallow modes of news information engagement in an increasingly fragmented digital news environment (Moller et al., 2020). We found during the experimental intervention, that most participants read news articles within a relatively short period of time. We speculate that this may be related to users' reading habits on mobile devices. Specifically, fragmented browsing is a typical feature of news information engagement on social media platforms (Moller et al., 2020). Dunaway et al. (2018) found that participants on mobile phones spent less time reading news articles and fixated on links for a shorter period of time than those viewing content on a desktop. Similarly, Keib et al. (2021) used the same material and followed the same procedure to test users' visual attention to, and engagement with, social media posts on mobile phones and on desktop computers. The findings showed that users spent half as much time perusing content on mobile phones versus desktops, but there was no discernible difference in willingness to click and share (Keib et al., 2021). Nevertheless, reading or dwell time has been shown to be an important component of news information engagement (Lagun et al., 2016), which could potentially influence the public's stigmatization of PLWHA. Therefore, future studies should focus on potential differences in the impact of diverse levels of news information engagement (e.g., short-term shallow engagement versus long-term deep engagement) on HIV public stigma based on a fragmented digital news environment. In general, based on the results of Study 2, an anti-stigmatizing frame with positive descriptions and more HIV/AIDS scientific knowledge that can be captured more directly and quickly by the public in a short time is essential in reducing HIV public stigma.

Public health interventions through social media can be developed to reduce HIV public stigma (Betton et al., 2015). Social media is a relatively new direction that is emerging in the field of public health; it offers novel opportunities in prevention and surveillance, responses to major public health emergencies, and health communications (Finch et al., 2016). Social media provides a powerful source of information for user groups of all ages, especially those growing up with social media (Dong et al., 2017). Douglass and Moy (2019) developed an

interactive learning module based on social media applications; they invited 145 pharmacy students to watch fictional case scenarios through social media applications and conducted online discussions. Pre- and post-intervention results revealed that a brief anti-stigma intervention centred on social media reduced participants' mental health stigma. Further studies are needed to establish the evidence base to demonstrate the effectiveness of social media interventions on HIV public stigma. The current study reveals one of the possible influence mechanisms by which news information engagement on social media can increase readers' state empathy, thereby reducing HIV public stigma. Other influence mechanisms of social media on HIV public stigma and the manner of promoting highly effective interventions are plausible directions for future study.

There are several limitations of this study. First, it was carried out among college students who have higher education and can be assumed to have better comprehension than the general population; this may generate biased results. Thus, the generalizability of the results requires further investigation. Second, the current study focused on the state, rather than the trait, of empathy during message processing. It is reasonable to assume that a higher level of trait empathy might motivate individuals to engage in more empathy-related activities (Cuff et al., 2016). Future studies should consider trait empathy as a control variable. Third, the format of news on social media is not limited to text. Images (McClure et al., 2011) and videos (Tippin & Maranzan, 2019) have shown different effects on obesity stigma and mental illness stigma, respectively. Whether images, video news, or short video content has the more complex impact on HIV public stigma is a critical direction for future research. Fourth, in addition to social media context, traditional media (e.g., newspaper and magazine) and offline public service campaigns are also important ways in which university students are exposed to HIV-related news and information (Ren et al., 2014; Tung et al., 2013). There is a need to further measure the differences in the impact of different media context (both online and offline) on HIV public stigma.

Conflict of Interest

The authors have no conflicts of interest to declare.

Authors' Contribution

Along He: project administration, conceptualization, writing—original draft, writing—review & editing. **Hao Liu:** investigation, data curation. **Yuanzi Tian:** investigation, data curation.

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