Investigating the Relationship Between Anxiety, Depression & Loneliness with Addictive
Smartphone Behaviour Amongst Young Adults During the COVID-19 Pandemic.

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Abstract

Aims: Previous research documents smartphones' relationship with mental health, but research is limited within an Irish context. Studies indicate a rise in smartphone use during COVID-19. Therefore, this study investigates the relationship between mental health and addictive smartphone behaviours during COVID-19, whilst exploring gender differences within addictive smartphone behaviours. **Method:** Online surveys were administered via social media involving four questionnaires; The Depression, Anxiety & Stress Scale, The Smartphone Addiction Scale, The UCLA Loneliness Scale and The Coronavirus Anxiety Scale. 178 participants aged 18-30, with a mean age of 25.02 years (SD = 2.48) interacted with this study. **Results:** There was a weak positive association between loneliness and addictive smartphone behaviours (r = .14, p >.001). Coronavirus-related anxiety had a moderate positive association with addictive smartphone behaviour (r = .46, p >.001). Generalized anxiety displayed a strong positive association with addictive smartphone behaviour (r =.69, p< .001). The most significant association was between depression and addictive smartphone behaviour (r =.72, p< .001). A multiple regression model explained 58% of variance in addictive smartphone behaviours. Depression, generalized anxiety and COVID-19 anxiety were uniquely predictive of addictive smartphone behaviours. A Mann-Whittney U test revealed females displayed significantly higher addictive smartphone behaviours (M = 108.14) than males (M = 75.61). **Conclusion:** Findings suggest there is a relationship between forms of anxiety, depression and loneliness with addictive smartphone behaviours, and females may be most vulnerable. Interventional measures are advised for vulnerable populations. Future longitudinal approaches are recommended to assess negative effects that may last after COVID-19.

Introduction

The rapid advancement of technological innovation has resulted in a ubiquitous demand for smartphone devices. Through the installation of smartphone applications, the possible uses of these devices grow daily (Nishad & Rana, 2016). It has been estimated that a total of six billion individuals globally have operated a smartphone in the year 2020 (Jonsson et al., 2017). This estimate represents 76.92% of the global population, therefore, it is of interest to understand the psychological effect smartphones may have on individuals (Cheever et al., 2018). Specifically, it is of importance to further examine individuals' motivations to use these devices, their attitudes towards smartphones and what exactly is the impact that smartphones can have on peoples' mental health (Eide et al., 2018).

A cross-national study conducted by Lopez-Fernandez et al (2017) which involved ten countries found that smartphone users spent on average 8.9 hours on their devices each day. The daily use of smartphones has now become a fundamental aspect of people's lives (King et al., 2013). Alhazmi et al., (2018) characterizes smartphones as "having the world at the palm of your hands" (p.1) due to the fact that they are the most easily accessible way of connecting to the internet (Malinen & Ojala, 2012). Some researchers maintain that these ever-present devices yield positive results for people (Jin & Park, 2010) as they encourage "numerous gratifications, such as sociability, entertainment, information finding, coping strategies and social identity maintenance" (Panova & Carbonell, 2018, p.1). However, Csibi et al (2019) suggest that due to the wide spectrum of such gratifications that smartphones present, it may result in the exaggerated use of the devices. Li and Lin (2019) note some negative possible outcomes that excessive smartphone use may generate such as decreased academic performance, increased anxiety, loneliness and the possibility of developing an addiction to the device (Musumari et al., 2020).

Park (2005) defines addiction as any form of extreme behaviour, whereas Kuss and Griffiths (2011) describe smartphone addiction as the excessive use of the device to a level where it interferes with the daily life of the user. Similarly, Moreno et al., (2013) conceptualises addictive smartphone behaviour as 'smartphone use that is excessive or impulsive in nature leading to adverse life consequences, specifically physical, emotional, social or functional impairment' (p.1885). Common trends of addictive smartphone behaviour are universally recognized due to their stimulating nature (Shoukat, 2019). Kwon et al., (2013) underline that addiction's main psychopathology lies within the impaired control of stimuli that leads to compulsive behaviours, which is putative in smartphone users. Although smartphone addiction is not yet a distinct psychiatric diagnosis, it could still be acknowledged as a behavioural disorder within psychiatric diagnosis manuals, as Zou et al., (2019) define non-substance addiction as involving food addiction, gambling addiction, internet addiction, and smartphone addiction.

To date, a large number of studies have documented negative psychological effects that addictive smartphone behaviour may result in such as; anxiety and depression (Elhai et al., 2017) and suicidal ideation in adolescents (Arrivillaga et al., 2020). Evidence from a seminal study by Kim et al., (2019) investigating whether there was a relationship between smartphone addiction and the mental health of university students reported that individuals who used their smartphones for longer periods were at an increased risk of displaying anxiety and depression symptomology. In addition, there seems to be gender differences in addictive smartphone behaviours. Previous literature suggests that females generally display higher levels of addictive smartphone behaviours compared to males (Carbonell et al., 2018; Demirci et al., 2015; Hong et al, 2012). Such findings have been supported by a recent study from Wang and Zheng (2020) which found that among a student sample, females displayed stronger addictive smartphone behaviours than that of the males, and that amongst both

genders, the self-reported levels of anxiety and depression were associated with longer periods spent using smartphones.

Smartphone addiction has been portrayed as the most prevalent yet "invisible" addiction of the 21st century, as it is likely to be socially accepted as normal (Roberts et al., 2014). Studies have revealed that smartphone addiction is seen in 35% of all users, with one study reporting smartphone addiction levels of 48% among a university student sample (Aljomaa et al., 2016). This has caused some researchers to argue that the denial of smartphone addiction as a disorder may be problematic due to the inevitable fact that excessive smartphone use has been shown to possess the same phenomenological and neurobiological processes as recognised substance disorders (Grant & Chamberlain, 2016; Jorgenson et al., 2016). Elhai et al. (2020) specifically questions why Internet Gaming is a proposed disorder for future diagnostic manuals yet smartphone addiction is not. This is despite the fact that NOMOPHOBIA (No MObile PHone PhoBIA) is recognised as a psychological condition of fearing the prospect of being detached from one's mobile phone, and this term is based on previous definitions of addiction within such diagnostic manuals (Bhattacharya et al., 2019). Upon considering what populations smartphone addiction may impact; it has been postulated that young adults are at the highest risk of developing smartphone addictions (Cha & Seo, 2018) which may be due to psychological factors such as loneliness (Onuoha, 2019).

Loneliness is described as the subjective phenomenon of feeling separated from others (Gierveld et al., 2006) or the absence of social relationships that provide basic emotional needs (Yanguas et al., 2018; Quadt et al., 2020). Social isolation on the other hand, has been described as a lack of social contact (Loades et al., 2020) "which merges the subjective feeling of loneliness and the objective deficiencies associated with social interactions and networks" (Hawkley & Capitanio, 2015, p.2). Although loneliness and social

isolation are different concepts, researchers advise that they should be investigated together due to research showing that both concepts share overlapping qualities, and both are known to cause severe negative mental health issues (Golden et al., 2009; Klinenberg, 2016). Studies also indicate that individuals who experience more social isolation tend to display higher levels of loneliness (Columb et al., 2020) and may be twice as likely to display addictive behaviours such as excessive smartphone use (Hossenbor et al., 2014). In fact, it has been hypothesised that loneliness and smartphone use share a reciprocal relationship (Bian & Leung, 2015). This may be seen in the study conducted by Sonmez et al., (2020), which found that individuals who reported higher baseline loneliness scores displayed a high prevalence of addictive smartphone behaviour. Furthermore, Achterbergh et al., (2020) highlights that young adults usually display higher instances of loneliness than other age groups. Mahapatra (2019) argues that this may be the reason that young adults are considered to be particularly vulnerable to smartphone addiction. This is evident in Jiang et al.,'s (2018) research emphasising that loneliness is commonly seen as the strongest predictor for smartphone addiction in young adult samples.

The recent COVID-19 global pandemic has resulted in increased levels of loneliness and social isolation due to enforced lockdown measures and minimisation of social contacts in an attempt to reduce the spread of the virus (Adhikari et al., 2020; McGinty et al., 2020; Yip & Chau, 2020). Thakur & Jain (2020) suggest that the new social isolation norms will not only be accompanied by higher reports of loneliness, but also higher levels of depression and even suicidal ideation due to the toll it may take on individual's mental health. It is purported that levels of anxiety are at an all-time high due to exposure to disease-related news in the media, which has been shown to increase 'emotional contagion' and levels of anxiety (Asmundson et al., 2010; Asmundson & Taylor, 2020; Resnyansky, 2014, p.1). This sentiment seems to be supported by Huang & Zhao (2020) who investigated the mental health

of 7,236 participants in China, and found that 35.1% of individuals displayed symptoms of

severe depression and anxiety in reaction to the outbreak. Similarly, a 12-month Canadian

longitudinal study investigating 773 university students' recent stressful experiences and

mental health showed that students without pre-existing mental health concerns were more

likely to display declining mental health stemming from the increased social isolation in

response to COVID-19 (Hamza, et al., 2020). Balaratnasingam and Janca (2006) further

emphasise the necessity of investigating the public's mental health during pandemics due to

heightened levels of fear and anxiety, which is suggested to instigate negative patterns of

psychological behaviour and well-being.

Due to such heightened mental health issues and increased mandated isolation rules,

the development or exacerbation of addictive behaviours such as smartphone addiction may

be prevalent (Király et al., 2020). This appears to be reinforced within Greenfield's (2021)

theoretical paper which hypothesises that smartphone use offers a functional role in providing

distraction from feelings of isolation in individuals. The Adult Pacifier Hypothesis

specifically indicates that smartphone devices are used by many as attachment objects, much

in the same way as pacifiers are used by children as a form of comfort. Two controlled lab

experiments testing this hypothesis underlined that individuals tend to strongly believe that

smartphones do in fact bring a sense of comfort during stressful situations (Melumad &

Pham, 2018). The public's reliance on technologies during COVID-19 is vastly increasing,

and it has been proposed that the use of smartphones may not only be a useful way to

emotionally cope during this time, but also a possible way of minimizing the spread of the

virus (Garfin, 2020; Lades et al., 2020).

Despite the disadvantages of addictive smartphone behaviours outlined above, it is

clear that smartphones do innately possess some pragmatic value in the context of COVID-19

(Torous et al., 2020). The World Health Organization have consistently encouraged the use of

technological devices such as smartphones as a way to combat the spread of the highly infectious disease (He, 2020). Videoconferencing applications that are available on smartphone devices such as Zoom, Google Meet or Microsoft Teams have witnessed a surge in downloads globally and have been shown to be an effective way of keeping people virtually connected in their occupational, social and educational lives from a safe distance (Sindiani et al., 2020). Smartphones have also been beneficial in minimizing the spread of COVID-19 in additional ways, such as contactless mobile payment or by simply presenting individuals the option of shopping online from the safety of their homes (Iyengar et al., 2020). Smartphone applications have also proved to deliver positive healthcare implications via COVID-19 tracing and telemedicine applications (Singh et al., 2020). This has enabled individuals to accurately track the spread of the virus, as well as offering medical advice safely over the phone which has contributed in the prevention of healthcare systems becoming overwhelmed (Kisely et al., 2020). Although smartphones can aid the daily lives of many during COVID-19, such as providing safety measures or simply offering endless forms of distraction from the unpleasant feelings of anxiety relating to the coronavirus or social isolation, such benefits should be considered alongside the possibilities of harm (Haidt & Allen, 2020).

Therefore, it is relevant to develop a more nuanced evaluation of possible negative outcomes that excessive smartphone use during COVID-19 may be associated with, such as anxiety and depression (Melumad & Pham, 2020). Mallet et al. (2020) urge for more research to be undertaken as to identify factors that may play a role in preventing the substantial risks of developing addictive behaviours during COVID-19's lockdowns. A recent study by Wolniewicz et al. (2020) explicitly investigated whether anxiety had any relationship with excessive smartphone use and depression during COVID-19 in a Chinese population involving adults. The results showed a direct correlation with the severity of smartphone use

and both depression and anxiety during the pandemic's lockdown. Although these results suggest that there is in fact a relationship between anxiety, depression and excessive smartphone use, it is difficult to discern whether it is a causal one. Moreover, it remains unclear whether depression and anxiety instigate increased smartphone use, or whether excessive smartphone use promotes depression and anxiety symptomology.

With the prospect of several further worldwide mandated lockdowns for the foreseeable future, it is of worth investigating the long-term impacts that addictive smartphone behaviours may have on individuals. It is also of significance to identify populations that may be especially vulnerable to addictive smartphone behaviours. Previous literature implies that females generally tend to display higher levels of addictive smartphone behaviours in contrast to males. Furthermore, recent studies have also demonstrated that females may be more susceptible in experiencing a decline in overall mental health in response to the COVID-19 pandemic than males (Beranuy et al., 2019; Pierce et al., 2020) Thus, the need for further investigation is deemed as imperative as to assist in the development of tailored interventions to prevent and treat any mental and physical health implications (Javed et al., 2020).

Most of the psychological literature pertaining to smartphone addiction to date has been conducted in China (Dong et al., 2020) which may be due to the reality that there are 2.21 smartphones for every person in Hong Kong (Billieux et al., 2015; Gutiérrez et al., 2016). Other studies illustrate how various cultural idiosyncrasies are reflected in smartphone behaviour (Lei & Yusoff, 2020). Hence, it may be of benefit to investigate whether sociocultural differences that exist in Ireland influence smartphone behaviours (Panova & Carbonell, 2018). Therefore, the motivation for the present study is to address gaps in the literature regarding the scarce amount of smartphone behaviour studies that have taken place within an Irish context.

The research aim of the present study is to investigate whether there is a relationship between anxiety, depression and loneliness with addictive smartphone behaviour in young adults during COVID-19. Two forms of anxiety will be measured to investigate general anxiety and coronavirus-related anxiety. The present study seeks to utilize a quantitative, cross-sectional research design as to test the research hypotheses.

Research Question 1: Is there a relationship between anxiety, depression and loneliness with addictive smartphone behaviour during COVID-19? Hypothesis: It is predicted that there will be a positive correlation between anxiety, depression and loneliness with addictive smartphone behaviour.

Research Question 2: Is there an association between addictive smartphone behaviour and Gender? Hypothesis: There will be a significant association between smartphone use and gender. It is predicted that females may display higher levels of addictive smartphone behaviour compared to males.

Methods

Participants

The participants in the present study were recruited using a convenience sampling method via the researcher's social media accounts such as Facebook and Instagram. G*Power Statistical Analyses (Faul et al., 2009) were conducted to determine appropriate sample sizes. For a correlation test, a 0.3 effect size with a 0.5 alpha level, was run at 80% power. For the regression analyses, a G*Power analysis was conducted applying a 0.35 effect size with a 0.5 alpha level was run at a power of 0.8, which included the 5 variables of anxiety, depression, loneliness, coronavirus-related anxiety and addictive smartphone behaviour scores. After these calculations, it was proposed to attract at least 84 participants as to achieve statistically powerful analyses. The final sample consisted of 178 (Males: n = 102; Females: n = 76, Other: n = 0) young adults. The study involved young adults between the ages of 18 – 30 with a mean age of 25.02 (SD = 2.48), as this age group may be the most susceptible population to develop addictive smartphone behaviours (Cha & Seo, 2018).

Procedure

The participants were recruited through the researcher's social media sites of Facebook and Instagram. The researcher posted a linked web-address to a Google Forms document on his personal social media accounts. Upon clicking the invitational link administered by the researcher, individuals were greeted with an information sheet (Appendix V) which detailed the topic of the study, why the study is necessary and what the study would entail for them in clear and easily understood language. This sheet also explained any risks and benefits of the study, as well as, the participants' right to withdraw from the study up until the submission of the completed survey, which is in accordance with the Freedom of Information legislation. It was explained that upon submission of the survey, all data would be automatically anonymised, thus rendering their data as unidentifiable. After the information sheet, participants were asked to fill out a consent form (Appendix VI) by ticking

a box indicating that they understood what is involved in the study, and that they independently chose to participate. A screener question then appeared asking the participant if they were over the required age of 18 and under the age of 31. If participants provided an age that is within the study's exclusion criteria (under the age of 18 or 31 and over), the survey ended there, and an explanation was provided. The survey involved the use of four standardized questionnaires. These questionnaires included the Smartphone Addiction Scale (SAS; Kwon et al., 2013) see Appendix I, the Depression, Anxiety & Stress Scale (DASS-21; Lovibond & Lovibond, 1995) see Appendix II, the UCLA Loneliness Scale (Russell et al, 1978) see Appendix III, and the Coronavirus Anxiety Scale (CAS; Lee, 2020) see Appendix IV. The completion of the survey reportedly took approximately ten minutes. Following the submission of the survey, participants proceeded to the debriefing sheet (Appendix VII) which expressed the researcher's appreciation for them taking part in the study. This also outlined available support services in the circumstance that they felt in any way distressed before, during or after the study. This debriefing sheet reiterated that all data involved in the study is anonymous for the confidentiality of the participant, and that the only non-anonymised data to be retained are the consent forms. Participants were subsequently assured that all data will be safely stored on a robust password protected private computer and saved for 5 years, in line with NCI's data retention policy. Participants were notified that the results will be presented within the researcher's final year dissertation, which will be submitted to National College of Ireland. Lastly, this sheet stated that if any participant felt the need to obtain further information that they are welcome to contact the researcher or the study's supervisor. Both of these individuals' contact information in the form of email addresses were attached at the bottom of the sheet.

Measures

      Demographics. Participants were initially asked to provide their age and gender (male, female, other). Participants were then were asked to indicate which of the following better describes the area in which they reside (rural settings or urban settings). It was reported that 14.6% of the participants lived in rural settings (n = 26) and 85.4% of participants lived in urban settings (n = 152). Additionally, participants were asked to indicate which of the following five options described their occupation the most accurately: Student & Unemployed/Retired, Student & Employed, Employed & Not a Student, Unemployed/Retired & Not a Student or N/A. It was reported that 12.4% of participants were either a Student & Unemployed/Retired (n = 22), 12.9% indicated that they were a Student & Employed (n = 23), 69.7% of participants reported being Employed & Not a Student (n = 124), 5% of participants were Unemployed/Retired & Not a Student (n = 9) and 0% of participants selected the N/A option (n = 0).

      Addictive Smartphone Behaviours. The Smartphone Addiction Scale (SAS; Kwon et al., 2013) is a standardized questionnaire commonly utilized in psychological research measuring behaviours relating to smartphone addiction. The scale uses 33 items which are answered on a 6-point Likert scale. An example of an item involved within is the statement of "I Check SNS (Social Networking Service) sites like Twitter, Instagram or Facebook right after waking up", to which the participant is to answer by selecting one of the following, 1 = "strongly disagree", 2 = "disagree", 3 = "weakly disagree", 4 = "weakly agree", 5 = "agree" and 6 = "strongly agree". The sum of the entirety of the answers provides the participant's overall addictive smartphone behaviour score. The scores can range from 10 – 60, and higher scores indicate possible smartphone addiction. The SAS scores involve no reverse coded items, and each item is significantly related to general measures of addiction,

providing strong validity and reliability (Kwon et al., 2013). In the present study, this scale displayed a Cronbach standardized alpha of 0.93. See Appendix I for further detail.

Depression and Anxiety. The Depression, Anxiety and Stress Scale (DASS-21; Lovibond & Lovibond, 1995) is a mental health screener measuring the severity of emotional and behavioural symptoms that are associated with anxiety, depression and stress. The scale includes 21 questions which takes about 5 minutes to complete. The questionnaire applies a 4-point Likert scale involving items such as; "I couldn't seem to experience any positive feeling at all", to which subjects may respond with, "Never", "Sometimes" "Often" and "Almost Always". Each answer of the items is awarded a number of points, varying from 0 to 3 (Never = 0, Sometimes = 1, Often = 2, Almost Always = 3). The sum of all responses is then summed, and the three subscales of depression, anxiety & stress are separately awarded a score between 0 -18 and 24, depending on how many questions are assigned to each feature of measurement. For each subscale, higher scores indicate more severe and frequent feelings of the measurement during the past week. However, it should be noted that although this scale measures stress in individuals, the subscale involving items pertaining to stress will not be included within any statistical analyses, as stress is not being examined within the current study. The scoring of this scale does not involve any items that necessitate reverse coding. The DASS-21 is found to be a valid and reliable method of measuring depression and anxiety in non-clinical young adults (Henrey & Crawford, 2005). In the present study, this scale displayed a Cronbach standardized alpha of 0.81. See Appendix II for further detail.

Loneliness. The UCLA Loneliness Scale (Russell et al, 1978) is a questionnaire intended to assess feelings of loneliness and social isolation in individuals**.** The scale involves 20 items relating to how often the subject feels disconnected from other people, and is answered using a 4-point rating scale. An example of a typical item within the questionnaire is "I lack companionship", to which O = "I often feel this way", S = "I sometimes feel this

way", R = "I rarely feel this way" and N = "I never feel this way". Upon completion, the researcher calculates each individual's loneliness score by averaging their ratings, with higher scores indicating higher loneliness. Although other versions of this scale include items that entail reverse coding, the present version used within this study does not. Yanguas et al., (2018) indicate that the UCLA scale is the most common measurement of loneliness in psychological research, as it scores highly in tests of reliability and validity (Cramer et al., 1999). In the present study, this scale displayed a Cronbach standardized alpha of 0.84. See Appendix III for further detail.

Anxiety Relating to COVID-19. The Coronavirus Anxiety Scale (CAS; Lee, 2020) is a brief self-report screener to measure and identify dysfunctional anxiety in individuals related to the coronavirus (COVID-19) crisis, and usually takes five minutes to complete. The questionnaire includes 5 items regarding the participant's perceived anxiety towards the COVID-19 outbreak. An example of a typical statement included is, "I felt dizzy, lightheaded, or faint, when I read or listened to news about the coronavirus", to which participants rate their agreement to the statement along a 5-point scale, where $0 =$ not at all and $4 =$ nearly every day. Thereupon, the researcher may calculate the participant's score by simply summing all of the answers' scores together. None of the five items in this scale involve the need for reverse coding. Any individuals who score ≥ 9 may indicate dysfunctional anxiety and are therefore suggested to seek further treatment. Independent studies across the United States involving adults demonstrated that this measure shows validity and reliability in measuring anxiety relating to COVID-19 (Lee, 2020). In the present study, this scale displayed a Cronbach standardized alpha of 0.87. See Appendix IV for further detail.

Design and Analyses

The present study utilized a cross-sectional research design to test the research hypotheses. A quantitative approach was implemented using a self-report survey design to collect data. There were four predictor variables (PV's) included in the study which consisted of the following: 1) anxiety 2) depression 3) loneliness and 4) anxiety relating to the coronavirus. The criterion variable (CV) used in this study was addictive smartphone behaviour. A Spearman's Rho correlation was conducted to assess the associations between anxiety, depression, loneliness and anxiety relating to the coronavirus with addictive smartphone behaviour. A standard multiple regression analyses was then performed to determine how well addictive smartphone behaviours could be explained by six variables including gender, age, depression, anxiety, loneliness and coronavirus-related anxiety. Lastly, a Mann-Whitney U test was conducted to test if females display higher rates of addictive smartphone behaviours than males. Additional Mann-Whitney U tests were also conducted to investigate gender differences within anxiety, depression, loneliness, coronavirus-related anxiety and two items within the smartphone addiction scale regarding frequency of social media use.

Results

Descriptive Statistics

Descriptive statistics for all categorical variables in the current study are presented in Table 1, and descriptive statistics for all continuous variables are presented in Table 2. Tests of normality revealed that the smartphone addiction was normally distributed (Shapiro-Wilk $p > 0.05$), however, age, gender, occupation, place of residence (rural/urban), depression scores, anxiety scores, loneliness scores and coronavirus-related anxiety scores were all non-normally distributed (Shapiro-Wilk $p < 0.05$). Histograms and Q-Q plots are displayed for each of the scales' scores (see figures 1-5 in Appendix IX). Participants had a mean age of 25.02 years (SD = 2.48), ranging from 18 to 30. The mean levels of loneliness were 29.8, which according to the scoring instructions of Russell et al., (1978) indicated moderate loneliness. The mean levels of depression were 9.7, whilst mean scores for anxiety were 8.0, which indicated significant depression and anxiety with possible psychiatric morbidity (Lovibond & Lovibond, 1995). Additionally, the mean score for coronavirus-related anxiety was 3.7, indicating mild anxiety amongst participants regarding the COVID-19 pandemic (Lee, 2020). Finally, mean scores for addictive smartphone behaviours were 124.4, suggesting a moderate risk of smartphone addiction (Kwon et al., 2013). However, there appeared to be considerable variation in these scores.

Table 1

Frequencies for the current sample on each demographic variable

Variable	Frequency	Valid Percentage
Gender		
Male	101	57.3
Female	76	42.7
Residency		
Urban	152	85.4
Rural	26	14.6
Occupation		
Student, unemployed	24	13.5
Student, employed	22	12.4
Employed	125	70.2
Unemployed/retired	7	3.9

Table 2

Descriptive statistics of all continuous variables.

	Mean (95% Confidence Intervals)	Median	SD	Range
Age	25.02 (24.65 – 25.65)	25	2.48	19-30
Addictive Smartphone Behaviour Scores	124.39 (119.50 -129.29)	123	33.10	43-197
Loneliness Scores	29.75 (27.28 -32.22)	32	16.70	0-60
Coronavirus-Related Anxiety Scores	3.74 (3.03-4.46)	1	4.83	0-20
Depression Scores	9.73 (8.81-10.64)	9	6.21	0-21
Anxiety Scores	8.03 (7.11-8.96)	7	6.23	0-21

Inferential Statistics

Prior to conducting the standard multiple regression analyses, Spearman's Rho correlations were conducted to investigate the relationships between all of the PVs and CVs as well as assessing for multicollinearity. Results from these analyses are presented in Table 3. With respect to the first aim of the present study, the correlations between the PVs (depression, anxiety, loneliness & coronavirus-related anxiety) and the CV (addictive smartphone behaviour) were examined. Firstly, there was a weak positive correlation between addictive smartphone behaviour scores and overall loneliness scores ($r = .14$, $n = 178$, $p > .001$). There was also a moderate positive correlation between addictive smartphone behaviour scores and coronavirus-related anxiety ($r = .46$, $n = 178$, $p > .001$). However, there was a strong positive correlation between addictive smartphone behaviour scores and anxiety ($r = .69$, $n = 178$, $p < .001$). Lastly, the most significant positive correlation was between addictive smartphone behaviour and depression ($r = .72$, $n = 178$, $p < .001$).

Table 3

Correlations between all continuous variables.

Variables	1	2	3	4	5
1. Addictive Smartphone Behaviours	1				
2. Loneliness	.148*	1			
3. Coronavirus-Related Anxiety	.468**	.066	1		
4. Depression	.720**	.071	.487**	1	
5. Anxiety	.690	.127	.481**	.856**	1

$N = 178$; Statistical significance: *$p < .05$; **$p < .01$

A standard multiple regression analysis was performed to determine how well addictive smartphone behaviours could be explained by six variables including gender, age, depression, anxiety, loneliness and coronavirus-related anxiety (see Table 4 for details). The

six variables explained 58% of variance in addictive smartphone behaviours ($F_{(6, 178)}$ = 41.68, $p < .001$). Three of the six variables were found to be uniquely predictive of addictive smartphone behaviour. Depression was the strongest predictor ($\beta = .48$, $p < .001$), followed by generalized anxiety ($\beta = .18$, $p = .085$) and coronavirus-related anxiety ($\beta = .15$, $p < .014$). These results show that higher levels of both depression & anxiety are associated with higher levels of addictive smartphone behaviours. Additionally, results indicate that higher levels of anxiety relating to the coronavirus is also associated with addictive smartphone behaviours.

Table 4

Multiple regression model predicting addictive smartphone behaviour scores

	R^2	Adj R^2	β	B	SE	P
Model	.594	.580				
Age			-.07	-.98	.67	.148
Gender			.02	1.3	3.7	.713
Loneliness			.07	.14	.98	.149
Coronavirus-related anxiety			.15*	1.0	.41	.014
Depression			.48***	2.5	.53	.000
Anxiety			.18	.95	.55	.085

Note. R^2 = R-squared; Adj R^2 = Adjusted R-squared; β = standardized beta value; B = unstandardized beta value; SE = Standard errors of B; CI 95% (B) = 95% confidence interval for B; N = 398; Statistical significance: *p < .05; **p < .01; ***p < .001

Finally, a non-parametric Mann-Whitney U test was conducted to compare addictive smartphone behaviours amongst genders. This test indicated that addictive smartphone behaviour scores were significantly higher for females (M = 108.14) than for males (M = 75.61), U = 2459.5, Z = -4.166 p < .001 r = .31. Further Mann-Whitney U tests were conducted to compare gender differences between this study's predictor variables. Females

scored significantly higher in loneliness (M = 95.98) than did males (M = 84.67), U = 3383.5, Z = -1.449 p < .001 r = .09. Females also scored significantly higher in coronavirus-related anxiety (M = 115.07) compared to males (M = 70.45), U = 1933.0, Z = -5.856 p < .001 r = .19. Females again scored significantly higher within generalized anxiety measures (M = 109.66) than males (M = 74.48), U = 2344.0, Z = -4.515 p < .001 r = .11. Lastly, the most significant disparity between gender scores was within the depression measure, where females scored notably higher (M = 110.23) than males did (M = 74.05), U = 2300.5, Z = -4.640 p < .001 r = .12. Additional Mann-Whitney U tests compared gender differences within answers on two of the smartphone addiction scale's items regarding frequency of social media use. Females scored higher on question 24 (M = 100.43) in contrast to males (M = 81.36), U = 3045.5, Z = -2.502 p < .001 r = .03, and also scored higher on question 25 (M = 105.52) compared to males (M = 77.56), U = 2658.5, Z = -3.807 p < .001 r = .08.

Discussion

The present study aimed to investigate the relationship between anxiety, depression and loneliness with addictive smartphone behaviour among young adults during COVID-19. The study also assessed gender differences within addictive smartphone behaviour. Previous studies have shown that excessive smartphone use is commonly associated with an array of mental health concerns including, but not limited to, increased levels of anxiety, depression, loneliness and the possibility of becoming addicted to the device (Arrivillaga et al., 2020; Kim et al., 2019; Twenge & Campbell, 2019). Prior research has also suggested that females are more likely to adopt addictive smartphone behaviours than males (Carbonell et al., 2018; Hong et al, 2012; Wang & Zheng, 2020). Therefore, this study formulated two hypotheses to address the aims of the study.

Results from the correlation analysis revealed a weak yet significantly positive association between addictive smartphone behaviour and loneliness. This finding is consistent with previous research that has found a relationship between addictive behaviours relating to smartphone use and loneliness in young adults (Sonmez et al., 2021; Yalcin et al., 2020). Analyses also revealed a weak but positive association between addictive smartphone behaviour and coronavirus-related anxiety. To date, only one previous study has also investigated the association between addictive smartphone behaviours and coronavirus-related anxiety in a young adult population (Elhai et al., 2020). Nevertheless, similar results were found, suggesting a relationship between both variables. Correlation analyses also revealed that depression and generalized anxiety were the most strongly associated variables with addictive smartphone behaviour, in a bivariate context. These findings have been reported in many previous studies involving young adults (Alhassan et al., 2018; Gao et al., 2016; Wan-Ismael et al., 2020). A standard multiple regression analysis investigated if addictive smartphone behaviours could be predicted by the variables incorporated within this

study. The overall model was significant in predicting addictive smartphone behaviours within the participants. Moreover, three variables involved in the regression model were uniquely predictive of addictive smartphone behaviour. The strongest predictor was shown to be depression, which is supported by previous studies (Boumosleh & Jaalouk, 2017; Rozgonjuk et al., 2018). This may indicate that people who experience depression may be more likely to engage in behaviours that resemble smartphone addiction. Generalized anxiety was also found to be associated with addictive smartphone behaviour within the multivariate model. Studies by Cocorada̓ et al., (2018) and Yang et al., (2019) both found similar results and demonstrate that general anxiety was reliable in predicting excessive smartphone use in young adults. Lastly, within the multiple regression model whilst controlling for the other variables, addictive smartphone behaviour was also associated with anxiety relating to the coronavirus. This finding is of particular interest, as there is limited literature relating to this novel relationship.

The current study's second hypothesis, based on prior literature, stated that females may display higher rates of addictive smartphone behaviour. Results from the Mann-Whitney U test indicated that females did in fact score significantly higher in addictive smartphone behaviours compared to males. This implies that female participants were inclined to display more severe addictive smartphone behaviours than male participants. This finding compounds upon the wealth of literature that conveys similar results, and may be indicative of a predisposition for such behaviours (Demirci et al., 2015; Hong et al, 2012; Wang & Zheng, 2020). Predicated upon the above findings, there is evidence to suggest that the results of this study support the studies hypotheses. Although, it should also be noted that additional Mann-Whitney U tests were also performed seeking to understand how other gender differences between variables may have influenced addictive smartphone behaviours. Females additionally scored noticeably higher in each of the following; generalized anxiety,

depression, loneliness, coronavirus-related anxiety and two items within the addictive smartphone behaviours measure, which related to frequency of social media use.

The present study's findings add to an abundance of literature identifying females as being more vulnerable to excessive smartphone use than males (Billieux et al., 2008; Demirci et al., 2015; Hong et al, 2012). This is interesting, as it is typically thought that males spend more time using technology as a whole (Ono & Zavodny, 2005). A potential explanation for this is that gaming has increased during COVID-19 (Balhara et al., 2020) and males often play video games more than females (Lopez-Fernandez et al., 2019). Thus, males may be more likely to use gaming consoles or personal computers than females (Romo-Avilés et al., 2020). As such, this may result in exaggerated use of smartphones in females compared to males. Although, a more nuanced understanding of what exactly contributes to technology preferences is needed, as male gaming tendencies unlikely account completely for the large disparity within smartphone use between genders. For example, in a recent study by Prokes and Housel (2021) female university students reported using smartphones more to interact with coursework, whereas, male students showed a preference towards using their laptops. However, the findings from the current study emphasises that anxiety, depression and coronavirus-related anxiety may be the prominent predictors of smartphone use, which may lead to addictive smartphone behaviours.

Research demonstrates that depression and anxiety are highly comorbid, so much so that anti-depressant medications are routinely prescribed in the treatment of anxiety disorders (Möller et al., 2016). Therefore, it is often customary within psychological research to examine both disorders simultaneously (Adams et al., 2016). Biological research postulates that females are twice as vulnerable to experience depression and anxiety than males (McLean et al., 2011). Many researchers emphasise that the female hormones of estrogen and progesterone result in brain chemistry that differs to males', and thus may contribute to

gender differences within such mood disorders (Li et al., 2017; Parker & Brotchie, 2010).

Furthermore, Krishnan & Nestler (2010) highlight that the female brain has shown to process

serotonin at a slightly slower rate than that of the male brain, making females susceptible to

encounter stress-related disorders. This may be evident in findings from a recent study

involving a representative sample of Ireland undertaken by Hyland et al., (2020) which found

that screening positive for depression and anxiety during COVID-19 was associated with

being of a younger age and female. On extension, this may provide a more thorough

understanding of two of the current study's findings. Firstly, why females scored higher in

measures of depression and anxiety, and secondly, how this may have contributed to females

displaying higher instances of addictive smartphone behaviours. Of course, biological

explanations of gender differences in mood disorders may be reductionist (Karlsson &

Kamppinen, 1995), as they neglect societal and cultural norms which can place differential

pressures and norms on both genders (Maji, 2018; Britton et al., 2006; Falicov, 2003), which

can also be communicated via social media (Nielson et al., 2020; Santarossa & Woodruff,

2017). However, although the present study cannot directly infer that rates of depression and

anxiety have actually increased since the COVID-19 outbreak, cumulative research has

demonstrated instances of this occurrence worldwide (Fountoulakis et al., 2021; Pan et al.,

2021). Therefore, as excessive smartphone use is closely linked with depression and anxiety,

it is possible that individuals who experienced depression and anxiety within this study may

have used their smartphones as attachment objects (Melumad & Pham, 2018) to nullify

negative moods (Garfin, 2020) which may have intensified whilst enduring strict lockdown

laws imposed by the Irish government.

As previously mentioned, although results from the present study lack the potential

for any definitive inclination that loneliness has increased due to the pandemic, Dahlberg

(2021) points to a pronounced elevation in loneliness levels as a direct consequence of new

social isolation norms intended to mitigate the spread of the virus. In addition, being a young adult has been described as a risk factor for encountering feelings of loneliness during COVID-19 (Groarke et al., 2020). In times of loneliness, it is posited that individuals seek companionship with friends via their smartphones (Gao et al., 2016). Related to this, research has previously proposed that females tend to be closer to their friends than males are (Rose & Rudolph, 2006) and may look at smartphones as "social devices" (Yang et al., 2018). This may impart some insight in to the aforementioned findings of this study showing that loneliness was correlated with addictive smartphone behaviour, and more specifically, that females scored higher in measures of loneliness and addictive smartphone behaviours compared to males. Additionally, although it is not a validated measure of social media usage, females also scored higher in two items within the smartphone addiction scale measuring frequency of social media use. This is further worrisome as literature regularly suggests social media has a strong relationship with loneliness, depression and anxiety (Karim, 2020; Youssef et al., 2020). It has even been argued that social media can influence suicide-related behaviour (Luxton et al., 2012). Furthermore, research suggests there has been a surge in incidents of self-harm and suicide attempts in female adolescents since the inception of social media (Sedgwick et al., 2019).

Moreover, individuals who never displayed symptoms of health anxiety prior to the outbreak, may now be experiencing anxiety in relation to the virus (Xiong et al, 2020). Previous research insinuates that in times of crisis, propensities to engage in information seeking behaviours for the purpose of reducing feelings of uncertainty can manifest (Macias et al., 2009; Procopio & Procopio, 2007). The coronavirus may be considered as such a crisis, as it has instigated substantial aberrations to all facets of life. Hence, this may have heightened any sense of trepidation amongst participants, promoting increased demands for information regarding COVID-19. This in turn may have led to "doomscrolling", which is

described as excessive amounts of scrolling through smart devices predicated upon the

absorption of dystopian news (Lupinacci, 2021). Doomscrolling is closely associated with

"cyberchondria", and it has been proposed that COVID-19 has exacerbated both behaviours

(Paulsen & Fuller, 2020; Starcevic et al., 2020). Cyberchondria is conceptualized as

"excessive patterns of online health research that is associated with an increase in health

anxiety and distress" (Starcevic, 2017, p.1). This possibly illustrates why individuals who

scored higher in coronavirus-related anxiety tended to display higher rates of addictive

smartphone behaviour within the present study. This would not be wholly surprising as

Collado-Borrell et al., (2020) implies that 86 percent of people now use smartphones to

retrieve daily news. Moreover, in a recent study, participants reported that even though they

did not feel as though their overall smartphone use increased during COVID-19, 54% of

participants specified using the devices to keep updated with news more than usual (Ohme et

al., 2020). Furthermore, it has been demonstrated that 72% of young people use social media

as their primary source of news (Haug et al., 2015). This is alarming as individuals who

retrieve news from social media have been characterized as "less informed" and more prone

to believe in conspiracy theories (Pennycook & Rand, 2019). In fact, the dissemination of

conspiracy theories is on the rise since the outbreak (Orso et al., 2020), to the extent that it is

said there is an "infodemic" concurrently taking place (Rathore & Farooq, 2020). Notably,

there is a disconcerting rate of conspiracy theorist communities that have purportedly spread

mass misinformation on social media regarding potential detrimental health impacts that can

be induced from the COVID-19 vaccine (Hakim, 2021) which may have instigated or

aggravated coronavirus-related anxiety in vulnerable individuals within this study (Kazan et

al., 2021).

There are a number of limitations to the current study. First and foremost, due to the

restricted timeframe of this study, it was necessary to implement a cross-sectional research

design. Although this allowed the researcher to conveniently collect data at one time point

facilitating the submission date of the study, it lacks the ability to infer any causal

relationship between the predictor variables and addictive smartphone behaviour. For

instance, the researcher cannot assume that addictive smartphone behaviours increased due to

anxiety, depression and loneliness. Similarly, one cannot assume that anxiety, depression and

loneliness increased due to addictive smartphone behaviours, as the direction of the

association cannot be determined. Additionally, it cannot reliably be concluded that

smartphone use has increased during COVID-19, as there is no baseline measure of

smartphone use in the study population prior to COVID-19. Therefore, any associations

found should be interpreted with caution. Hence, future studies may utilize longitudinal

approaches. This could highlight patterns pertaining to variables that may occur over time,

whilst providing a means of identifying a cause-and-effect relationship between anxiety,

depression and loneliness with addictive smartphone behaviours. Thus, if such a relationship

is established, it may mean that negative effects associated with addictive smartphone

behaviour during COVID-19 may linger after the pandemic.

     Although all scales used in the current study are widely used in psychological

research, various issues regarding such scales remain prevalent as limitations within this

study. Firstly, all scales involved in the present study were that of self-report measures, which

are not always reliable as they are susceptible to response biases (Smith et al., 2018).

Although the anonymity of all surveys was clearly stated, the possibility remains that some

participants may have missed this detail. In such a case, it may have encouraged a situation

where individuals may have been inclined to choose answers deemed as socially desirable,

and therefore not representative of how the individual actually felt or behaved at the time.

There is a particular concern relating to the possibility of a self-selecting bias that may have

occurred when interacting with the smartphone addiction scale, which may have affected the

accuracy of the measure. There is an ongoing debate whether this scale is a precise measurement of addictive smartphone behaviour (Alavi et al., 2020), furthermore, Hodes and Thomas (2021) argues that smartphone addiction scales in general commonly produce both underestimations and overestimations of actual screen-time. Thus, future studies may opt to additionally avail of one of the many applications that logs screen time and tracks user preferences. This may aid in delivering further insights into what specific smartphone tendencies are associated with higher risks of addictive smartphone behaviour, and any gender differences within such behaviours. Furthermore, as none of the scales featured reverse-coded scoring, it is plausible that some participants may have selected answers systematically, for example, selecting answer 'A' as every 2nd response. Future studies should include the versions of each scale which incorporates reverse-scoring for optimal validity.

The scale utilized to measure participants' anxiety relating to COVID-19 was the Coronavirus Anxiety Scale (CAS). It is feasible that this scale may not have measured anxiety regarding COVID-19 as precisely as possible. Although the scale showed good reliability, the limited 5 question scale was only intended to measure anxiety relating to the initial breakout of the novel virus (Lee, 2020). At the time of participants interacting with this scale, it was already a year in to the pandemic and vaccinations had begun to be administered. Perhaps future studies could benefit from an updated measurement of coronavirus anxiety with a higher number of more nuanced questions.

As only four scales were used to investigate the research questions, it may be judged as a limitation as it is deemed to be non-exhaustive, whilst neglecting the possibility of confounding variables. For example, it may be that the development of addictive smartphone behaviours is a result of concurrent mental health issues that were not examined in this research. It would be beneficial if future studies aimed to involve additional scales measuring further variables, whilst considering incorporating neuropsychiatric interviews of participants

conducted by qualified professionals. It should also be noted that the DASS-21 scale which assessed depression and generalized anxiety within this study was not primarily intended for the use of the general public, it was designed as a tool for populations who are seeking mental health services. Additionally, this measure may be prone to underreports of depression in males due to modern masculinity norms (Iwamoto et al., 2018). However, many studies have documented using this scale including a nonclinical sample involving males. Consequently, there is little reason to believe that this scale would distort the results in any way that may impact the study's hypotheses testing.

Lastly, the survey was advertised using the researcher's social media accounts. While this does contribute towards reaching the population which the research question aims to address (young adults who actively use smartphones), it does limit the scope of the survey response to contacts of the researcher, who predominately live in Dublin. Thus, this convenience sample may not be generalisable to the entire population of young adults in Ireland. For instance, most of the survey respondents resided in urban areas (85.4%) rather than rural areas (14.6%). Future research should be advertised on a wider scale, and attempts should be made to recruit participants from a more diverse demographic sample.

This study also had a number of strengths. The age of the sample used in this study was individuals aged 18 – 30 years old. It is frequently understood that this demographic is particularly vulnerable in developing addictive smartphone behaviours (Cha & Seo, 2018; Haug et al., 2015). Therefore, the age of the participant sample is considered a strength of this study, as it is likely to be representative of the most susceptible age group to adopt behaviours of an addictive nature regarding smartphone use.

The survey used in this study was distributed online, which facilitated ease of access for many participants as it did not especially limit the geographical scope of the research, as is often the case with pen and paper surveys. This also allowed participants to complete the

survey in a location that was familiar and convenient to them. While this does reduce the researcher's control of the experimental environment, this is considered as a strength of the study as it may have reduced participants' test anxiety on the day the study was completed.

A prevailing strength of this study remains in the fact that this research provides further support to the growing literature regarding the relationship between anxiety, depression and loneliness with addictive smartphone behaviour (Elhai et al., 2017; Musumari et al., 2020). More categorically, it addresses a gap in the literature regarding the scarcity of such research that has taken place in the context of COVID-19 within Ireland.

This study's findings build upon existing literature concerning the relationship between anxiety, depression and loneliness with excessive smartphone use. Therefore, a practical implication of the present study is that the possibility of addictive smartphone behaviours during COVID-19 should be addressed thoroughly on a societal level, as to combat the negative impacts it may have on mental health. Based on our findings, broader implications should involve the minister for health (Stephen Donnelly), and the minister for education, research, innovation and science (Simon Harris) implementing new policies emphasising the perilous effects that addictive smartphone behaviours during COVID-19 may have on individuals. Moreover, in light of The World Health Organisation's encouragement to utilize technology to mitigate the spread of COVID-19, Irish public health bodies such as the Health Service Executive (HSE) may consider undertaking new campaigns highlighting the negative impact that excessive smartphone use can have on mental health. Guidelines which incorporate behaviour change techniques on how to use smartphone devices in moderation should be released, targeting young adults, particularly females, as this research study suggests that these individuals are most vulnerable. This would be in the interest of national public health, as there is growing evidence outlining the many negative mental health outcomes related to behaviours that resemble smartphone addiction. Public

health bodies should consider implementing these targeted interventions in the near future as there is an increasing number of studies that show that smartphone use is in fact rising since the arrival of COVID-19 (Elhai et al., 2020). As such, any addictive smartphone behaviours that may have developed and negative health effects arising from such behaviours could potentially endure after COVID-19 restrictions have ceased. The application of such recommendations may play an important role in reducing negative mental health outcomes, and may necessitate additional governmental funding for further research examining preventative, protective and therapeutic programs for those in Irish society who may be vulnerable to addictive smartphone behaviour.

Conclusions

This study compounds upon the existing evidence that anxiety, depression and loneliness are all related to smartphone behaviours of an addictive nature, and that young female adults may be predisposed to such behaviours. Future studies could offer new insights to this phenomenon by including study participants from diverse backgrounds and including measurements of confounding variables. For example, it would be of interest if key-workers are as susceptible to addictive smartphone behaviours as those who are working from home. Additionally, a survey of coping mechanisms could investigate if maladaptive coping styles are linked to addictive smartphone behaviours. This research could also shed light on lifestyle behaviours which promote resilience to addictive smartphone behaviours. Furthermore, longitudinal studies could identify any patterns within variables that leads to addictive smartphone behaviours in vulnerable populations, whilst quantifying any lasting negative effects that is caused by such behaviours. The present research highlights the link between depression, anxiety, loneliness and addictive smartphone behaviours. This study has the potential to inform public policy concerning safe smartphone use during the COVID-19 pandemic. The HSE should implement a public health campaign which emphasises the

possible negative impacts resulting from excessive smartphone use, featuring tips on how to

negate these impacts.

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Appendices

Appendix I

SAS

The Smartphone addiction scale (SAS) is a scale intended to measure behaviours relating to smartphone addiction that consisted of 33 items with a six-point Likert scale (1: ''strongly disagree'' and 6: ''strongly agree'') based on self-reporting.

1. Missing planned work due to smartphone use

2. Having a hard time concentrating in class, while doing assignments, or while working due to smartphone use

3. Experiencing lightheadedness or blurred vision due to excessive smartphone use

4. Feeling pain in the wrists or at the back of the neck while using a smartphone

5. Feeling tired and lacking adequate sleep due to excessive smartphone use

6. Feeling calm or cosy while using a smartphone

7. Feeling pleasant or excited while using a smartphone

8. Feeling confident while using a smartphone

9. Being able to get rid of stress with a smartphone

10. There is nothing more fun to do than using my smartphone

11. My life would be empty without my smartphone

12. Feeling most liberal while using a smartphone

13. Using a smartphone is the most fun thing to do

14. Won't be able to stand not having a smartphone

15. Feeling impatient and fretful when I am not holding my smartphone

16. Having my smartphone in my mind even when I am not using it

17. I will never give up using my smartphone even when my daily life is already greatly affected by it

18. Getting irritated when bothered while using my smartphone

19. Bringing my smartphone to the toilet even when I am in a hurry to get there

20. Feeling great meeting more people via smartphone use

21. Feeling that my relationships with my smartphone buddies are more intimate than my relationships with my real-life friends

22. Not being able to use my smartphone would be as painful as losing a friend

23. Feeling that my smartphone buddies understand me better than my real-life friends

24. Constantly checking my smartphone so as not to miss conversations between other people on Twitter or Facebook

25. Checking SNS (Social Networking Service) sites like Twitter or Facebook right after waking up

26. Preferring talking with my smartphone buddies to hanging out with my real-life friends or with the other members of my family

27. Preferring searching from my smartphone to asking other people

28. My fully charged battery does not last for one whole day

29. Using my smartphone longer than I had intended

30. Feeling the urge to use my smartphone again right after I stopped using it

31. Having tried time and again to shorten my smartphone use time, but failing all the time

32. Always thinking that I should shorten my smartphone use time

33. The people around me tell me that I use my smartphone too much

Appendix II

DASS-21

Please read each statement and circle a number 0, 1, 2 or 3 which indicates how much the statement applied to you over the past week. There are no right or wrong answers. Do not spend too much time on any statement. The rating scale is as follows: 0 Did not apply to me at all - NEVER 1 Applied to me to some degree, or some of the time - SOMETIMES 2 Applied to me to a considerable degree, or a good part of time - OFTEN 3 Applied to me very much, or most of the time - ALMOST ALWAYS

1. I found it hard to wind down 0 1 2 3

2. I was aware of dryness of my mouth 0 1 2 3

3. I couldn't seem to experience any positive feeling at all 0 1 2 3
4. I experienced breathing difficulty (eg, excessively rapid breathing, breathlessness in the absence of physical exertion) 0 1 2 3
5. I found it difficult to work up the initiative to do things 0 1 2 3
6. I tended to over-react to situations 0 1 2 3
7. I experienced trembling (eg, in the hands) 0 1 2 3
8. I felt that I was using a lot of nervous energy 0 1 2 3
9. I was worried about situations in which I might panic and make a fool of myself 0 1 2 3
10. I felt that I had nothing to look forward to 0 1 2 3 I found myself getting agitated 0 1 2 3
11. I found it difficult to relax 0 1 2 3 I felt down-hearted and blue 0 1 2 3
12. I was intolerant of anything that kept me from getting on with what I was doing 0 1 2 3
13. I felt I was close to panic 0 1 2 3 I was unable to become enthusiastic about anything 0 1 2 3
14. I felt I wasn't worth much as a person 0 1 2 3
15. I felt that I was rather touchy 0 1 2 3
16. I was aware of the action of my heart in the absence of physical exertion (eg, sense of heart rate increase, heart missing a beat) 0 1 2 3
17. I felt scared without any good reason 0 1 2 3 I felt that life was meaningless 0 1 2 3

Appendix III

UCLA LONELINESS SCALE

Description of Measure: A 20-item scale designed to measure one's subjective feelings of loneliness as well as feelings of social isolation. Participants rate each item as either O ("I often feel this way"), S ("I sometimes feel this way"), R ("I rarely feel this way"), N ("I never feel this way").

INSTRUCTIONS: Indicate how often each of the statements below is descriptive of you. C indicates "I often feel this way" S indicates "I sometimes feel this way" R indicates "I rarely feel this way" N indicates "I never feel this way"

1. I am unhappy doing so many things alone O S R N

2. I have nobody to talk to O S R N

3. I cannot tolerate being so alone O S R N

4. I lack companionship O S R N

5. I feel as if nobody really understands me O S R N

6. I find myself waiting for people to call or write O S R N

7. There is no one I can turn to O S R N

8. I am no longer close to anyone O S R N

9. My interests and ideas are not shared by those around me O S R N

10. I feel left out O S R N

11. I feel completely alone O S R N

12. I am unable to reach out and communicate with those around me O S R N

13. My social relationships are superficial O S R N

14. I feel starved for company O S R N

15. No one really knows me well O S R N

16. I feel isolated from others O S R N

17. I am unhappy being so withdrawn O S R N

18. It is difficult for me to make friends O S R N

19. I feel shut out and excluded by others O S R N

20. People are around me but not with me O S R N

Scoring: Make all O's =3, all S's =2, all R's =1, and all N's =0. Keep scoring continuous.

Appendix IV

CAS

The Coronavirus Anxiety Scale (CAS) is a self-report mental health screener of dysfunctional anxiety associated with the coronavirus outbreak. Due to a significant number of people experiencing clinically significant fear and anxiety during infectious disease outbreaks, the CAS was developed to help clinicians and researchers efficiently identify cases of individuals functionally impaired by coronavirus-related anxiety.

Each item of the CAS is rated on a 5-point scale, from 0 (not at all) to 4 (nearly every day), based on experiences over the past two weeks.

0 - Not at all

1 - Rare, less than a day or two

2 - Several days

3 - More than 7 days

4 - Nearly every day over the last 2 weeks.

Mark only one oval.

1. I felt dizzy, lightheaded, or faint, when I read or listened to news about the coronavirus

2. I had trouble falling or staying asleep because I was thinking about the coronavirus

3. I felt paralysed or frozen when I thought about or was exposed to information about the coronavirus

4. I lost interest in eating when I thought about or was exposed to information about the coronavirus

5. I felt nauseous or had stomach problems when I thought about or was exposed to information about the coronavirus

Appendix V

Participant Information Leaflet

Investigating the Relationship Between Anxiety, Depression & Loneliness with Addictive Smartphone Behaviour Amongst Young Adults During the Covid-19 Pandemic.

You are being invited to participate in a research study. Upon deciding whether or not to choose to take part in this current study, please take the time to read this document in entirety. It will explain the nature of the research, why it is taking place and what exactly it would involve for you. In the case that you may have any questions about the information provided, please do not hesitate to contact me using the details at the end of this sheet.

What is this study about?

My name is Rory Boland and I am a final year student in the BA in Psychology programme at National College of Ireland. Each student must carry out an independent research project as part of our degree. The aim of the current proposed study is to investigate whether there is a relationship between anxiety, depression & loneliness with addictive smartphone behaviour amongst young adults during the COVID-19 pandemic. This study will be supervised by Dr Michelle Kelly.

What will taking part in the study involve?

If you decide to participate in this research, you will be asked to complete a series of online questionnaires which are intended to measure your perceived anxiety, depression, stress, loneliness and personal smartphone use levels during COVID-19. These questionnaires should take no longer than 20 minutes to complete.

Who can take part?

You may take part in this study if you are of the ages between 18-30, operate a smartphone and only if you choose to be a participant by way of your own independent choice. You may not take part in this study if you are under the age of 18. You also may not take part in this study if you are 31 years of age or older. This exclusion criteria will be applied due to previous literature that acknowledge young adults between such ages as the most liable population to adopt addictive smartphone behaviours.

Do I have to take part?

The participation in this study is completely voluntary and each participant will have the right to refuse to participate. If you do decide to take part in this study you also have the right to withdraw without any consequences whatsoever. It should be noted that it will not be possible to withdraw your data upon the completion of the questionnaires. This is because, after completing the questionnaires, the results are immediately anonymised, therefore, individual responses will not be identifiable.

What are the possible risks and benefits of taking part?

There is no guarantee that there will be any benefits to you in taking part in this research. However, the information retrieved will contribute to research that helps us further understand how anxiety, depression and feelings of loneliness may lead to addictive smartphone behaviours, which can impact both physical and mental health. A possible benefit for you in taking part in this research is learning how certain mental states such as anxiety, depression and loneliness may affect your behaviours such as; impulsive or intensive smartphone use. A possible benefit may also lie within your honest answering of the questionnaires, which may allow for the personal assessment of your own mental states, and if they influence you to adopt addictive smartphone behaviours, and to what extent. Upon collection and analysis of all data, the findings of the research will be discussed in detail, and the researcher aims to touch on existing research that may aid in negating such negative behaviours. Due to certain sensitive questions that involve personal feelings and behaviours, there is a slight possibility that some participants may experience minor distress upon filling out the questionnaires. In this instance, you may choose not to complete and exit the questionnaires. If you do submit data and still feel in any way distressed, please do not hesitate to contact the relevant support services that are provided at the end of the debriefing sheet.

Will taking part be confidential and what will happen to my data?

Taking part in this study will be confidential. All questionnaire used are anonymous, meaning it is not possible to identify a participant based on their responses to the questionnaire. All data collected for the study will be treated in the strictest confidence. The data from this research will be saved for 5 years, which is in accordance with NCI's data retention policy. The only non-anonymised data that will be retained will be the online consent forms that will display a ticked box indicating consent, which will also be safely stored in a robust password protected encrypted file on the researcher's private college computer, which will also be password protected.

What will happen to the results of the study?

The full results of this study will be presented in my final year dissertation, which will be submitted to National College of Ireland. If you feel it is necessary to obtain any further information, please do not hesitate to contact the researcher (Rory Boland) or the study's supervisor (Dr Michelle Kelly). Please see the relevant contact details below. Thank you.

Rory Boland,

Final Year BA Psychology Student & Researcher at National College of Ireland,

X18102123@student.ncirl.ie

Dr Michelle Kelly,

Research Supervisor & Lecturer in the Department of Psychology at National College of Ireland,

Michelle.Kelly@ncirl.ie

Appendix VI

Consent Form

In participating in the current research, I understand and agree to the following:

This research is being conducted by Rory Boland, a final year undergraduate student at the School of Business, National College of Ireland.

The method proposed for this research project has been approved in principle by the Departmental Ethics Committee of National College of Ireland, which means that the Committee does not have concerns about the procedure itself as detailed by the student. It is, however, Rory Boland's responsibility to adhere to ethical guidelines in the dealings with participants and the collection/handling of data.

If I have any concerns about participation, it is understood that, in accordance with the Freedom of Information legislation, I can refuse to participate or withdraw my data at any time up until the submission of the questionnaires.

I have been informed as to the general nature of the study and it is of my own independent volition that I choose to participate.

There are no known discomforts or safety risks associated with participation.

All data from the present study will be treated in a confidential manner. The data from all participants will be collected, analysed, and submitted in the final report to the Psychology Department in the School of Business at National College of Ireland. The only information that will be non-anonymous will be that of a checked box on the consent form. No participant's data will be released by name at any stage of the data analysis or in the final report.

At the conclusion of my participation, any questions or concerns I may have will be fully addressed by the researcher or the study's supervisor.

I may withdraw from this study at any time up until submission of the questionnaires if I have any concerns.

Signed: _____

Participant _____

Researcher _____ Date _____

Appendix VII

Debriefing Sheet

Thank you for taking part as a research participant in the present study investigating the relationship between anxiety, depression and loneliness with addictive smartphone behaviour amongst young adults during the COVID-19 pandemic. This research's aims were to determine if individuals displayed addictive smartphone behaviours due to a hypothesised elevation in levels of anxiety, depression and loneliness in response to the COVID-19 pandemic. Another aim of this study was to examine the difference of addictive smartphone behaviour within males and females, as it was hypothesised based upon previous literature, that females may display higher levels of addictive smartphone behaviour.

The questionnaires used in this study are confidential and any data submitted in the study will be immediately automatically anonymised. This means, that submitted data will not be identifiable, therefore, data will not be retrievable in the case of withdrawing data after the completion of the questionnaires. All data collected from this research will be used for the sole purpose of the head researcher's final year undergraduate dissertation. In line with National College of Ireland policies, all collected data from this study will be stored for 5 years. To ensure confidentiality, the data will be secured on a password encrypted file on a proven robust password protected private computer, operated and accessible only by the head researcher.

In the event that you feel in any way psychologically distressed before, during or after interacting with this study, it is kindly advised to contact the relevant helpline phone numbers and support groups that are provided below to seek emotional support if necessary.

Pieta House: 1800 247 247

Grow: 1890 474 474

Aware Support Line: 1800 80 48 48

Samaritans Support Line: 116 123

Shine: 1890 621 631

Irish Advocacy Network: (01) 872 8684

If you feel it is necessary to obtain any further information, please do not hesitate to contact the head researcher or the study's supervisor, please see their relevant contact details below.

Rory Boland,

Final Year BA Psychology Student & Researcher at National College of Ireland,

X18102123@student.ncirl.ie

Dr Michelle Kelly,

Research Supervisor & Lecturer in the Department of Psychology at National College of Ireland,

Michelle.Kelly@ncirl.ie

Thank you for participating in this study.

Appendix VIII

Figures 1 - 5

Figure 1

Histogram and Q-Q plot showed normal distribution of data for the smartphone addiction scale.
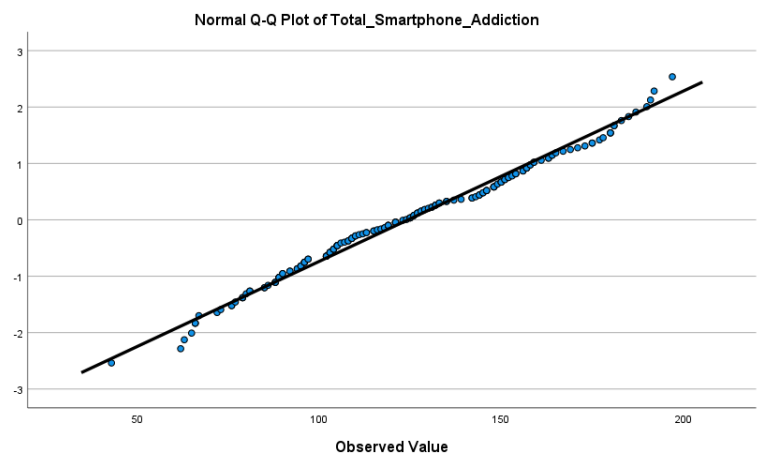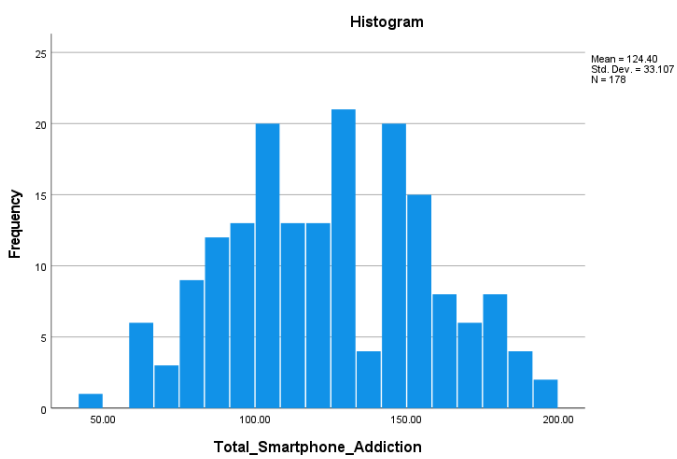
Figure 2

Histogram and Q-Q plot showing non-normal distribution of data for the UCLA loneliness scale.
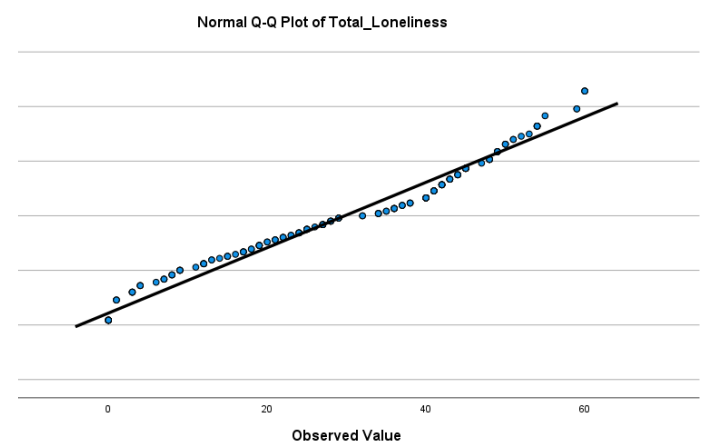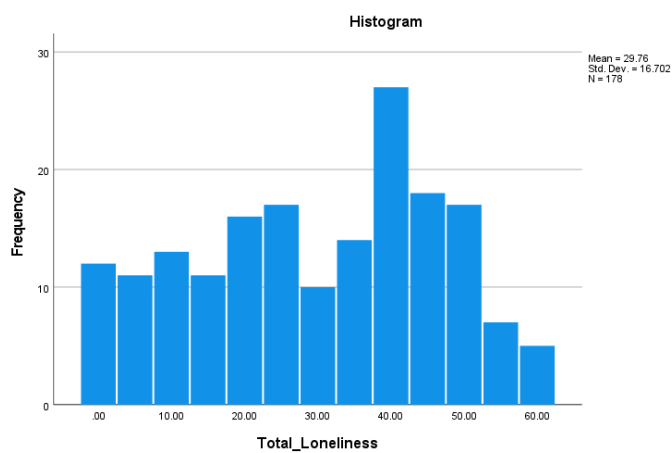
Figure 3

Histogram and Q-Q plot showing non-normal distribution of data for the DASS-21 anxiety subscale.
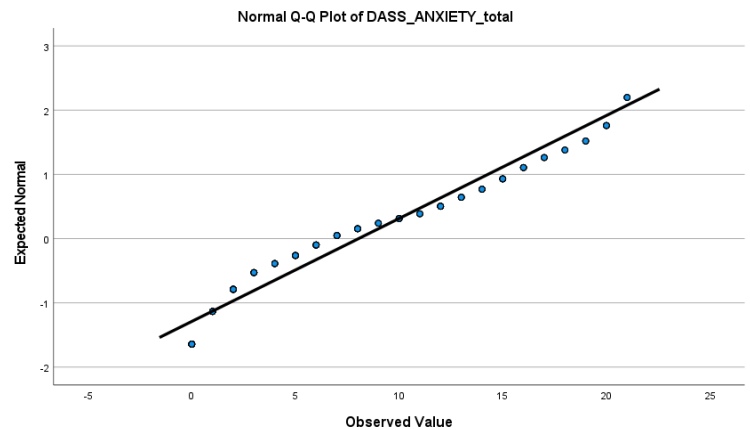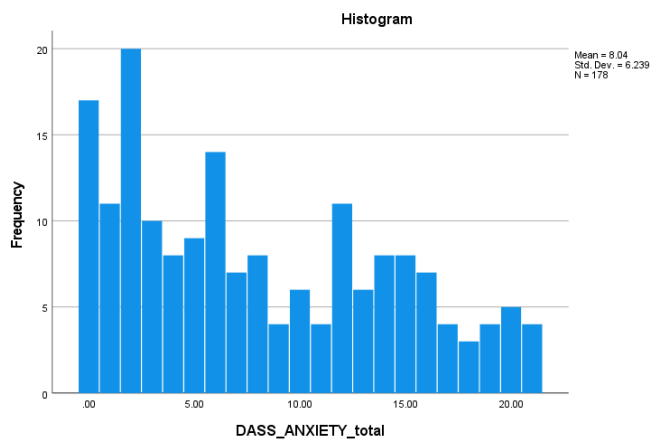
Figure 4

Histogram and Q-Q plot showing non-normal distribution of data for the DASS-21 depression subscale.
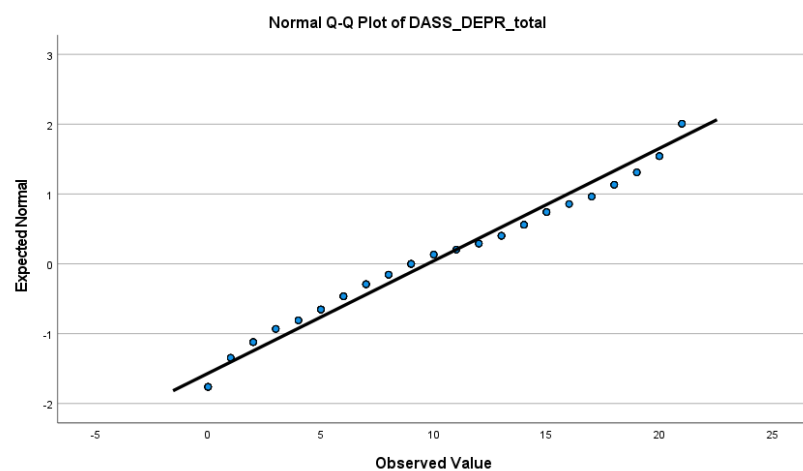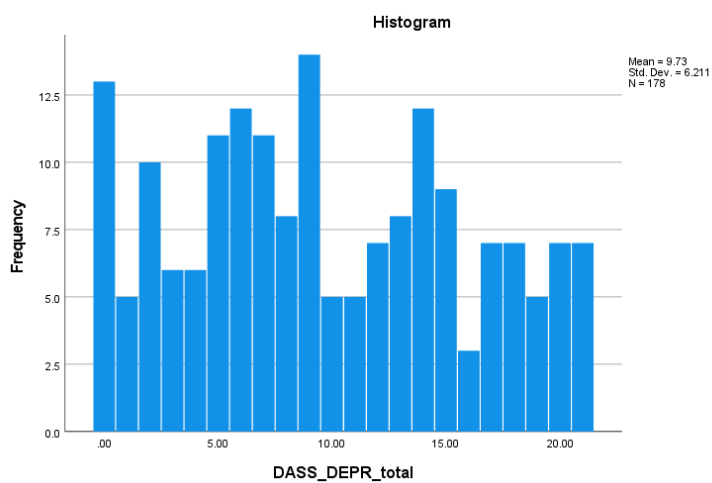
Figure 5

Histogram and Q-Q plot showing non-normal distribution of data for the Coronavirus Anxiety scale.
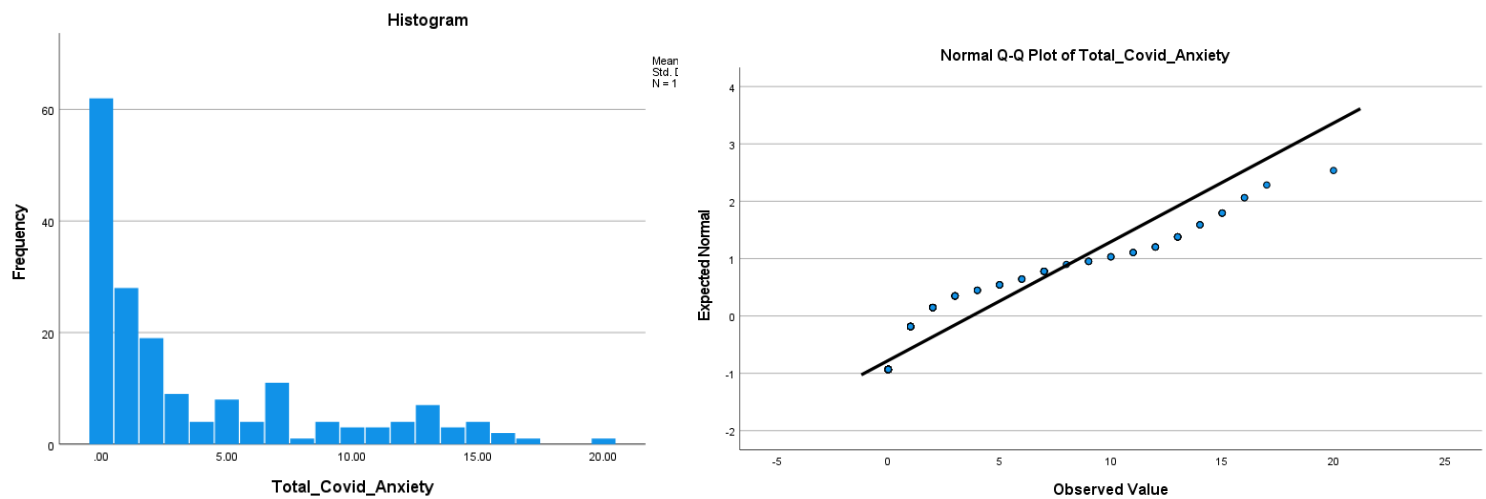
Appendix IX

Evidence of SPSS Data File and Output