Psychology Research and Behavior Management

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ORIGINAL RESEARCH

Investigating Binge-Watching Adverse Mental Health Outcomes During Covid-19 Pandemic: Moderating Role of Screen Time for Web Series Using Online Streaming

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Background and Purpose: Watching multiple episodes using streaming services, such as Netflix, Hulu, and Youku, has become widespread in recent years. While much attention has been paid to binge-watching, there is, however, a dearth of research on binge-watching and its adverse psychological effects during the COVID-19 pandemic. To the best of our knowledge, less attention has been paid to understanding the multiple influences of binge-watching on binge-watchers during the COVID-19 pandemic. Most of the past studies on this topic mainly underscored the individual's motivations for binge-watching. Also, past studies were limited and inconclusive as they mostly espoused only the underpinning adverse effects of binge-watching without looking into the association between binge-watching and screen time for web series through online streaming services during the COVID-19 pandemic. Therefore, this study sought to fill this gap by probing the association between binge-watching and psychological aftereffects.

Participants and Methods: The study employed a cross-sectional research design vis-à-vis the survey method. A sample of 1089 adult respondents was collected through an online administrated questionnaire.

Results: The findings of this study demonstrated that extensive binge-watching is an antecedent of stress, loneliness, insomnia, depression and anxiety. Furthermore, it was found that screen time on binge-watching could intensify these adverse effects of binge-watching. Interestingly, the moderating effect of screen time on binge-watching was found to be insignificant for stress and loneliness.

Conclusion: The findings of this study suggest that binge-watching correlates with psychological and mental health symptoms including stress, loneliness, insomnia, depression and anxiety. Hence, this study suggests that consumption of web series through online streaming services related literacy interventions are imperative to help the audience become critical about online streaming content and its comparison to the real social world.

Keywords: binge-watching, COVID-19, depression, anxiety, stress, insomnia, loneliness and online addiction

Introduction

Binge-watching gained popularity with the paradigm shift in the consumption patterns of entertainment media content through streaming channels.[1] This has taken watching films, series, and episodes to a new level as the traditional weekly episodic releases in TV shows are now being watched simultaneously because the

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Received: 12 July 2021
Accepted: 23 September 2021
Published: 8 October 2021

whole season is made available online.[2] Using these online streaming services for consuming several episodes of television shows in rapid succession is known as binge-watching.[3] It has become a new global norm in the consumption of television shows[1,4] and individuals have adopted it as their leisure activity.[2,5]

Since binge-watching has rapidly become the new standardized approach of viewing TV shows, especially among young adults,[6] it is assumed that excessive engagement in binge-watching leads to problematic patterns of watching TV series and deleterious effects.[7,8] Consequently, binge-watching is amongst the significant inventions in the contemporary world that creates adverse aftereffects.[3,9] Several studies identified that insomnia and exhaustion are among the initial evidence of impairments associated with repetitive binge-watching.[10] Other studies posited that a sedentary and unhealthy lifestyle,[8] negligence of other tasks, and social relationship reduction[5] are the aftereffects of binge-watching. While the persuasive nature of TV series can pose a real challenge to viewers' self-control abilities, it does not run down the addictive impact of binge-watching as there is a common consensus in the literature that binge-watching has addictive qualities.[2,11]

In addition, significant psychological disorders that may have resulted in binge-watching have been reported among people during the isolation days of covid-19.[7,12] People experienced visible symptoms of stress, trauma, frustration, depression, tension, hypersensitivity, attention deficit, and mood swings during this virus outbreak.[13,14] An extensive literature exists to support the notion that binge-watching is a growing problematic phenomenon.[3,15] The emphasis of binge-watching research has been mainly on underlying motivations,[11,16] content,[17,18] or the health concerns[19] and involvement.[20] Furthermore, the streaming channels were seen as promoting binge-watching as they kept dropping new web series during covid-19, which compelled individuals to sit and binge-watch intensively.[4] Therefore, this isolation phase provided people with a perfect opportunity to engage in streaming channels like Netflix, Hulu, Amazon Prime.[21]

To this end, researchers believe that streaming channels excessively used digital gadgets in drawing people away from real-life experiences.[3] It is not an unfounded argument that an avalanche of digital entertainment now surrounds people on screens, and therefore, screen time for web series through online streaming services has become a vital fragment of modern lifestyle.[5] However, recent research has identified apprehensions about the excessive digital screen time on the public's wellbeing. For instance, studies affirmed that screen time is related to obesity,[22] harmful effects on irritability[23] and mental well-being.[24] Although there is a rapid upsurge in binge-watching from streaming services like Hulu, Amazon Prime, Disney Plus, and Netflix, and watching online television during the COVID-19 pandemic, no prior quantitative study has been carried out to probe into the negative influences of post-binge-watching. On the other hand, a systematic review of existing literature found no conclusive evidence for a negative outcome of screen time for web series through online streaming services on the psychological well-being of individuals.[25] However, limited academic research that addresses the effects of binge-watching on the mental health of individuals who become "hooked" to series/shows during the COVID-19 pandemic exists.[9]

Furthermore, there is evidence that during the COVID-19 isolation, screen time and digital engagements such as binge-watching have been drastically surged.[7,10] Therefore, understanding the influence of excessive digital screen time for web series on the psychological well-being of individuals has become pertinent at this time, owing to its potential associations with psychological problems. Similarly, as a comparatively new phenomenon, binge-watching has yet to be comprehensively investigated.[1,9] Thus, it is proper to probe into the impact binge-watching and screen time for web series through online streaming services has on individuals. Therefore, the purpose of this study is to determine the association between psychological well-being issues (eg, depression, anxiety, loneliness, and insomnia) and binge-watching. In answering this question, this study will fill the research lacuna that exists by exploring binge-watching multiple psychological and mental health effects on individuals during covid-19. Given the above prognosis, COVID-19 endures growth in digital natives; therefore, the study also taps the moderating implications of the excessive use of binge-watching (screen time) in ascending psychological issues.

Literature Review and Hypothesis Development

Binge-Watching and Depression and Anxiety

Depression and anxiety conditions are among the significant common disorders in people. People with symptoms of depression frequently have attributes of anxiety

conditions.[7] While people with anxiety disarrays usually reported depression.[26] Scholars delineated that both conditions may ensue simultaneously. Depression and anxiety are related to substantively augmented poor psychological well-being outcomes. The World Health Organization also categorized depression as the prominent global poor psychological well-being issue.[27] Recent studies noted that regardless of the social media usage benefits, its excessive usage stands as one of the common reasons for the substantive increase in depression and anxiety.[28,29] There is abundant literature affirming the association of both depression and anxiety with social media use. For example, studies noted that digital engagements have replaced face-to-face social relations and can adversely influence psychological well-being.[30] Thus, studies have identified that depression and anxiety are common in individuals who excessively consume social media.[10,29]

It is, therefore, no gainsaying that the release of web series at once has promoted the binge-watching that boosts excessive exposure. Correspondingly, excessive disclosure to well-curated, impractical depictions on digital platforms (eg, web series) may give individuals the imprint that others are more contented, making them feel depressed due to social isolation contrast.[31] Steins-Loeber et al[15] described binge-watching depression as a "widely acknowledged non-clinical term for feeling down after finishing a series or a film and is surprisingly common. Furthermore, various studies have suggested depressive symptoms parallel with the post-binge-watching phenomenon.[3,15,32,33] For instance, Kottasz et al[33] measured the "post-series depression" phenomenon and described it as a feeling of longing and melancholy after consuming all the series. Evidence from literature[15] plausibly indicates that binge-watching can intensify depression and anxiety among people. Hence, this study aims to develop an understanding of whether excessive involvement with binge-watching results in possible depressive symptoms and therefore, we hypothesize that;

H1. Binge-watching influences the feeling of depression and anxiety in an individual.

Binge-Watching and Stress

Psychological stress is any modification that causes affective, mental, or psychosomatic stress.[34,35] Research has categorized indications of stress in three major categories: (1) psychological, (2) emotional, and (3) behavioral.[34] Few usual indications of stress involve; (1) mood switching, (2) experiencing restlessness, (3) disruption in asleep, (4) being angry, (5) poor self-care, and (6) difficulty concentrating.[36,37] In verily, the people react to the stressors (stimuli) once they feel stress to managing the stress.[34,35] To do so, they tend to avoid such situations and adopt the diversion strategy.[8] The cognitive-behavioral theory also noted that stress is a plausible and substantial catalyst of problematical digital technologies and media usage.[28] Earlier investigations have shown that usage of digital technologies can cause stress and have negative consequences such as mood switching,[10] experiencing restlessness,[36] perceived stress,[12] or disruption in sleep.[37] Few cohort research has also provided evidence that binge-watching could be associated with stress.[8] This research argues that using digital technologies such as watching multiple episodes for a more extended period (binge-watching) can increase the level of stress, and therefore, in line with previous findings, we hypothesized that:

H2. Binge-watching influences the feeling of stress in an individual.

Binge-Watching and Loneliness

Loneliness is an antithesis of societal well-being and refers to the sense of missing a close associate (eg, emotional loneliness) or the absence of an inclusive societal linkage (eg, social loneliness).[38] Therefore, loneliness is recognized as a unique factor in assessing societal well-being as it echoes an individual's communal exchanges or detachment.[39] Another case that elucidates loneliness is a condition that happens to owe to the non-existence of quality relations in the following circumstances; (1) when the extent of current relations is slighter compared to desired relations and (2) when there is a deficiency in the desired intimacy.[38] Therefore, arguably, loneliness can be a manifestation of the undesirable feeling of deficiency in relationships and happens in people of all age groups.[40]

A plethora of research has suggested that loneliness results in excessive entertainment gadgets, including TV or the internet.[41] To this end, people engage obsessively in digital activities such as social media usage to gratify their inner self.[39] To buttress this point, Pittman and Reich[40] have revealed that loneliness is a predictor of digital engagements such as internet addictions among people. Conversely, extant research has also reported that excessive TV and social media usage can infuse the feeling of loneliness.[42] Thus, exposure to TV shows in which

characters are involved in intimacies and social relationships can arouse discrepancies among people's present relations and their anticipated relations.

Despite the fact that digital media and TV shows offer excellent social comparison prospects,[42,43] it is imperative to note that literature on social comparison theory explains that individuals compare themselves to media characters (eg, characters in web series).[44] This upward comparison phenomenon is quite evident when people watch characters in TV shows depicting healthier social relationships compared to the present relationships of the viewers. Thus, feelings of desired relationships may trigger a sense of loneliness among those individuals who may believe that others are better than they are. Studies have identified the association between the growing addictive use of digital technologies and increases in the level of loneliness.[42,45] Therefore, presumably, people may experience feelings that include a sense of loss, longing for more, melancholy, and feelings of emptiness and frustration after watching multiple series. Based on this empirical evidence, we hypothesize that;

H3. Binge-watching influences the sense of social and emotional loneliness.

Binge-Watching and Insomnia

Insomnia is defined as a sleep disorder that can disturb sleep patterns and can result in deprived sleep periods, daytime fatigue, sleep irregularity, and difficulties falling asleep.[46] Therefore, insomnia is a foremost well-being concern related to the excessive psychosomatic problem.[46,47] Apart from other reasons, recent extant literature has associated deprived sleeping patterns with digital technology usages such as social media usage or internet screen time.[48,49] Also, the literature suggests that augmented digital technology usage is linked with deprived sleep period,[50] late-night sleep times and rise times,[51] lengthier sleep expectancies,[49] losing sleep,[52] and amplified daytime fatigue.[48]

Other studies that highlighted the impact of binge-watching include those that stated that it causes lack of sleep,[8] daytime exhaustion,[9] and losing sleep because of continuous watching web series in a single sitting.[11] Drawing on this analogy, it could be deduced that insomnia and deprived sleeping patterns are associated with binge-watching. Therefore, although investigation on causes of insomnia during the COVID-19 pandemic is minimal, consistent with earlier studies, we anticipated that binge-watching would influence low-quality sleep and insomnia, and we hypothesized that:

H4. Binge-watching influences insomnia in an individual.

Moderation of Screen Time

It is assumed that excessive binge-watching may result in possible adverse outcomes that could lead an individual towards loss of control over watching.[32] The Person-Affect-Cognition-Execution (hereafter I-PACE) model elucidated the process of internet-usage disorders (eg, loneliness, etc.). The model suggested that initially, people start engaging in internet-based activities such as watching web-series mainly for gratification.[53] For example, during COVID-19 lockdown, people felt bored and indulged more frequently in using the internet, including watching web series for diversion.[7] This sense of gratification drives digital engagement, which in turn alters the affective and cognitive reactions to digital-addiction-related impetuses.[26,54] Once the digital-addiction course (eg, binge-watching) advances, the extent of practised gratification diminishes. Simultaneously, the extent of the "compensating effect" grows in the process of the digital-addiction. Therefore, it is arguable that excessive digital screen time (eg, binge-watching) leads to diminishing control over the use of particular digital activity.[26]

The I-PACE model suggests that such diminishing control can escalate adverse outcomes such as stress, depression, and loneliness.[55] Building upon the I-PACE model, this study argues that excessive screen time for web series through online streaming services can negatively impact.-[54,55] For example, the I-PACE model posits that negative moods, a sense of losing social relationships, anxiety, and many other psychological concerns may be further aggravated by constant digital engagements.[54] Many studies also support the negative influence of excessive online screen time, such as binge-watching[1,8] and internet use[30,42] on psychological detriments. Therefore, it is imperative to know if more time spent on binge-watching causes depressive symptoms. Here, we hypothesize that;

H5 (a): Screen time on binge-watching moderates the relationship between (a) feeling of depression and anxiety, (b) stress, (c) loneliness, and (d) insomnia in an individual and binge-watching.

Methods and Materials

Research Design

This study employed a cross-sectional research design vis-à-vis an online survey for the data collection from the

target population. The purpose of this research is to predict the theory-driven psychological adverse effects of the post-binge-watching phenomenon and addiction-related stimulus that triggered adults to binge-watch during the COVID-19 pandemic. Given that binge-watching through live and online streaming platforms (eg, Hulu, Amazon Prime, Disney Plus, and Netflix) increased during COVID-19 lockdown globally, this research considered online media users for the data collection. Given the above prognosis, the questionnaire used in this study was administered online.

Procedure, Recruitment Criteria, and Sample Size

Based on the nature of this study, the criteria for inclusion of the participants were (1) ages 18 and above and (2) watched episodic TV series regularly or more intensively, such as several episodes in a go for more than two or three hours during the covid-19 lockdown and movement restrictions in one sitting on streaming services. Two "filter" questions regarding the criteria mentioned above were used for the appropriate selection of the target population. The questionnaire was disseminated through posting Google form link to questionnaire on multiple social networking platforms (eg, Facebook, LinkedIn, Twitter, official pages, etc.), mobile SMS invitations, and comments sections of e-commerce sites. Data of 1089 adults (male = 651, 59.78%) was collected from 1st January 2021 to 30th April 2021. To ensure validation of the sample representation, we executed an analysis on the G-Power software, which demonstrated that a sample size of greater than 1000 would be adequate, with effect size f = 0.43 and power 0.90 (p = 0.001), provided that the proposed model includes six variables (one independent variable, four dependent variables, and one moderating variable; screen time).

Measures

Past studies reported that depression and anxiety are the usual adverse feelings among individuals concerning media technology usage.[56] To precisely measure the indicators of depression and anxiety, this study adopted the Kroenke et al PHQ-4 scale (The Patient Health Questionnaire-4).[57] The PHQ-4 contains four items 4 points Likert scale "(1= Not at all, 2= several days, 3= More than half the days and 4= nearly every day)" that combines two items of PHQ-2 to assess depression and two items of GAD-2 to measure anxiety. The PHQ-4 has been widely used as a symptomatic measure of depression and anxiety.[56] The value of 3 or above on the PHQ-4 indicates the potential of depression and anxiety in an individual. Stress was measured using the sub-scale of "DASS-21" adopted from Oei et al.[58] Seven items were measured on a 4-point Likert scale (1= did not apply to me at all, 2= Applied to me to some degree or some of the time, 3= Applied to me to a considerable degree or a good part of the time, and 4= Applied to me very much or most of the time).

Loneliness was measured using six items on a 4-point Likert scale "(1= not at all, 2= sometimes, 3= good part of the time and 4= Yes most of the time)" adopted from Gierveld and Tilburg.[38] Insomnia was measured using the scale adopted from Crönlein et al.[47] Four items were measured on a 4-point Likert scale "(1= Always, 2= Mostly, 3= Sometimes 4= and Seldom)". In this study, binge-watching was operationalized as an addictive viewing of four (4) or more episodes of a series in quick succession (an average length of an episode is 30 min, filter question used was 2 hours). This is in consonance with literature that has indicated that binge-watching can be operationalized as an addictive habit if one feels discomfort or displeasure due to unavailability of the regular viewed or a favorite series due to some reasons (eg, new episode not released). Thus, heavy binge viewers can desire more and more, as long as they undergo watching more series. Binge-watching was measured using the three items scale adapted from Merikivi et al.[59] The respondents read the statement as follows; "my overall experience about using the streaming service for watching TV shows is" and requested to respond three on 5-point semantical scale (1=Very displeased– 5= Very pleased, 1= Very frustrated– 5= Very contented and 1= Absolutely terrible – 5= Very delighted). (5). Furthermore, we measured the screen time using the following statement; How many hours did you spend weekly watching online streaming TV series. The respondents were requested to record their responses on a categorical scale (1= Less than or approximately 2 hours, 2= 3–6 hours, and 3= More than 7 hours). Lastly, demographic attributes such as gender, age, income, and education were also collected and were treated as control variables for the identification of any possible confounding effects.

Statistical Methods

The study performed the descriptive statistical examination before the Partial Least Squares structural equation

modeling (hereafter PLS-SEM) was adopted for the validity and hypotheses testing. The SPSS software was used for the preliminary analysis, including (a) missing values, (b) normality, (c) correlations, (d) sample adequacy test, and (e) Herman's test for common method biases. The data was collected using an online form. Therefore, no missing entry was found. After analyzing the descriptive statistical examination, the PLS.3.3 software was used for the primary analysis, including reliability, validity, model fitness assessments and hypotheses testing. Details of each procedure are discussed in the result section.

Results

Demographic analysis revealed that respondents were aged between 18 and 69 years (see Table 1). Regarding gender, 592 were male (54.36%), and 497 were female (45.64%). In terms of educational level, 83 had matriculation certificates (7.6%), 123 had intermediate degrees (11.3%), 386 had undergraduate degrees (35.4%), and 493 had higher than undergraduate level education (45.7%). For marital status, 653 were single (59.9%), 416 were married (38.3%), and 20 were divorced (1.8%).

Table 1 Sample Descriptive Characteristics

Gender	Frequency	%
Male	592	54.4
Female	497	45.6
Marital Status		
Single	653	59.9
Married	416	38.3
Divorced	20	1.8
Screen Time		
= 2 hours	224	20.6
3–6 hours	469	43.1
≥7 hours	396	36.3
Education		
Matriculation Certificates	83	7.6
Intermediate	123	11.3
Undergraduate	386	35.4
Post graduate and above	493	45.7
Age		
18–25	646	59.3
26–35	289	26.6
36–50	96	8.8
51–69	58	5.3
≥70	0	0

After the demographic analysis, outliers' assessment, including univariate, bivariate, and multivariate analysis, was undertaken. The analysis revealed 95 outliers cases and was deleted from the total sample of 1089. Hence, the remaining data set was used for the proceeding. The removal of the 95 cases was slighter than the recommended threshold of 15% permissible removal. Second, the correlations analysis after computation of the variables; BW, DA, ST, LN, and IS was performed, demonstrating the significant relationships between them (see Table 2). Third, the exploratory factor analysis using the principal component factor was carried out on segregated data of 400 cases to see sample adequacy. The results based on the KMO values and Barlett test significance demonstrated perfect sample adequacy in the sample. Lastly, the preliminary analysis involved Herman's test. To do so, we loaded all constructs' items on a single factor, and the results demonstrated a variance of 29%. These results ensured that there is no issue of common method biases, and we proceeded for PLS-SEM analysis.

Partial Least Squares Structural Equation Modeling (PLS-SEM)

The PLS-SEM used the variance-based modeling approach and a recognized technique in behavioral research. In addition, the study employed the Smart PLS.3 software owing to its competency in predicting factors involved in inference on the endogenous variables using manifold processes to seek (a) revelation of measurement inaccuracies, (b) appropriateness for multifaceted model, and (c) suitability to forecast multiple factors influences simultaneously.[60,61] Moreover, the usefulness of the PLS-SEM method in this study derives from the fact that it includes a variance-based procedure that is more appropriate than regression when the proposed model contains a multifaceted structure.

In compliance with PLS-SEM guidelines,[61] we implemented the six recommended steps in executing the PLS-SEM; (1) estimates of the measurement model fitness, (2) removal of the items (within the permissible limits of 15–20% if required for achieving model fitness), (3) estimations of reliability (4) multi-collinearity detection, (5) Validity assessments and (6) employing the bootstrapping method for the hypotheses testing. In the first step, assessments of measurement model fitness were performed on

Table 2 Correlation and Descriptive Statistics

Variable	Mean	SD	BW	DA	ST	LN	IS
Binge-watching	3.93	1.03	1				
Depression & Anxiety	2.79	0.87	0.28*	1			
Stress	2.18	0.95	0.39*	0.16*	1		
Loneliness	1.89	0.59	0.26*	0.07*	0.23*	1	
Insomnia	2.54	0.78	0.31*	0.12*	0.17*	0.09*	1

Note: *Statistically significant.
Abbreviations: SD, Standard Deviation; BW, Binge-watching; DA, Depression & Anxiety; ST, Stress; LN, Loneliness; IS, Insomnia.

the PLS.3 software. The model comprised five constructs, BW, DA, ST, LN, IS, and n=994. The results obtained from running PLS.3 software algorithms demonstrated satisfactory model fitness; SRMR =0.061, NFI = 0.97, and RMSEA = 0.036. Nonetheless, 3-items in total were removed to obtain the model fitness. One item each from the constructs of LN, IS, and ST was removed for this purpose.

Reliability Estimations

After the model fitness, we ascertained the validity and reliability estimations and the test result demonstrated that all BW, DA, ST, LN, and IS constructs have reasonable reliability estimates (see Table 3). Furthermore, the PLS reliability estimation provides authentic results utilizing cross-validation through various sets of tests counting (a) Jöreskog's rho (ρc) and (b) Cronbach's alpha (α).

Furthermore, the PLS analysis found no multicollinearity issue amongst the BW, DA, ST, LN, and IS constructs. For this reason, the variance inflation factor (henceforth VIF) was evaluated, and results demonstrated acceptable values of the VIF= ≤10 for all items (see Table 3).

Validity Assessments

Next, the PLS-SEM estimations of the measurement model demonstrated the prescribed or recommended satisfactory convergent validity as the Average Variance Extracted and Composite reliability (see Table 3) for all constructs were within the acceptable and suggested parameters (AVE = ≥0.5 and CR = ≥0.8). Table 4 and Figure 1 include the items loading of all constructs.

Next, the study observed Heterotrait-Monotrait Ratio of Correlations (henceforth HTMT) and Fornell-Larcker criterion-based (henceforth FLC) values to evaluate the discriminant validity. The estimation of HTMT and FLC (see Table 5) were within the acceptable and suggested parameters (HTMT = ≥0.9 and AVE = ≥0.5).

Hypothesis Testing

The study used the PLS-SEM bootstrapping method with 300 iterations for inferential analysis. The results in Table 6 and Figure 2 verified that BW significantly predicts the DA (β=0.326, $p < 0.000$, T = 9.38 and R^2=0.106), ST (β=0.340, $p < 0.000$, T = 9.44 and R^2=0.116), LN (β=0.423, $p < 0.000$, T = 11.86 and R^2=0.179), and IS (β=0.292, $p < 0.000$, T = 8.98 and R^2=0.085). The effect size of BW on the DA (Cohen f^2=0.19), ST (Cohen f^2=0.13), LN (Cohen f^2=0.22), and IS (Cohen f^2=0.09) was found significant. Furthermore, the model's predictive power was analyzed using the recommended Q value, which demonstrated a good percentage of 39.2% (Q = 0.392). Thus, H1, H2, H3, and H4 were supported, respectively.

According to the scholars, control variables are not the focal variables in the study but could be potential confounding factors. The study has considered several

Table 3 Reliability and Convergent Validity

Variable	α	rho_A	Composite Reliability	AVE
Binge-watching	0.837	0.845	0.902	0.753
Depression & Anxiety	0.818	0.829	0.880	0.647
Stress	0.915	0.922	0.934	0.704
Loneliness	0.813	0.817	0.869	0.571
Insomnia	0.783	0.842	0.870	0.690

Abbreviations: α, Cronbach's alpha; rho_A, Jöreskog's rho; AVE, Average Variance Extracted.

Table 4 Item Loadings and VIF

Items	BW	DA	IS	LN	ST	VIF
BW1	0.887					2.058
BW2	0.883					2.100
BW3	0.832					1.788
DA1		0.777				1.819
DA2		0.818				2.107
DA3		0.866				2.092
DA4		0.751				1.585
IS2			0.825			1.574
IS3			0.777			1.658
IS4			0.887			1.671
LN1				0.741		1.463
LN2				0.734		1.564
LN3				0.770		1.728
LN4				0.774		1.950
LN5				0.757		1.751
ST1					0.769	2.179
ST2					0.793	2.375
ST3					0.888	2.353
ST4					0.897	2.189
ST5					0.783	1.958
ST6					0.891	2.925

Abbreviations: BW, Binge-watching; DA, Depression & Anxiety; ST, Stress; LN, Loneliness; IS, Insomnia; VIF, Variance Inflation.

demographic factors that can potentially increase the risk of certain psychopathology (eg, stress). The potential influencing factors (eg, gender, etc.) have been treated as control variables of this study. To identify potential confounding variables among the control variables in the relationship between BW and dependent variables, we ran another model using the PLS-SEM bootstrapping method. The results of PLS path analysis presented in Table 6 verified that age is a potential confounding factor that significantly but inversely predicts the DA (β=−0.144, $p < 0.000$, T = 4.64), LN (β=−0.133, $p < 0.000$, T = 4.26). Moreover, Educational-Level appeared as the potential confounding factor that significantly predicts the IS (β=0.087, $p < 0.001$, T = 1.30). However, the coefficients for other demographic attributes, including gender, and marital status were found insignificant. The implications of these results are discussed in the next section.

Moderation Analysis

The research employed the product type composite approach using 5000 bootstrapping and 300 iterations to test the moderating influence of screen time on the BW. In doing so, we ran four models (see Table 7) using the two-step approach. Independent variables, dependent variables, and moderating variables were entered in the first instance to run each model. Next, the interaction term was entered using the PLS software function of computation of moderating variable. This study involved four consequences of the BW. Therefore, a total of four models were examined. In each model, the direct influence of moderating variable

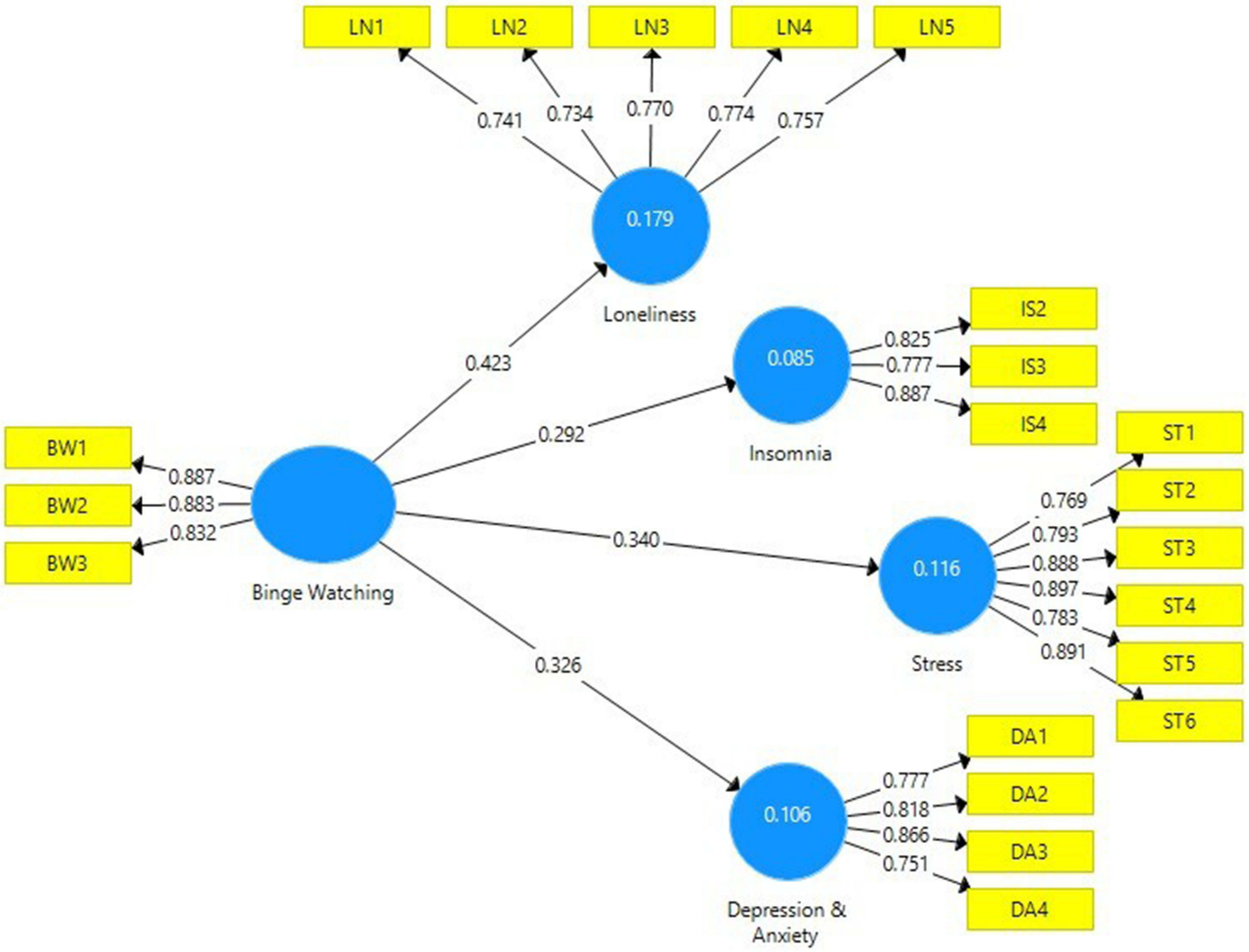

Figure 1 Measurement model.

screen time was estimated along with the effect of BW (see Table 7).

In model 1, after the interaction term (screen time X BW), the moderating influence of the screen time was significant on DA (β = 0.154 and p = 0.000), and therefore H5 (a) was supported. However, the moderating influence of the screen time (screen time X BW) was not significant on ST (β = −0.131 and p = 0.259); hence, H5 (b) was rejected. In a similar vein, the moderating influence of the screen time (screen time X BW) was also not significant on LN (β = −0.144 and p = 0.177); hence, H5(c) was also rejected. In contrast, the moderating influence of the screen time was significant on IS (β = 0.134 and p = 0.000), and H5 (d) was therefore supported.

Table 5 Discriminant Validity

	BW $_{HTMT}$	**DA $_{HTMT}$**	**IS $_{HTMT}$**	**LN $_{HTMT}$**	**ST $_{HTMT}$**	**BW$_{FLC}$**	**DA $_{FLC}$**	**IS$_{FLC}$**	**LN$_{FLC}$**	**ST$_{FLC}$**
BW	1					0.868				
DA	0.387	1				0.326	0.804			
IS	0.342	0.406	1			0.292	0.330	0.831		
LN	0.502	0.618	0.329	1		0.423	0.504	0.279	0.755	
ST	0.386	0.629	0.398	0.728	1	0.340	0.545	0.343	0.634	0.839

Abbreviations: BW, Binge-watching; DA, Depression & Anxiety; ST, Stress; LN, Loneliness; IS, Insomnia; HTMT, Heterotrait-Monotrait Ratio of Correlations; FLC, Fornell-Larcker criterion-based.

Table 6 Standardized Regression Weights

Paths	β	T-values	P-values	f^2	Results
Binge-watching -> Depression & Anxiety	0.326	9.38	0.000	0.19	H1 Supported
Binge-watching -> Stress	0.340	9.44	0.000	0.13	H2 Supported
Binge-watching -> Loneliness	0.423	11.86	0.000	0.22	H3 Supported
Binge-watching -> Insomnia	0.292	8.98	0.000	0.09	H4 Supported
Paths	**β**	**T-Values**	**P-values**	**Confounding Effect**	
CV: Age (BW→DA)	−0.144	4.64	0.000	Yes	
CV: Age (BW→ST)	0.002	0.13	0.893	No	
CV: Age (BW→LN)	−0.133	4.26	0.000	Yes	
CV: Age (BW→IS)	0.035	0.88	0.375	No	
CV: Gender (BW→DA)	0.087	1.21	0.001	No (low T-value)	
CV: Gender (BW→ST)	−0.017	1.30	0.193	No	
CV: Gender (BW→LN)	−0.027	1.06	0.287	No	
CV: Gender (BW→IS)	0.013	0.40	0.682	No	
CV: Educational-Level (BW→DA)	0.049	1.63	0.102	No	
CV: Educational-Level (BW→ST)	0.028	1.67	0.094	No	
CV: Educational-Level (BW→LN)	0.037	1.46	0.142	No	
CV: Educational-Level (BW→IS)	0.148	4.46	0.000	Yes	
CV: Martial Status (BW→DA)	0.413	1.20	0.637	No	
CV: Martial Status (BW→ST)	0.902	1.61	0.893	No	
CV: Martial Status (BW→LN)	0.489	0.91	0.295	No	
CV: Martial Status (BW→IS)	0.235	2.78	0.781	No	

Abbreviations: CV, Control Variable; BW, Binge-watching; DA, Depression & Anxiety; ST, Stress; LN, Loneliness; IS, Insomnia; β, Standardized Regression.

Discussion

This study used a cross-sectional research design vis-à-vis online survey method to investigate the impact of binge-watching on depression, anxiety, stress, loneliness, and insomnia. The study posed four direct and four moderating hypotheses. The findings of this study supported the four direct hypotheses and the moderating hypotheses H5a and H5d. In contrast, hypotheses H5b and H5c were not supported. According to recent literature, binge-watching has severely affected people's mental health.[10] For instance, studies reported binge-watching corresponds to a wide range of psychological outcomes.[62] Our study supports the same line of argument by emphasizing that binge-watching during this COVID-19 outbreak at individual, community, national, and international levels has been associated with many psychological consequences framing depression, anxiety, loneliness, and insomnia.

In other words, our results indicated that binge-watching resulted in negative consequences such as depression, anxiety, stress, and loneliness. These findings are aligned with the previous literature.[63] Interestingly, our findings suggested that when binge-watching is personally not fulfilling, it is associated with loneliness and depression.[15,32,33] One plausible reason can be that the reality of binge-watchers resonates with the reality depicted in the episodes that may give them the impression that other people around them are more content with their lives. This may make them feel depressed due to social isolation.[31]

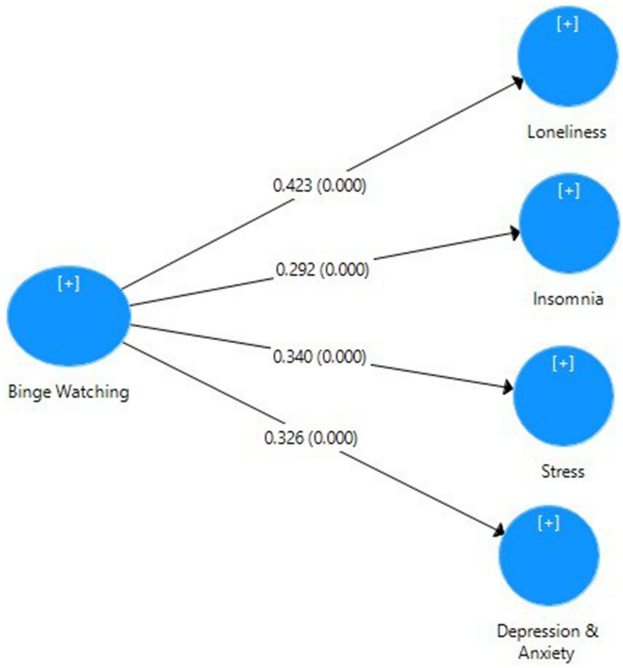

Figure 2 Structural model.

Recently, video streaming services such as Netflix, Hulu, and Amazon Prime have been growing at an exponential and reckless pace because of their affordability, wide availability, and accessibility through any internet-connected device.[2] These streaming platforms are readily available at the consumer's convenience; hence now, they have become part and parcel of most people's daily routines.[64] Moreover, episodes traditionally released weekly have now been changed to release the entire TV series season on streaming platforms. This predicates a cultural shift in entertainment content consumption.[3,8] Therefore, it is not perplexing that watching multiple episodes of a TV series "back-to-back" has become the trending and current mode of TV series watching. Specifically, people have become the new normative mode of viewing TV shows, especially among young adults.[6] Drawing on the analogy of I-PACE theory, the present study found that binge-watching is associated with insomnia, stress, anxiety, depression, and loneliness in individuals. For instance, extant literature identified that the usage of digital technologies could cause stress and have negative consequences such as mood swapping,[10] feeling restlessness,[36] and stress.[12] Moreover, evidence from cohort research has also supported that binge-watching could be associated with stress.[8]

The results of hypothesis 3 are consistent with the past research suggesting emergent psychological issues such as loneliness owing to the addictive use of digital technologies.-[42,45] These addictive behaviors among the binge-watchers isolate the individuals from their real-life situations and align them more with the realities of binge-watching. As a result, the individuals feel a sense of loneliness when their real-life realities and mediated realities are incompatible. In a similar vein, augmented digital technology usage corresponds to deprived sleep periods.[50,52] In addition to the direct impact of screen time, this study also tested the moderating influence of screen time on binge-watching. It involved the testing of the direct influence of moderating variable screen time was estimated along with the effect of binge-watching. The moderating influence of screen time for web series through online streaming services was significant on insomnia, depression and anxiety. However, the moderating effect of screen time for web series through online streaming services did not find a significant association with stress and loneliness. These findings seem surprising but are consistent with the Uses and Gratification literature that posits that audiences' use of the media is goal-orientated such as relaxation (Steiner & Xu, 2020).[40,65] Therefore, a significant moderating effect of screen time for web series through online streaming services was not found for stress and loneliness amongst the binge-watchers.

Moreover, the results of demographic attributes have also interesting implications. The analysis identified age as the confounding factor that reported an inverse association with DA and LN. Consistent with the results of prior literature,[66] it has affirmed that older people have fewer chances of getting

Table 7 Moderation Effects Findings

Moderation Effects	*β*	Standard Bootstrap Results		Hypothesis
		t-Value	P-value	
Model 1 (Screen time X BW)→DA	0.154	4.581	0.000	H5(a) Supported
Model 1 (Screen time X BW)→ST	−0.131	1.148	0.259	H5(b) Rejected
Model 1 (Screen time X BW)→LN	−0.144	1.351	0.177	H5(c) Rejected
Model 1 (Screen time X BW)→IS	0.134	5.599	0.000	H5(d) Supported

Abbreviations: BW, Binge-watching; DA, Depression & Anxiety; ST, Stress; LN, Loneliness; IS, Insomnia; β, Standardized Regression.

adverse effects of binge-watching. One plausible explanation of this phenomenon can be derived from uses and gratification theory that describes certain motives that drive media content viewing including gratification.[65] Extant pieces of literature that used this theory have found that diverse motivations of binge-watching, in turn, determine psychological outcomes.[65] For example, an older person binge-watches so as to gratify their feelings of LN - that is why they might be less vulnerable. Another interesting factor was educational-Level which showed very minute but a possible tradeoff in outlining the intensity of insomnia. These results can be understood in light of past literature which reported a greater tendency of insomnia among highly educated people.[67] However, these demographic results are inconclusive and limited. Albeit this study has not underpinned demographic features as a focal variable, these results indicated interesting facades for future research.

Finally, our results validated the PACE model, suggesting that binge-watching causes depression, anxiety, stress, and loneliness. This study has succeeded in exhibiting that binge-watching is interlinked with more negative emotions than positive emotions. To this end, this study aligns with that of Flayelle et al[63] which found that sense of guilt, losing control, and dependability are traits of negative emotions. Likewise, Panda and Pandey[66] specified that college students who face negative emotions after continuous watching are likely to spend more time binge-viewing. This is attributed to the experience of feelings such as lack of control, dependence, or pity due to procrastination resulting from binge-watching. Consequently, it is inferred that people are still inclined to binge-watching once they had already binge-watched a series, irrespective of the positive and negative emotions generated. Hence, using a national online survey, the results of PLS-SEM verified that binge-watching significantly predicts depression, anxiety, loneliness, stress, and insomnia among individuals.

Limitations

This study has some limitations that can be addressed in future studies. Firstly, further studies should strive to measure binge-watchers' demographics and viewing patterns to see if any demographic factor plays any role in this experience. Secondly, future studies should investigate the nature of the content, representing a significant transformation in media consumption patterns. Thirdly, another imperative future investigation question might be regarding how screen time for web series through online streaming services is associated with other health-related outcomes such as obesity. Lastly, another aspect missing in this study is the viewing experience, screen cues for binge-watching, and streaming channel elements that stimulate the phenomenon of binge-watching, which could be a great addition to the study of binge-watching.

Conclusion

To the best of our knowledge, less attention has been paid to understanding the multiple influences of binge-watching on binge-watchers during the COVID-19 pandemic. Most of the past studies on this topic mainly underscored the individual's motivations for binge-watching.[11,16] Also, past studies were limited and inconclusive as they mostly espoused only the underpinning adverse effects of binge-watching without looking into the association between binge-watching and the individuals.[25] Therefore, this study is novel as it investigates the less explored moderating implications of screen time on binge-watching. The study reported that overall, screen time for web series online streaming has adverse effects on psychological and mental health symptoms. To summarize, higher screen time for consuming multiple episodes of the web series mainly can result in sleep deprivation, depression and anxiety symptoms. Thereby, the study suggests that there is a dire need to literate the people about the higher screen time for web series through online streaming services as a problematic viewing habit. Thus, the study suggests improving people's understanding of the usage of online streaming web series to avoid adverse psychological and mental health symptoms. The improved literacy can equip the individuals to reflect on the purposes digital streaming and media content serves for them more critically.

Data Sharing Statement

The data supporting the findings are available from the corresponding author on reasonable request.

Ethical Approval and Informed Consent

Written consent was signed by all participants of the study and all information was kept confidential. Ethical clearance was gained from the departmental research Review committee of the Centre for Media and Communication Studies, University of Gujrat, Gujrat-Pakistan. The study was performed as per Helsinki Declaration principles.

Acknowledgments

We would like to thank our data collectors and study participants.

Author Contributions

All authors made significant contributions to the work reported, either in its conception, study design, execution, acquisition of data, analysis and interpretation, or in all of these areas. They also took part in drafting, revising, or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Funding

No funding agencies or organizations are involved. It was conducted by the authors.

Disclosure

The authors report no conflicts of interest in this work.

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