

The Relationship between Psychological Impact and Self-control in Chinese Residents outside Hubei Province during the Epidemic of COVID-19: The mediation of self-regulated fatigue

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Research Article

Keywords: the psychological impact, COVID-19, self-regulated fatigue, self-control, Hubei Province, Wuhan city

Posted Date: October 30th, 2020

DOI: <https://doi.org/10.21203/rs.3.rs-99983/v1>

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Abstract

Aim: This study aimed to study the psychological impact of COVID-19 on Chinese residents outside the Hubei province and the relationship among impact of event, self-regulated fatigue and self-control.

Subject and Methods: The 400 questionnaires had been collected through an online survey platform from 30th January to 2nd February in 2020 and included 4 parts: (1) sociodemographic data; (2) The revised version of the Impact of Event Scale (IES-R); (3) Self-Regulatory Fatigue Scale (SRF-S); (4) Self control scale (SCS).

Results: (1) There were significant differences between different levels of sociodemographic variables on IES-R, SRF-S and SCS; (2) 75 (18.75%) residents reported a moderate-severe psychological impact; (3) There were significant differences between the previous researches and current study; (4) the high-score group of SCS had got significantly higher scores on SRF-S and IES-R. (5) Self-regulated fatigue partially mediated the relationship between impact of event and self-control.

Conclusion: We found that the residents suffered a psychological impact during the outbreak of COVID-19. The more self-control they were, the more self-regulated fatigue and psychological impact they suffered, and self-control could not only have a direct influence on psychological impact but also had affected it indirectly through self-regulated fatigue.

Introduction

COVID-19 had become a globally epidemic disease over the past few months (Wang 2020). Zhong Nanshan, a national specialist who had fought against SARS in 2004, made it clear that there might be human-to-human transmission in Jan 2020. Then the Chinese government had enforced a blockade of Wuhan city in Hubei province immediately. WHO determined the epidemic disease as Public Health Events of international concern on 30 Jan 2020 (Wilder-Smith et al. 2020). The cumulative confirmed cases were increasing fast, and the growth went on. The cumulative confirmed cases went over 10 thousand on 31 Jan 2020, and the increase went on. All was listed in table 1 and Figure 1 (NHC of the People's Republic of China 2020a,b,c,d).

Table 1 The epidemic situation of COVID-19 in China during the investigation (China, Jan 30 to Feb 2, 2020)

Date	New confirmed cases	New severe illness	New deaths	New discharge	New Suspect
30 Jan	1982	157	43	47	4812
31 Jan	2102	268	46	72	5019
1 Feb	2590	315	45	85	4562
2 Feb	2829	186	57	147	5173
Mean	2376	232	48	88	4892
Total	9503	926	191	351	19566

Some researches had shown that people who were exposed to an environment of being prone to be infected felt disturbed (Alecu 2020). Thousands of information poured in from everywhere such as the actual mortality rate, the quantity of confirmed cases and suspected cases, which had led to widespread uncertainty, insecurity with direct implications for the Chinese residents' daily life and mental health outside the Hubei province (Ornell et al. 2020). Chinese residents outside the Hubei province also felt so widespread fear of being infected. A recent research had examined 1,210 Chinese residents from 194 cities in January and February 2020 by using the Chinese version of Impact of Event Scale-Revised and had found that 24.5% of all respondents reported minimal psychological impact; 21.7% rated mild impact; and 53.8% reported a moderate or severe impact (Wang et al. 2020).

Chinese people were advised to cut down on going out to crowded places and wear a mask when they have a fever or cough (State Council Information Office of the People's Republic of China 2020). Thus people start to stay at home as long as they can until the epidemic disease came to an end, which we called home quarantine.

It is perceived the self as a goal-directed organism always making various self-regulatory adjustments in thought and action to match the reference value and goal (Earl 2008), such as maintaining a healthy sleep, diet and lifestyle under home quarantine. The residents had needed to avoid excessive exposure to COVID-19 news, maintain a healthy sleep, diet and lifestyle in order to maintain mental health (Shah et al. 2020). That means people should control themselves effectively to escape the attack of emotional and behavioral disorder. Previous researches have revealed that self-control is not only a kind of ability or trait, but also a kind of resource or state (Baumeister et al. 1998; Baumeister 2002). Baumeister et al. (1998) proposed a theory called the strength model, which assumed that self-control was a kind of finite resources for regulating one's thoughts, emotions and behaviors. And previous researches have revealed that people of high trait self-control can produce more ego-depletion than low trait self-control (Liu and Zhang 2016). Once the resources was depleted, it was difficult for people to employ all the resources in the subsequent work and the performance became poorer (Vohs and Faber 2007). And one would be more

self-regulated fatigue over time when one kept performance at a consistently high level (Lindner et al. 2017). And Loss of control could be one important variables that could account for the distress level were fear during SARS(Wong et al. 2005).

To sum up, we inferred people who exposed themselves in the COVID-19 might more or less suffer from psychological impact, and people of higher level of self-control will produce more self-regulated fatigue and more psychological impact. And self-regulatory fatigue might mediate the relationship between impact of event and self-control.

Methods

Participants and data collection

The questionnaires had been collected from 30th January to and 2nd February in 2020 when the epidemic situation was severe. We adopted cross-sectional research design and random sampling method, and used an anonymous questionnaire on an online survey platform called "Survey Star"(<https://www.wjx.cn>).It had collected 472 questionnaires from 18 provinces until 2nd February . All participants provided gave their informed consent for inclusion before they participated in the study. The study was conducted in accordance with the Declaration of Helsinki. Then we eliminated the questionnaires from Hubei or whose completion time is less than 300 seconds and obtained 400 valid questionnaires with an effective rate of 84.746% eventually. The age of participants ranged from 16 to 65 with an average age of 33.046(SD=12.479).

Table 2 The basic information of the online-survey participants

(China, Jan 30 to Feb 2, 2020)

	Number of people	Ratio (%)		Number of people	Ratio (%)
Gender			Distance from Wuhan		
Male	134	33.50%	Adjacent to Hubei province	236	59.00%
Female	245	61.25%	Not adjacent to Hubei province	164	41.00%
Missing	21	5.25%	Level of economic development		
Age			Economically developed areas	95	23.75%
16~25	130	32.50%	Developing areas	305	76.25%
25~35	85	21.25%	Accumulative number of confirmed cases in different province during the survey		
35~50	99	24.75%	<100	69	17.25%
>50	51	12.75%	100~200	53	13.25%
Missing	35	8.75%	200~300	183	45.75%
Educational attainment			300~400	71	17.75%
Master's and Doctoral degree	44	11.00%	>400	24	6.00%
Bachelor's degree	249	62.25%	Size of the city		
Secondary school, primary school and none	81	20.25%	Big-sized cities	70	17.50%
Missing	26	6.5%	Small and medium-sized cities	184	46.00%
			Towns	37	9.25%
			Rural	83	20.75%

Questionnaire design

This survey was composed of four parts including personal Information and three structured questionnaires: (1) sociodemographic data; (2) the psychological impact of the COVID-19 outbreak; (3) self-regulated fatigue; (4) self control.

The Impact of Event Scale (IES) was developed by Horowitz et al.(1979) and was revised to IES-R by Weiss and Marmarit(1997). IES-R was used to measure the psychological influence of COVID-19. It is a self-

report questionnaire to examine one's feeling after catastrophic life event, which included 22 items and three subscales called avoidance, intrusion, and hyperarousa(Zhang 2014).It had been well-validated in the Chinese population and used a 5-point rating scale on a range of 1–5(Zhang 2014), Whose total score was divided into >37(severe impact), 33–36 (moderate impact), 24–32 (mild impact), 0–23 (normal), and (Creamer et al. 2003).

Self-regulated fatigue was measured through Self-Regulatory Fatigue Scale(SRF-S) in the study, which was developed first in 2013 and consisted of 18 items measuring self-regulatory capacity with cognitive, emotional, and behavioral components. The internal consistency and reliability was acceptable (Cronbach's $\alpha=0.81$)(Nes and Ehlers 2013). And it had been revised Chinese version in 2015,which includes 17 items and the same subscales as the 2013 version. The result of CFA showed that the fit index of the Chinese version of SRF-S was acceptable ($\chi^2/df=5.08$ RMSEA=0.09 NFI=0.90 NNFI=0.90 CFI=0.92 IFI=0.92 GFI=0.90). And the internal consistency of the total score was 0.84 with the test-retest reliability coefficient equal to 0.73,and the internal consistency of the three subscales ranged from 0.64 to 0.69 with the test-retest reliability coefficient ranging from 0.62 to 0.67,Which indicated the reliability and validity of the scale are accepted(Wang et al. 2013).

Self-control was measured through Self control scale(SCS) which had a full version with 36 items and a simplified version with 13 items(Tangney et al. 2004). And Tan Shuhua et.al had revised it into Chinese version in 2008, which includes 19 items and five subscales called impulse-control, healthy-habits, resisting-temptation, focusing-on-work, refraining-from-entertainment. The result of CFA showed that the revised version had good construct validities ($\chi^2/df = 1.533$ RMSEA =0.050 GFI =0.91 IFI =0.93 NNFI =0.91 CFI =0.93) and good criterion-related validities ranging from 0.146 to 0.317($p<0.05$). The internal consistency of the total score was 0.862 and the test-retest reliability coefficient was 0.850. Besides the Cronbach's α of the five subscales ranged from 0.606 to 0.761(Tan and Guo 2008).

Statistical analysis

The scores of three structured questionnaires were expressed as mean and standard deviation. One-Way ANOVA and Independent-Sample T Test were used to estimate the differences in sociodemographic characteristics on IES-R,SRF-S, SCS, and Independent-Sample T Test were used to compare current study and previous research, high-score group and low-score group of IES-R on SRF-S and SCS. All tests were two-tailed, with a significance level of $p < 0.05$. It was performed by SPSS Statistic 20.0 (IBM SPSS Statistics, The English Version).

Results

The differences in sociodemographic variables on IES-R,SRF-S, SCS

Firstly, there was no difference between male and female on SRF-S($t=-0.53,p=0.59$) and SCS($t=-1.71,p=0.09$) except the total score of IES-R($t=2.09,p=0.04$).

Secondly, we divided the participants into four groups by age ,and listed 16~25 as team 1(N=130), 25~35 as team 2(N=85), 35~50 as team 3(N=99), >50 as team 4(N=51). The result of One-Way ANOVA showed that there were significant differences on the total score of SCS($F=12.86$, $p=0.00$) and SRF-S($F=5.86$, $p=0.00$), while there were no difference on IES-R($F=1.92$, $p=0.13$). Meanwhile, we found the participants in the team 4(>50) was significantly lower than the other teams on the total scores and all the subscales of SCS and SRF-S except the focusing-on-work subscale.

Thirdly, we divided the participants into three groups by educational attainment, and listed Master's and Doctoral degree as team 1(N=44), Bachelor's degree as team 2(N=249), secondary school, primary school and none as team 3(N=81). The result of One-Way ANOVA showed that there were no significant difference on SCS($F=0.1$, $p=0.91$) and SRF-S($F=2.19$, $p=0.11$), and significant differences on the total scores of IES-R.

Fourthly, there were many differences between different regions on IES-R,SRF-S and SCS: There were significant differences between the provinces adjacent to Hubei province (N=236) and the other ones(N=164) in China on IES-R($t=-2.76$, $p=0.01$), SRF-S($t=-2.04$, $p=0.04$) and SCS($t=3.40$, $p=0.00$). We divided the participants into two groups by GDP in different provinces ,and listed the top-8 provinces in 2019 , Shanghai and Beijing as economically developed areas(N=95) with the rest ones as developing areas(N=305).And then we found that people in economically developed areas got significantly higher scores on the total score of SCS($t=2.34$, $p=0.02$) and IES-R($t=3.54$, $p=0.00$), while there was no significant difference on SRF-S($t=1.08$, $p=0.28$). We divided the participants into five groups by the accumulative number of confirmed cases in different province during the survey, and listed <100 as team 1(N=69), 100~200 as team 2(N=53), 200~300 as team 3(N=183), 300~400 as team 4(N=71), >400 as team 5(N=24). The result of One-Way ANOVA showed that there were significant differences on the total score of SCS($F=3.09$, $p=0.02$), SRF-S($F=2.57$, $p=0.02$) and IES-R($F=9.00$, $p=0.00$). We divided the participants into four groups by the size of the city ,and listed the big-sized cities as team 1(N=70) such as provincial capital cities, small and medium-sized cities as team 2(N=184), towns as team 3(N=37), rural areas as team 4(N=83). The result of One-Way ANOVA showed that there were significant differences on the total score of SCS($F=3.74$, $p=0.01$), SRF-S($F=3.89$, $p=0.01$).

Detection rate of IES-R

Of all 400 participants, 268(67%)reported no psychological impact from the epidemic disease (score<23); 57 (14.25%) of all the participants reported mild psychological impact (score:24-32); 15 (3.75%) reported moderate psychological impact (score:33–36); and 60 (15%) reported a severe psychological impact (score > 37).

The comparison of current study and previous research on SRF-S and SCS

We put the means, SDs and the number of participants(N) in the mathematical formula of two independent sample T-test first, and then we found that the IES-R scores of current study was significantly lower than the previous research which included residents in Hubei province ($t=14.99$, $p<0.01$). The total

score and subscale scores of SRF-S are significantly higher than the previous study($t=3.43 \sim 12.83, p < 0.05$). The total score of SCS and the scores of focusing-on-work, Healthy-habits, refraining-from-entertainment, Resisting-temptation were significantly lower than the last one($t=3.64 \sim 12.68, p < 0.01$), while the scores of impulse-control were significantly higher than the previous research($t=3.07, p < 0.01$). All were listed in Table 3.

Table 3 The result of independent sample T-test between current study and previous research (China, Jan 30 to Feb 2, 2020)

Variables		Previous study			Current study			<i>t</i>
		Mean	SD	N	Mean	SD	N	
IES-R	Total score	32.98	15.64	1210	19.88	13.56	400	14.99**
Wang et al. 2020								
SRF-S	cognitive components	14.40	3.70	553	17.28	3.01	400	-12.83**
Wang et al. (2015)	emotional components	10.80	3.20	553	12.86	3.39	400	-9.55**
	behavioral components	11.30	3.60	553	12.10	3.49	400	-3.43**
	Total score of SRF-S	36.50	8.90	553	42.24	7.98	400	-10.26**
SCS	impulse control	3.42	1.04	202	3.64	0.67	400	-3.07**
Zhang et al. (2019)	focusing on work	4.28	1.25	202	3.27	0.70	400	12.68**
	healthy habits	4.12	0.88	202	3.35	0.84	400	10.46**
	refraining from entertainment	3.94	0.97	202	3.69	0.75	400	3.46**
	resisting temptation	3.52	1.23	202	3.21	0.68	400	3.97**
	Mean of SCS	3.80	0.77	202	3.45	0.54	400	6.43**

* : $p < 0.05$, **: $p < 0.01$,The revised version of the Impact of Event Scale(IES-R), Self-Regulatory Fatigue Scale(SRF-S),Self control scale (SCS).

The comparison of high-score group and low-score group of IES-R on SRF-S and SCS

We first sorted the total score of SCS in descending order, and then defined the top 202 participants as high-score group and the rest ones as low-score group. The result of independent sample T-test revealed that the high-score group had got significantly higher scores on the total score of SRF-S, emotional

components, behavioral components, the total score of IES-R than low-score group. All were listed in Table 4.

Table 4 The results of independent sample T-test between high-score group and low-score group (China, Jan 30 to Feb 2, 2020)

Variables	High-score group of SCS N=202		Low-score group of SCS N=198		t
	Mean	SD	Mean	SD	
cognitive components	18.24	2.76	16.31	2.99	6.725**
emotional components	14.52	3.19	11.14	2.72	11.409**
behavioral components	13.48	3.45	10.65	2.96	8.799**
Total score of SRF-S	46.24	7.05	38.10	6.80	11.742**
Total score of IES-R	45.39	15.23	38.31	10.50	5.421**

** : $p < 0.01$, The revised version of the Impact of Event Scale (IES-R), Self-Regulatory Fatigue Scale (SRF-S), Self control scale (SCS).

The mediating effect of Self-Regulatory Fatigue Scale (SRF-S) between Self Control Scale (SCS) and Impact of Event Scale-Revised (IES-R)

According to the testing procedure of The mediating effect which was formulated by Wen Zhonglin et al. (2004), we should make the total scores of SRF-S mediator, M IES-R dependent variable, Y SCS independent variable, X centralized first, and test the following three linear regression model equations in turn. The result were listed in table 5.

$$1: M = aX + e_2 \quad 2: Y = cX + e_1 \quad 3: Y = c'X + bM + e_3. \quad (1)$$

Table 5 The result of linear regression model

Model		Unstandardized coefficients		Standardized coefficients	t	Sig.	R Square	Adjusted R Square
		B	Std.Error	Beta				
Model1	(constant)	32.999	2.801		11.781	0.000	0.461	0.460
	SCS	0.531	0.029	0.679	18.46	0.000		
	Y \rightarrow SRF-S							
Model2	(constant)	41.217	6.076		6.783	0.000	0.111	0.109
	SCS	0.439	0.062	0.333	7.041	0.000		
	Y \rightarrow IES-R							
Model3	(constant)	25.889	6.902		3.751	0.000	0.152	0.147
	SCS	0.193	0.083	0.146	2.318	0.021		
	SRF-S	0.464	0.106	0.275	4.368	0.000		
	Y \rightarrow IES-R							

From Table 5, we could know the value of a, b, c and c' (c=0.333 \times p=0.000 \times a=0.679 \times p=0.000 \times c'=0.146 \times p=0.021 \times b=0.275 \times p=0.000), and determined there were significantly direct effect (a=0.679 \times p=0.000) and indirect effect (c=0.146 \times p=0.000). The value of c' meant that self-regulatory fatigue partially mediated the relationship between impact of event and self-control. The mediating effect divided by the total effect was $ab/c=(0.679 \times 0.275)/0.333=0.561$, The mediating effect explaining the variance of dependent variable was $\sqrt{0.147-0.109}=19.494\%$. The relationship between SCS, SRF-S and IES-R were presented intuitively on Figure 2.

Discussion

This study was firstly conducted to evaluate the psychological impact of COVID-19 on Chinese residents who lived outside the Hubei province from 30 January to 2 February 2020, just several days after the blockade of Wuhan city and when WHO determined it as public health emergency events of international concern. Secondly, another aims was to examine the relationship between self-control, self-regulatory fatigue and psychological influence.

From detection rate of IES-R which was mentioned above, 18.75% of Chinese residents who lived outside the Hubei province had been suffering a moderate or severe psychological impact from COVID-19 Epidemic, which was quite different with 53.8% of another Chinese research conducted. We had compared the composition of the participants and found that there were differences that we had collected 46% participants under the age of 30 comparing with 81.5% in previous research. Another difference was that

we had removed the questionnaires from Hubei province while they included(Wang et al. 2020). In addition, we also found there was nearly 15% of the residents suffering a severe impact comparing with 24.1% in the study which conducted in a month after a disastrous hydrogen fluoride spillage(Yoo et al. 2017) which seemed to be more terrible than COVID-19. However, IES-R was ever used as a tool of examining PTSD in the previous research(Kerai et al. 2017; Hong et al. 2009) and it had been proved that traumatic symptoms and the rebuilding of mental health would last from several months to several years. A previous research reveal that there was significant difference on IES-R in the patients of PTSD between 2 months, 7 months, 10 months, 20 months, 46 months(Estimate=-2.8, S.E.=0.9,p=0.03) after discharging from medical hospitalization for treatment of SARS. There were also significant differences on IES-R between in the patients of PTSD and no PTSD in 2 months , 7 months, 10 months, 20 months, 46 months(Hong et al.,2009).Thus, the residents of moderate to extremely severe impact still deserved to be better treated specially when there were intrusive symptoms (Feinstein et al. 2018).

The studies should not only have quantitative results, but also took the influence of culture into consideration. The study was conducted on the seventh or eighth day of the new year when the workers would usually go back to work in succession. Thus it made the workers being anxious because they could not go back to work immediately. The residents generally more or less suffered a psychological impact during 7-10 days of isolating themselves at home. T We had had one-on-one interviews with 5 residents about their living conditions and feelings through Wechat during the survey. It is known that one of traditional customs in Spring Festival was to meet with the relatives and friends to wish them all Happy New Year. However, nearly all the residents decided to send their wishes on Wechat or by mobile phones this year instead of visit, which made some people have a strong sense of loss. Therefore, all of them reported changes of behaviors, such as eating more, asleep later, waking up later, exercising less or spending more time surfing on internet than usual.

We noticed that the female suffered severer psychological impact and were easier to evade the event than the male, which was consistent with another Chinese research (Wang et al. 2020). In addition, It's to be unexpected that the residents over 50 didn't suffered severer impact which was consistent with another Chinese research conducted by Wang et.al(2020) despite of too much reports on that the old infected with COVID-19 were more likely to die. We guess that the old were influenced less because they were used to stay at home and got less information from internet. The residents of Master's and Doctoral degree suffered severer impact than the others, while Wang Cuiyan didn't find significant difference between them(Wang et al.,2020).In addition, it was interesting that the residents in different regions were differently affected from the disease. The residents from the provinces adjacent to Hubei province or in economically developed areas or in the province of the accumulative number of >400 confirmed cases or living in towns and rural areas suffered severer impact. It was similar to another research that divided the participants along the dimensions of location into high SARS-prevalent and low SARS-prevalent regions and found there were significant differences on between the regions (IES-R, Intrusion, Avoidance, Hyperarousal) (Lee et al. 2006). And only the residents from the provinces adjacent to Hubei province felt more self-regulated fatigued, and the residents in economically developed areas or from big-sized cities showed more self-control.

From what was mentioned above, it revealed that people felt more intruded after the blockade of Wuhan city(Wang et al. 2020) and was cognitively, emotionally, and behaviorally more tired than usual (Wang et al.,2015), and they were in a less favorable position of self-control including being more impulsive, less healthy habits, being vulnerable to temptation, less commitment to work, and more entertainment(Zhang et al.,2019). It was known to all that we had got little knowledge about how to treat COVID-19 effectively, thus many things got out of control in the situation, which forced someone to regulate physical and mental resources to keep the balance of a normal life. We had found that the higher level of self-control they were, the more self-regulated fatigue and psychological impact they felt. And self-control could not only had an direct influence on impact of event but also had an indirect influence on it through self-regulatory fatigue. One of high level of self-control would produce more ego depletion and then resulted in more psychological impact. A previous research had confirmed that people of high level of self control group made poorer performance in the ego depletion task(Wei 2013). Combined with the strength model of self -control(Baumeister and Bratslavsky, 1998;Baumeister, 2002), when people were experiencing a public health event and spent their self-control resources to deal with the emotional and behavioral problems, people of higher level of self-control would led to more self-regulated fatigue, which thus would gave rise to more psychological effects. A previous research thought that providing accurate and transparent information about the epidemic would contribute to the public's mental health during the outbreak(Xie et al. 2020).It was known to all that we had got little knowledge about how to treat COVID-19 effectively then, so people felt disturbed seriously and many things got out of control in the situation. Home quarantine forced someone to use physical and mental resources to keep the balance of a normal life.

Fatigue might be a warning of worse mental health conditions to the residents. Some residents with mild impact might adapt to working and studying at home and also might become severe mental impact because of more ego depletion, while the residents with severe mental impact might recover from the terrible feelings and also might develop into worsen condition later. Thus psychological support and self-awareness is extremely necessary.

Conclusions

We found that the residents suffered a psychological impact during the outbreak of COVID-19 .The more self-control they were, the more self-regulated fatigue and psychological impact they suffered, and self-control could not only had an direct influence on psychological impact but also had affected it indirectly through self-regulated fatigue.

Declarations

*Conflict of interest statement:*The authors declare that they have no competing interests.

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Figures

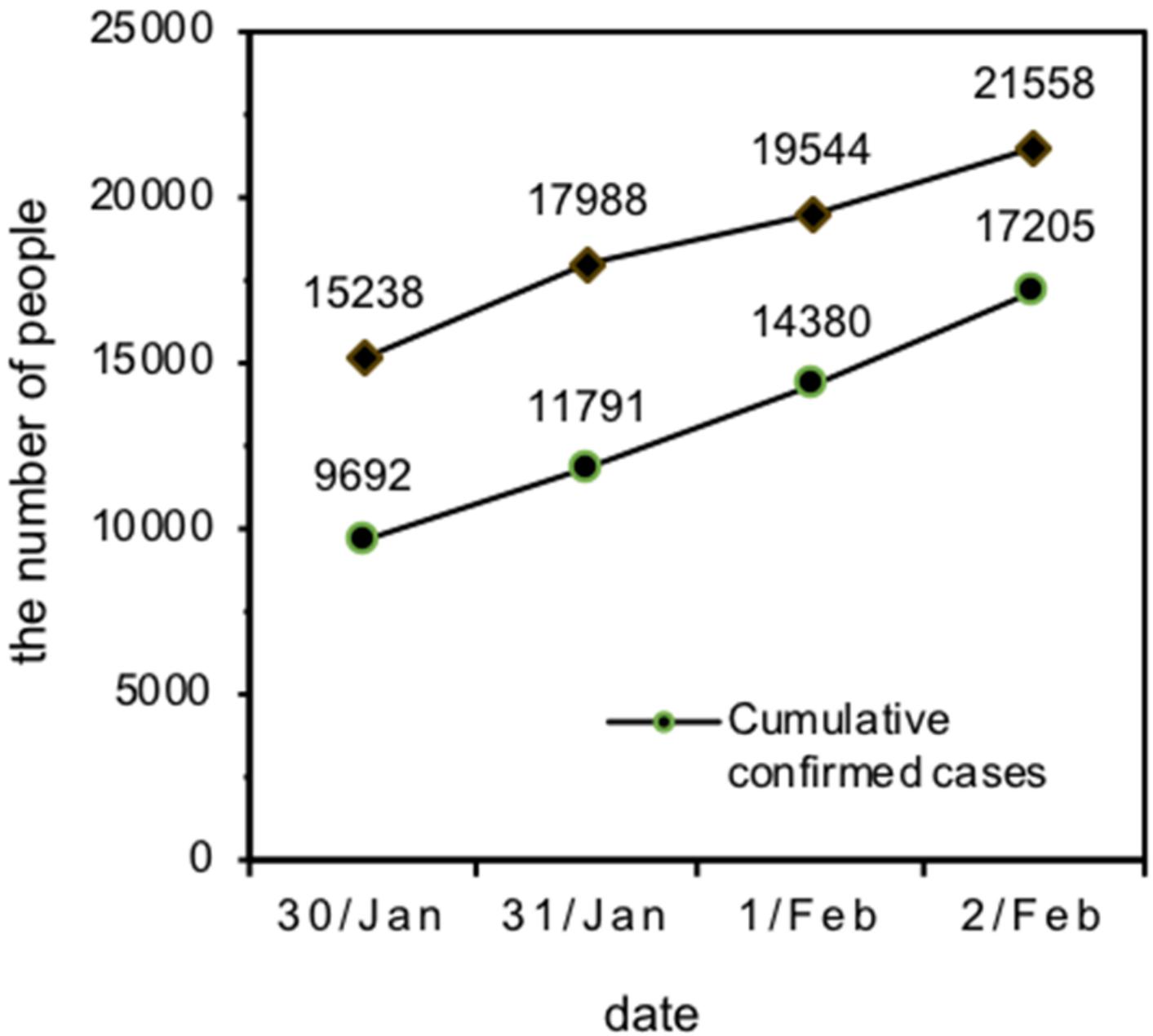
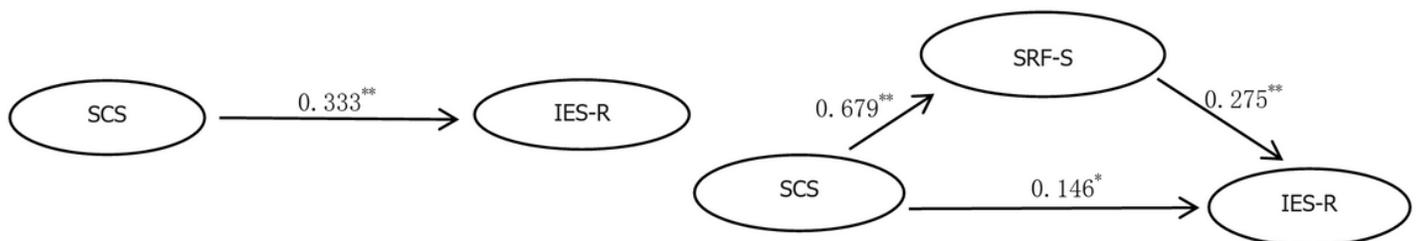


Figure 1

The cumulative confirmed cases and cumulative suspect of COVID-19 in China during the investigation(China, Jan 30 to Feb 2, 2020)



* :p < 0.05, **: p < 0.01

Figure 2

The mediating effect of SRF-S between IES-R and SCS