The relationship between smartphone use and the development of mental health issues.

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Abstract

Within media culture, there has been a notable increase in the discussion of excessive smartphone use and the possible negative health consequences elicited by this modern problem. A literature search revealed only a small amount of empirical research relating to these smartphone devices, and hardly any connecting smartphone overuse with symptoms of depression, stress and/or anxiety.

This study used internet testing and was correlational and cross sectional in design. A snowball sample of participants were sought from Facebook, yielding responses from 92 females and 27 males across various age groups. The self-report questionnaires; Smartphone Problematic Use Questionnaire and the Depression Anxiety and Stress Scale (DASS) 21 were administered.

This study found a moderate positive significant relationship between levels of smartphone use and symptoms of depression, stress and anxiety, hence, as smartphone use increases, so too does the problematic disorders. Results also concluded that no significant difference was found between males and females, or across age groups, with regards overuse of smartphones and the development of symptoms of depression, stress and anxiety.

In conclusion, it is safe to propose from this research that smartphones have negative health influences over users when used in excess. Further research might be valuable to delve deeper into other aspects of this trending issue.

Introduction

The smartphone belongs to the latest generation of the mobile phone. It is, in essence, a handheld computer device, with a touchscreen interface, which alleviates the constraints of the home or the office (Oxforddictionaries.com, 2015). Since the development of the first personal computer in the 1980's and the progression to the provision of an internet mechanism in the 1990's, the tech world has expanded rapidly to provide us with instantaneous connectivity via the smartphone (Lane & Manner, 2011). This new age mobile phone allows people to engage in much more than just one on one communication via calls and text messages. Individuals can surf the web, browse social networks, manage their email and banking, play video games, listen to music and much more (Billieux, 2012). According to EMarketer.com (2015), the global smartphone audience reached 1.75 billion in 2014 and they expect smartphone adoption to continue on a fast-paced trajectory through to 2017.

A recent Eircom Household Sentiment survey (2014) revealed that 61% of the Irish population own a smartphone, which equates to just over 2 million users. An Irish mobile youth report in 2014 discovered that of the 800 15-35 year olds surveyed, 96% own a smart phone and of those, 90% check their mobiles 'As Soon as they wake up' (Thinkhouse.ie, 2014). An International Data Corporation research report in the U.S (2013) surveyed 7,446 18-44 year olds and discovered that 79% of respondents keep their phone on or near them for all but 2 hours of their day and shockingly 1 out of 4 of all respondents could not recall a time in their day when their phone was not within arm's reach or in the same room (Levitas, 2013). These statistics highlight not only the striking levels of usage of smartphones but also the seemingly indispensable reliance on such devices.

Benefits and Caveats

Along with money and keys, smartphones have quickly becomes one of the three survival tools to carry on your person (Emanuel et al, 2015). As mentioned above, this mobile computer provides the user with text-messaging, calls, email, web browsing, still photos and video cameras, MP3 players, video playback, as well as the ability to run free and paid applications (Emanuel et al, 2015). The combination of mobile services with the internet has made living easier for individuals. Social networking facilitates global communication among people through applications like Facebook and Twitter (Agarwal & Kar, 2015). Similar applications like WhatsApp and Skype provide free phone calls for family and friends to stay connected anywhere in the world (Groarke, 2014). While some use their smartphones for mere communication, others use it for entertainment; listening to music, watching movies, shopping, playing online games, etc. (Agarwal & Kar, 2015). Smartphones have increasingly been integrated into people's professional lives as well as social. They provide better communication internally and externally and also help increase the efficiency and effectiveness of an organisation's activities (Ean et al., 2012).

Conversely**,** as popular as smartphones have become, they are not without their downsides. Excessive smartphone use can lead to maladaptive behaviours such as pathological gambling and an unhealthy relationship with pornographic material; it can decrease face to face social interaction; it can create problems within relationships; smartphone overuse can interfere with school and decrease academic ability and can even cause physical health problems such as pain in the wrists or back of neck and blurred vision (Choi et al., 2014).

Statistics from Digital Trends (2015) show that 70% of people use their smartphone while driving. This is not just for checking text messages or making calls but more worryingly people are checking their social media platforms for updates (Chang, 2015).

Despite these caveats, the multifunctional smartphone device continues to aid the increasing importance of digital mobility and connectivity.

Addiction

Weinstein and Lejoyeux characterise problematic internet use as the "excessive or poorly controlled preoccupations, urges or behaviours regarding Internet use that lead to impairment or distress" (Weinstein & Lejoyeux, 2010, p277). Running congruently with internet addiction, this new age mobile phone with internet capabilities, has led to much research in the area of smartphone addiction. Surprisingly, a new word has surfaced in the English language which describes this smartphone dependency accurately; *Nomophobia* (King et al, 2013). Nomophobia is abbreviated from 'No mobile phone phobia' and describes the anxiety of losing the smartphone or the fear of being out of mobile phone contact (Emanuel et al., 2015, p 292). Excessive smartphone use can lead to many psychological consequences. These include imbalance of real-life relationships, sleep, education and work; problems with verbal memory and attention; low wellbeing and high loneliness; and increased aggression, hostility and stress (Choi et al., 2014).

Behavioural addiction, like substance addiction, occurs when individuals find it difficult to control the frequency with which they partake in previously harmless behaviours such as shopping, sex, exercise and work (Tao et al, 2010). According to Rush (2011), smartphone problematic behaviours can elicit similar symptoms to substance addiction. These are listed as: *Indispensability* – the physical closeness and high value of utility of the phone; *Behavioural salience* – the smartphone has enough importance that it requires attending to*; Interpersonal conflict and relapse* – the conflict with colleagues, family and friends based on smartphone usage and the individual's relapse after and attempt to limit its use; *Decreased productivity* – the distraction and conflict with other activities, *Emotional*

connection – developed by personalisation of the phones features and the habits acquired from its use; *Loss of control*- relates to losing track of time while the smartphone is in use, negative impacts on academic or occupational work, sleep deprivation along with social difficulties; and finally, *Withdrawal* – experienced if unable to access the stimulus in which they are dependent upon (Rush, 2011). This study operationalises problematic use of smartphones as an excessive behaviour and looks to examine the negative behavioural consequences of this.

Stress

Stress is defined as "a negative emotional experience accompanied by predictable biochemical, physiological, cognitive, and behavioural changes that are directed either toward altering the stressful event or accommodating to it effects (Taylor, 2012, p. 113)". Technostress is a new age form of stress which one can suffer as a direct or indirect result of technology and which can cause both physiological and psychological symptoms for the user (Fox, 2014). As smartphones have increasingly been integrated into people's professional lives as well as social, this may create a demand to be available or reachable regardless of time and space (Thomée et al, 2011). Singh and Yadav (2015) explain that the relentless need to immediately review and respond to every alert on the phone can cause stress so grave that the user can begin to hear phantom vibrations or rings. Fox (2014) notes that there is a lack of research which has identified specific technologies and the impact that these have on technostress, signifying that more needs to be done in this area.

Anxiety

Anxiety was originally defined by Freud as an emotional state which includes feelings of tension, nervousness, apprehension and worry, and these feelings are accompanied by physiological arousal in the body (Spielberg, 2013). Research has shown that adolescent's preferred choice of communication via mobile phones is text messaging (Thinkhouse.ie, 2014). Individuals who are dependent upon this form of communication to stay close to friends and family, can sometimes devote too much attention to message replies, or the lack of. When an immediate response is not received, this can lead to negative feelings of isolation, and in turn, increased anxiety about being ostracised from their inner circle (Lu et al, 2011). Mobile phones may also be considered as status symbols for many Individuals; having the best make or model adds extra pressure to individual (Shambare et al, 2012). For many, it is difficult to strike the balance between feeling cut off from the real world when lost in the online domain and separation anxiety when the phone is not in your hand (Notaro, 2015). Current research is very limited when it comes to the psychological effects of excessive mobile phone use, however, negative outcomes associated with problematic internet appears to be a very consistent theme within the literature (Calpin et al, 2009), indicating a need for further in depth research into smartphone use and anxiety levels.

Depression

One in ten people in Ireland suffer from depression (Aware.ie, 2015). Depression is defined by the Encyclopaedia Britannica (2014) as an emotional state marked by feelings of low self-worth, guilt and an inability to enjoy life. Research has shown that some self-reported symptoms associated with using mobile phones most commonly include headaches, earache and sometimes also perceived concentration difficulties and fatigue (Thomée et al, 2011). Psychiatrist Dr. Paul Bester believes that excessive exposure to smartphone screen

time is contributing to mental illnesses like depression. He believes this mobile computer system is changing the ways in which children behave and their views the world (Allen, 2015). Poor sleep has emerged as a relevant health problem in technologically advanced societies. Because sleep is a biological mechanism related to mood regulation (Thomée, et al., 2011), it is no surprise that adolescents with sleep related issues, caused by problematic internet use, experience symptoms of depression (Cheung & Wong, 2011).

Although mobile phone and/or internet addiction is not listed in the DSM-V as a disorder, other addictive disorders such as alcoholism or drug abuse tend to coincide with the presence of depression (Young & Rogers, 1998). The concept of internet addiction is only now gaining credibility, therefore it is important to examine this subject further and attempt to correlate if smartphone over use can contribute to the symptoms of mental illnesses such as depression.

Demographic Differences

Previous research largely focuses on 18-22 year olds with regards mobile phone use, as these are the first adult generation to have grown up with mobile phone access (Forgays et al, 2014). Billieux (2012) noted that young age was also shown to predict more elevated actual use and symptoms of dependence on the mobile phone. This may be because young adults have different schedules than adolescents and they have the luxury to determine their own use of these computer devices, attributing to higher use of smartphones among this generation (Demirci et al, 2014). This leaves a noteworthy gap in the literature regarding older age groups and their use of smartphone technology. Billieux (2012) also highlights some gender differences regarding problematic use of the mobile phone. Some studies have found that women have more intensive actual use of the mobile phone than men do and other studies have shown that females are more prone to experience dependence on the mobile

phone (Billieux, 2012). While females tend to use their phones more for conversing; texting, talking and social networking, applications such as games appear to be more attractive to males (Griffiths, 2013). The aim of this current research is to exam gender and age differences in smartphone use alongside the potential development of problematic disorders.

Current Study

Mental health issues have been on the rise in recent eras (Olfson et al, 2015) and mobile phone addiction is considered possibly the biggest non-drug addiction of the twenty first century (Shambare et al, 2012). More and more people believe that their smartphone use is negatively affecting their lives. As the literature review has shown, research to this point has largely focused on the addictive quality of mobile phone use or internet use, and there has been quite limited research in the area of smartphones in particular. Previous literature also discusses the health effects of excessive mobile phone and internet use (Choi et al., 2014), but not specific to the smartphones.

The current study aims to investigate whether there are associations between the frequency of smartphone use and mental health symptoms. This paper proposes that high levels of smartphone use will be associated with higher scores on the DASS 21 scale (Gomez, 2014). It is also proposed in this research that males and females will differ significantly in the development of emotional and behavioural disorders due to the over use of their smartphone. And finally, the current paper also suggests that there will be significant age differences in relation to the over use of smartphones and the emergence of psychological issues.

Hypotheses

The first hypothesis (H1) proposes that participants with high levels of smartphone use will be associated with higher levels of depression.

The second hypothesis (H2) proposes that high levels of smartphone use will predict higher scores of anxiety.

The third hypothesis (H3) proposes that participants with high levels of smartphone use will be related to higher levels of stress.

The fourth hypothesis (H4) proposes that significant difference will appear between males and females with regards overuse of smartphones and the development of symptoms of depression, stress and anxiety.

The fifth hypothesis (H5) proposed there will be significant age differences in the overuse of smartphones and the levels of depression, stress and anxiety.

Method

Participants

Individuals over the age of 18 who owned a smartphone were a requirement for the participation in this research. A convenience and snowball sample consisting of the general public were recruited through the social networking site; Facebook. The survey was displayed via a link hosted by Google Forms on a Facebook page, and friends, family and other acquaintances took the liberty to share this link on their own pages also. The participants were sought in an anonymous manner as they were able to access the questionnaire without any contact from the researcher. Participation was voluntary without any incentives offered. The study consisted of one hundred and twenty one participants, however two did not qualify as they did not own a smartphone, leaving the final tally at one hundred and nineteen ($N = 119$) between the ages of eighteen and sixty nine years ($M = 32.44$,$SD = 8.18$). Of the participants, there were ninety two females (77%) and twenty seven males (23%).

Design

This study used internet testing and was correlational and cross sectional in design. Hypotheses 1 to 3 placed smartphone use as the predictor variable, and depression, stress and anxiety were the criterion variables. These hypotheses were tested using Pearson's r correlation coefficient. A series of Independent samples t-tests were used to examine the differences between males and females on each of the dependent variables; smartphone use, depression, anxiety and stress, for hypothesis number 4. Finally, hypotheses number 5 was tested using a one way between groups analysis of variance. Smartphone use and age were the independent variables and stress, anxiety and depression were the dependent.

Materials

The survey began with a declaration of consent followed by questions asking the participants for their age and if they own a smartphone. Those that were over 18 and answered yes to "do you own a smartphone?", moved on to provide their gender and a series of questions asking the participants at what point in their day they turn their phone on (e.g. "Before I leave the house in the morning" or "When I arrive at work/college/other") and when they turn it off (e.g. "When I sit down for dinner"). The questionnaire also asked about their most frequently used functions (e.g. internet, social networking sites, personal calls and messaging, work emails and calls, media, tools, games and other applications). The participants were also asked to select a number of options that applied closest to their smartphone usage and behaviours (e.g. "my smartphone is my alarm", "my smartphone is my watch", "my smartphone holds pictures and videos of my family and friends" and "I sleep with my smartphone next to my bed"). The subjects then completed two previously established self-report questionnaires: the Smartphone Problematic Use Questionnaire and the DASS 21 (Depression Anxiety and Stress Scale).

Smartphone Problematic Use Questionnaire

The Smartphone Problematic Use Questionnaire was designed by Rush (2011) to assess the risk of smartphone users developing problematic use. The scale comprised of questions from Walsh et al's 'Mobile Phone Involvement Questionnaire' (2008) and also components of behavioural addiction discussed by Brown (1993, 1997). The SPUQ consists of 44 questions and 8 subscales, which include withdrawal, loss of control, indispensability, interpersonal conflict and relapse, emotional connection, behavioural salience, perceived

success and decreased productivity. Withdrawal (Cronbach's α = .79) comprised of questions 10, 14, 21, 30, 32, 35, 36, 38, 39; Loss of control (Cronbach's α = .71) included items 3, 5, 16, 17, 24, 28, 29; Indispensability (Cronbach's α = .77) consisted of items 6, 9, 12, 22, 27, 31, 37, 40; Interpersonal conflict and relapse (Cronbach's α = .78) comprised of questions 2, 7, 8, 25, 26, 42, 43; Emotional connection (Cronbach's α = .28) included the items 1, 4, 11, 19, 34; Behavioural salience (Cronbach's α = .71) consisted of items 15, 33, 44; Perceived success (Cronbach's α = .81) included the questions 20, 23, 41; and finally, Decreased productivity (Cronbach's α = .57) comprised of items 13 and 18 (Rush, 2011). While the SPUQ contained these eight subscales, it was decided to use the scale in its entirety for the purpose of this research. The Smartphone Problematic Use Questionnaire showed good overall reliability (Cronbach's α = .78) (Rush, 2011).

Participants were instructed to indicate the degree to which they agreed with the statements on a five-point Likert scale, for example, questions such as "When friends complain about how much I use my smartphone, I get upset" and "I have tried to stop myself checking my smartphone" were answered by selecting (1) Strongly Disagree, (2) Somewhat Disagree, (3) Neither Agree nor Disagree, (4) Somewhat Agree and (5) Strongly Agree. Items were totalled to compile a score ranging from 44 to 220 for each individual. A cut-off score of 110 indicated which participants were at risk of developing problematic smartphone use.

DASS 21

The Depression Anxiety and Stress Scale is a 21 item measure which is non diagnostic in nature, but designed with the intention to measure the severity of symptoms of stress, anxiety and depression in an individual (Gomez, 2014). The scale consists of

questions such as “I found it difficult to relax” and “I felt down-hearted and blue” and were measured on a scale of 0 to 3 (0, Did not apply to me at all; 1, Applied to me to some degree, or some of the time; 2, Applied to me to a considerable degree, or good part of the time; and 3, Applied to me very much, or most of the time). Participants were asked to read each of the 21 statements and select a number which indicated how much the statement applied to them over the previous week. It is important to note that as the DASS measure is non diagnostic, a number of symptoms of depression, such as loss of appetite or disturbed sleep patterns, were not covered by the questions and would need to be assessed independently (Gomez, 2014).

Each item within the questionnaire belonged to a subscale of either stress (items 1, 6, 8,11,12,14, 18) anxiety (items 2,4,7,9,15,19,20) or depression (items 3,5,10,13,16,17,21). The sum of scores was taken for each subscale and because the DASS 21 is a shortened version of the DASS (consisting of 42 questions), the final score of each subscale was multiplied by 2. When matched with the DASS profile sheet, severity rankings were obtained for each subscale, e.g. A score of 10-14 within the anxiety subscale would be considered ‘moderate anxiety’ (Gomez, 2014). Henry and Crawford (2005) reported Cronbach’s alpha values of .88 for Depression, .82 for Anxiety, .90 for Stress and .93 for the overall measure.

Procedure

Ethical approval was sought and received from Dublin Business School Ethics Board before conducting this research. The 74 item questionnaire (Appendix 2) was created using www.google.com/forms. The survey went live on January 31st, 2016 and was deactivated on February 13th, 2016. The questionnaire was posted via a link to the social networking site Facebook, and some participants took the liberty to share the link on their own Facebook page.

The first page of the questionnaire (Appendix 1) informed the participants of the purpose of this study. The title indicated it was a survey on smartphone attachment and so no further clarification was provided on the investigation. Subjects were informed that their participation was voluntary, confidential and anonymous and the survey would take approximately 10-15 minutes to complete. Contact information for the researcher was also provided here, should the participants have any questions.

Informed consent was obtained prior to completion of the questionnaire and subjects were notified that they had the right to withdraw from the study at any time before their responses had been submitted. Both age and the type of mobile phone possessed by the individual were prerequisites to partaking in the survey; Participants must be over the age of 18 and own a smartphone. Subjects then proceeded to provide their gender and were instructed to answer 8 further questions as accurately and truthfully as possible.

The questionnaire concluded by thanking the subjects for their time and provided an information page (Appendix 3) should the participant have been affected by any of the survey's content. When all questionnaires were collected, the data was entered into the Statistical Package for Social Sciences (SPSS) version 22 for analysing.

Results

Descriptive Statistics

The sample consisted of 119 participants, 92 females (77%) and 27 males (23%). Participants ranged from 18-69 years with a mean age of 32.44 (SD = 8.18) (see Table 3). Their ages were then grouped into three categories; group 1 consisted of ages 18-29 years (57 participants, 47.9%), Group 2 contained those who fell between 30-39 years (46 participants, 38.7%) and Group 3 were made up of ages 40-69 (16 participants, 13.4%) (see Figure 1).

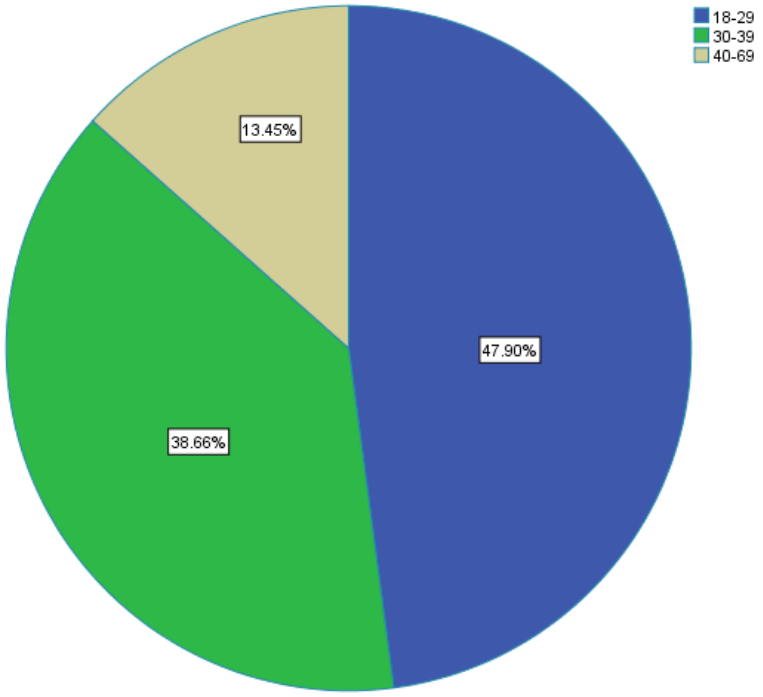

Figure 1: *Pie chart showing participants age categories*

When asked "when do you usually turn your phone on?" 96% of participants stated they never turn their phone off. Similarly, when asked "When do you usually turn your phone off?" 94% stated they never do so.

The most frequently used phone functions which were selected by participants were social networking sites (64.3%), personal phone calls and messaging (53%) and internet

(except for social networking) (41.1%). The least used phone function was games or other applications (26.4%) (See Table 1).

Table 1*: Percentage of smartphone functions in the order that they are used*

Smartphone function (%)	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Internet (except for social networking)	41.1	19.6	27.7	7.1	1.8	0.9	1.8
Social networking (Facebook, Twitter)	64.3	15.7	8.7	7.8	0.9	0.9	1.7
Personal phone calls/messaging	53.0	24.3	17.4	1.7	3.5	0	0
Work emails/phone calls	25.5	12.3	2.8	13.2	8.5	13.2	24.5
Media (Music/Movies/TV shows/Camera)	26.2	6.5	15.0	20.6	15.0	9.3	7.5
Tools (Calendar/Notepad/Calculator)	26.6	7.5	13.1	13.1	24.3	14.0	7.5
Games/Other Apps	16.0	5.7	3.8	12.3	13.2	22.6	26.4

1 = smartphone function is used the most; 7 = smartphone function is used the least

Additionally, participants were asked to indicate which of the four following options apply to them; ‘My smartphone is my alarm’ (93.3%), ‘My smartphone is my watch’ (64.7%), ‘My smartphone holds pictures and videos of my family and friends’ (95.8%) and ‘I sleep with my smartphone next to my bed’ (31.9%) (See Table 2)

Table 2: *Participants asked to indicate which of the four following options apply to them*

Indicate which of these apply to you	Yes	No	%
My smartphone is my alarm	111	8	93.3
My smartphone is my watch	77	42	64.7
My smartphone holds pictures and videos of my family and friends	114	5	95.8
I sleep with my smartphone next to my bed	38	81	31.9

Of the 94 valid Smartphone Problematic Use Questionnaire scores, 24 participants (26%) had low levels of smartphone use; a score of 109 and below, and 70 (74%) had high levels of smartphone use; a score of 110 and above. The mean score for smartphone use was 123.24 (SD = 24.61). This indicates that the average number of the sample have a high level of smartphone use. Out of a possible score of 220, the highest score was 201 (see Table 3).

Table 3: *Descriptive Statistics for Age, Smartphone problematic use and Depression, Stress and Anxiety levels*

Variables	Mean	SD	Median	Minimum	Maximum
Age	32.44	8.18	30	18	69
Smartphone Problematic Use	123.24	24.61	124	59	201
Depression	9.48	10.66	6	0	42
Anxiety	7.05	8.75	4	0	38
Stress	12.48	9.34	10	0	42

Within the DASS scale, of the 113 valid 'Stress' scores, 81 (71.5%) participants were considered to have 'normal' levels of stress (a score of 14 and below) while 32 participants (28.4%) possessed stress levels anywhere from 'mild' to 'extremely severe'. Of the 114 valid

'Anxiety' scores 71 (62.2%) participants were considered to have 'normal' levels of anxiety (a score of 7 and below) and 43 participants (37.9%) scored upwards from 'mild' to 'extremely severe'. Of the 111 valid 'Depression' scores, 69 (62.1%) participants were considered to have 'normal' levels of depression (a score of 9 and below) while 42 participants (37.8%) recorded a score ranging from 'mild' to 'extremely severe'. The mean score for stress levels was 12.48 (SD = 9.37), the mean score for anxiety levels was 7.05 (SD = 8.75) and the mean score for depression levels was 9.48 (SD = 10.66) indicating that the average number of the sample, for each subscale, possess in and around normal levels of depression, anxiety and stress. Out of a possible score of 42 for each subscale, the highest score for depression and stress were 42, and 38 for anxiety (See Table 2).

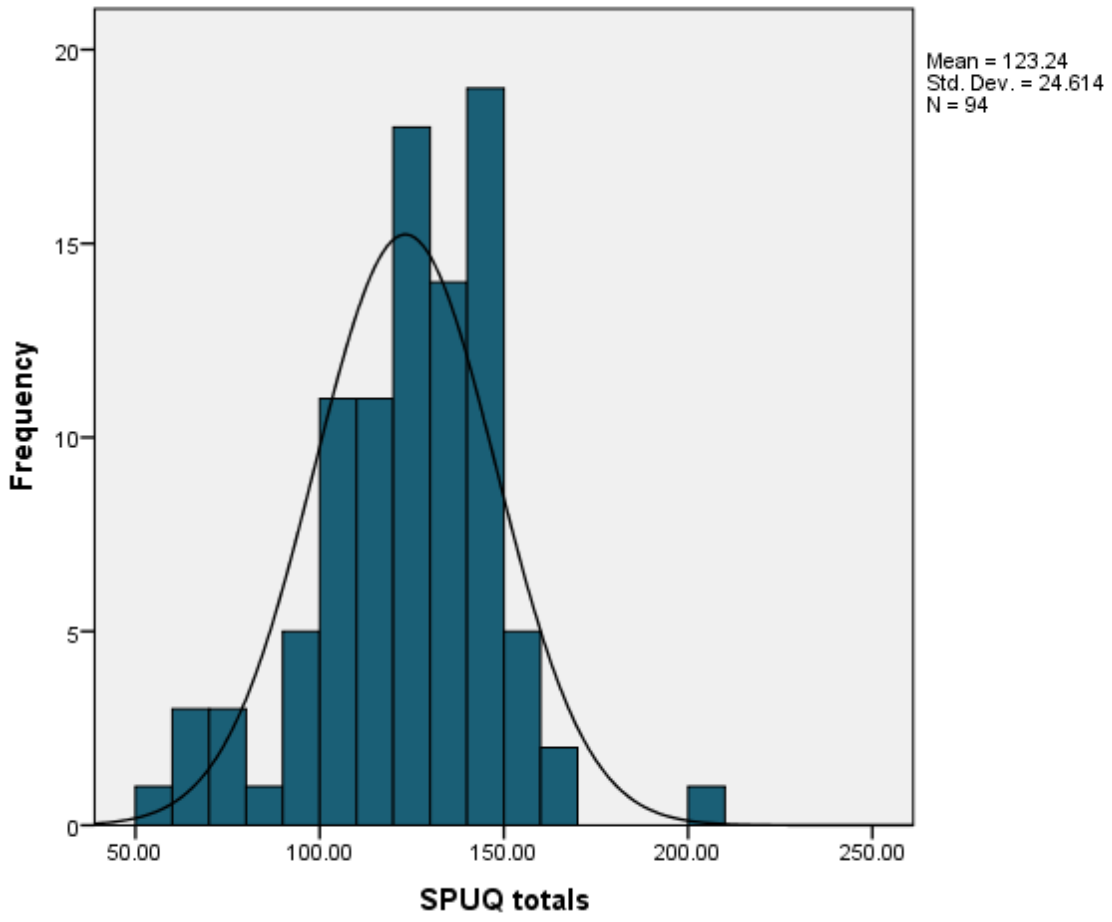

Figure 2: *Histogram of the Smartphone Problematic Use Questionnaire's distribution of scores.*

Figure 3 focuses on question 16 of the Smartphone Problematic Use Questionnaire; "I am addicted to my smartphone". This question provides an insight into people's opinions of their smartphone use. 29.6% (*n = 34)* of participants somewhat agree that they are addicted to their smartphone, while 23.5% reported they were not (*n* = 27). This comes in stark contrast to research conducted by Groake just two years ago in 2014, where it was found that approximately 54% of her sample disagreed that they were addicted to their smartphone. This is a noteworthy reflection of society's increased reliance and dependency on these portable computers.

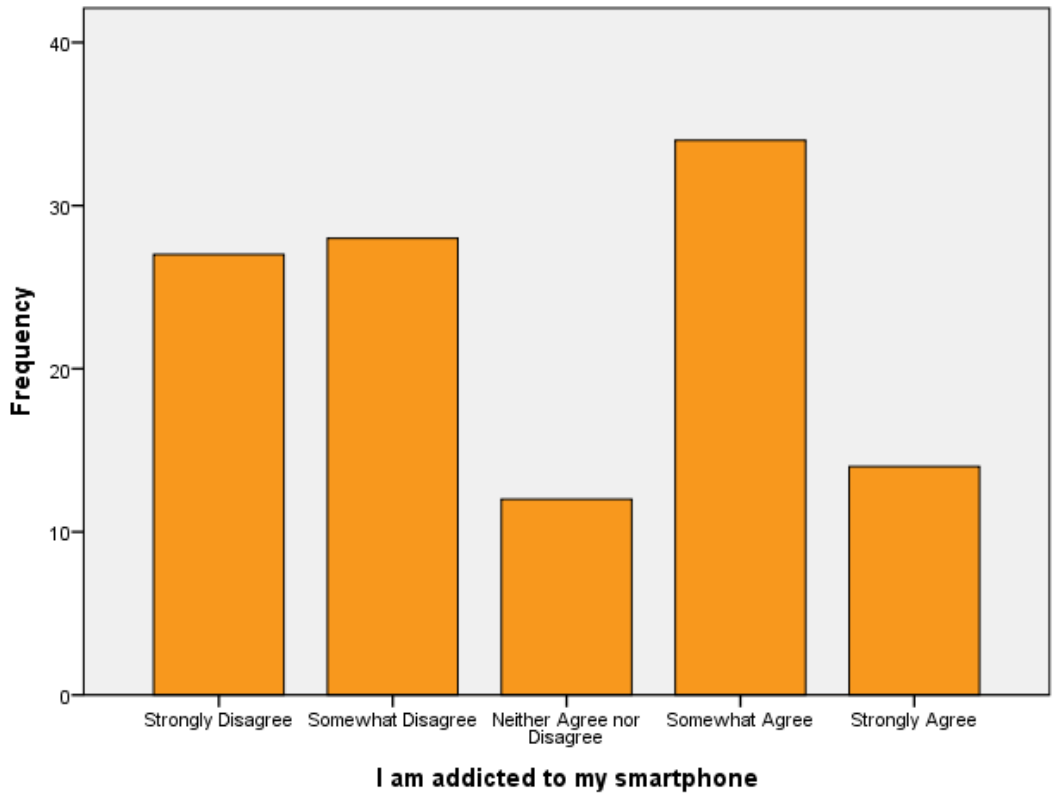

Figure 3: *Bar chart representing the responses to question 16 of the Smartphone Problematic Use Questionnaire; "I am addicted to my smartphone"*

Inferential Statistics

Normality checks were performed across all data. Each of the DASS subscales of stress, anxiety and depression displayed a degree of skewness, however the parametric tests performed were robust enough to deal with the distortions.

Hypothesis 1

A Pearson's r correlation coefficient was used to test whether high levels of smartphone use were associated with higher levels of depression. The results showed that that there was a moderate positive significant relationship between smartphone problematic use (M = 123.24, SD = 24.61) and depression (M = 9.48, SD = 10.66) ($r(89) = .34$, $p < .001$, $R^2 = 11.56\%$). Therefore the null hypothesis was rejected. This relationship can account for 11.56% of variation of scores and demonstrates that as the use of the smartphone increases, so does the level of depression.

Hypothesis 2

The second hypothesis proposes that high levels of smartphone use will predict higher scores of anxiety. A Pearson's r correlation coefficient found that there was a moderate positive significant relationship between smartphone problematic use (M = 123.24, SD = 24.61) and Anxiety (M = 7.05, SD = 8.75) ($r(93) = 0.332$, $p < .001$, $R^2 = 11.02\%$). Therefore the null hypothesis is rejected. Indicating that as smartphone use rises, so too do anxiety levels. This relationship can account for 11.02% of variation of scores.

Hypothesis 3

A Pearson's r correlation coefficient was used to test whether participants with high levels of smartphone use will be related to higher levels of stress. Results found that there was a moderate positive significant relationship between Smartphone Problematic Use (M = 123.24, SD = 24.61) and Stress (M = 12.48, SD = 9.34) (r (91) = .3, p = .004, R^2 = 9%). Therefore the null hypothesis is rejected. This relationship can account for 9% of variation of scores and illustrates that as smartphone use increases, so too do stress levels.

Hypothesis 4

A series of Independent samples t-test were conducted to test the fourth hypothesis which proposed that a significant difference will appear between males and females with regards overuse of smartphones and the development of symptoms of depression, stress and anxiety.

(a) Firstly, an independent samples t-test was conducted to compare the depression levels of both males and females. The results found that statistically there was no significant difference between depression levels of males (M = 7.17, SD = 5.84) and females (M = 10.11, SD = 11.59) (t (76.14) = 1.713, p = .091, CI (95%) -.48 -> 6.38). Therefore the null hypothesis is accepted.

(b) The same test was then conducted to compare the stress levels of both males and females. The results concluded that statistically there was no significant difference between stress levels of males (M = 10.08, SD = 7.11) and females (M = 13.16, SD = 9.81) (t (111) = 1.463, p = .146, CI (95%) -1.09 -> 7.25). Consequently, the null hypothesis is accepted.

(c) Similarly, an independent samples t-test found that statistically there was no significant difference between anxiety levels of males (M = 5.04, SD = 6.43) and females (M

= 7.62, SD = 9.25) (t (112) = 1.306, p = .194, CI (95%) -1.33 -> 6.49). Therefore the null hypothesis is accepted.

(d) And finally, an independent samples t-test found that statistically there was no significant difference between the smartphone use of males (M = 119.27, SD = 29.58) and females (M = 124.46, SD = 22.99) (t (92) = 0.86, p = .39, CI (95%) -6.74 -> 17.11). Thus the null hypothesis is accepted.

Subsequently, hypothesis four is not supported. No significant difference was found between males and females with regards overuse of smartphones and the development of symptoms of depression, stress and anxiety.

Hypothesis 5

A one-way between groups analysis of variance was conducted to discover if there was significant age differences in the overuse of smartphones and the levels of depression, stress and anxiety. Participants were divided into 3 age groups (Group 1, ages 18-29 years, *n* =57; Group 2, ages 30-39 years, *n* = 46; Group 3, ages 40-69 years, *n* = 16). The one-way ANOVA revealed that there was no statistically significant difference in smartphone use (F (2 , 91) = .80, p = .45) and levels of depression (F (2 , 108) = .57, p = .57), stress (F (2 , 110) = .79, p = .46) and anxiety (F (2 , 111) = 2.59, p = .080) across the three different age groups. Therefore the null hypothesis is accepted.

Discussion

The aim of the present study was to investigate the causal relationship between excessive smartphone use and the development of mental health issues. The variables studied included smartphone usage levels, measured by the Smartphone Problematic Use Questionnaire, and also levels of depression, stress and anxiety, measured by the DASS 21. It also aimed to expand current knowledge in the area by examining the difference in genders and age groups with regards smartphone use and the development of problematic disorders.

The first hypothesis predicted that participants with high levels of smartphone use will be associated with higher levels of depression. This hypothesis was supported. A moderate positive significant relationship was found between smartphone problematic use and depression. These findings are consistent with recent research in the area which showed that depression levels are significantly higher in a high smartphone use group versus a low smartphone use group (Demirci et al, 2015).

Secondly, it was hypothesised that high levels of smartphone use will predict higher scores of anxiety. This hypothesis was supported, with a moderate positive significant relationship found between smartphone problematic use and anxiety levels. Again, this reflects previous research which demonstrated that anxiety levels were significantly higher in a high smartphone use group than a low smartphone use group (Demirci et al, 2015). To the best of our knowledge, Demirci et al's study (2015) was one of the first studies to examine the relationship between the severity of smartphone use and depression and anxiety levels, demonstrating that this research is exploring a relatively new area.

Hypothesis three anticipated that that participants with high levels of smartphone use will be related to higher levels of stress. This hypothesis was also supported. A moderate positive significant relationship was found between smartphone problematic use and stress levels. Technostress is a phenomenon mentioned by Lee et al (2014) whereby end users

experience stress due to information and communication overload. This research coincides with findings that the overdependence on smartphones leads to user stress (Lee et al, 2014). The fourth hypothesis predicted that significant differences will appear between males and females with regards overuse of smartphones and the development of symptoms of depression, stress and anxiety. This hypothesis was rejected as no significant differences were found between males and females with regards smartphone use and problematic disorders. Previous research noted that many have regarded technology as a "boy's toy". The internet was developed by men for men with males comprising of 95% of all internet users (Weiser, 2000). So it is interesting to note that within current trends, illustrated in this research, both men and women partake in internet/technological use at similar levels. To the best of our knowledge, this is the first study examining how symptoms of mental ill-health develop from overuse across males and females and unfortunately no differences were found across genders.

The fifth and final hypothesis investigated age differences in the overuse of smartphones and the levels of depression, stress and anxiety. This hypothesis was rejected as there was no statistically significant difference in smartphone use and levels of depression, stress and anxiety across the three different age groups. The majority of research into mobile phone use has explored young adults or adolescents, placing little attention on those generations over the age of 25 (Forgays et al, 2014). With almost 94% of participants in this study aged 25 and over, this study appears to be one of the first that attempts to explore smartphone use in adult generations. While there was no correlation between smartphone over use and the development of problematic behaviours, this research still gave an insight into how dependent older generations have become on these devices.

Strengths and Implications

Firstly, this study has contributed to the research on smartphone technology. Exploration into this area of communication technology has only begun as this new age technology continues on its fast paced trajectory through 2016 and onwards. This study focuses on the negative health effects of smartphone use which is a prominent topic within media culture at present. It explored the proposition that human health has deteriorated since the introduction and expansion of the smartphone device and verified its relationship to mental health issues like depression, stress and anxiety.

This study extended research by attempting to examine all age groups and their smartphone use. Previous research into the area largely focused on adolescent audiences, as these were considered the most tech savvy, and adult populations were not fully represented. This investigation welcomed all individuals over the age of 18 to provide input on their smartphone use. It demonstrated that adults are also prone to grow dependent on their mobile phones, which in turn can produce mental health issues, revealing also that a previous generation gap is diminishing.

The significant findings of hypotheses one through three demonstrate the value of this study. The results showed that high levels of smartphone use could contribute to or even cultivate symptoms of depression, stress and anxiety. This indicates that even though smartphone addiction, mobile phone and/or internet addiction is not listed in the DSM-V as a disorder, the concepts of behavioural addiction need to be considered and examined further as they gain more and more credibility and merit inclusion in the Diagnostic and Statistical Manual of Mental Disorders.

Weaknesses and Limitations

The quantitative nature of the analysis meant that participants were restricted in their responses. Many questions required a tick for the most appropriate answer or a measurement using the Likert scale. Unfortunately, the one or two qualitative answers volunteered by participants did not warrant inclusion in this paper as there was no real theme to each response. Fully qualitative research, such as interviews, would have provided more descriptive detail, and in turn, more robust findings.

Furthermore, the self-report style questionnaires of the quantitative analysis required participants to be capable of introspection, without this they could not submit accurate responses. Additionally, many participants may have reported socially desirable responses over their true feelings and behaviours. As a result of this, the data may not be reflective of the subject's actual level of smartphone use and genuine emotional state.

The sample consisted of 119 participants and while this is a reasonable size, it limits the capacity to generalise these findings to the wider population. Also, the fact that a convenience and snowball sample was used to recruit participants, this left the research open to sampling bias. Time constraints were a major factor in the inability to recruit a larger sample. Additionally, time constraints also limited the content of the investigation. Questionnaires were kept short (a 10-15 minute completion time) so participants would not become bored and careless with their responses.

As the DASS 21 scale required you to indicate an answer based on your feelings over the previous week, extraneous variables are very likely to have influenced the results. Personal circumstances over a short period of time could directly influence an individual's response, for example, stress related to work or anxiety related to an impending social occasion.

Future research

The significant correlation between problematic smartphone use and symptoms of mental health issues like stress, anxiety and depression may be useful for future research into the area of attitudes and smartphone use. Research could be performed on limiting people's accessibility to their mobile phones. This would create less demands on the individual and thus decreasing their dependency and the psychological effects associated with same. Future research could also be performed on a wider demographic in order to gain a more in depth analysis of smartphone overuse and the mental health issues arising from this.

Conclusion

The aim of this study was to explore the relationship between excessive smartphone use and the development of problematic mental health issues like stress, anxiety and depression, across genders and different age groups. This topic is very much still in its infancy. It has become a popular subject in contemporary media coverage of late but there has been no substantial empirical investigations in the correlations between smartphone overuse and symptoms of stress, anxiety and depression.

As evident from the questionnaire, smartphones have become much more than just a quintessential mobile phone, but rather an intrinsic part of day to day life. 95% of participants questioned don't turn off their smartphone at any stage in the day; 96% have personalised their smartphone with pictures and videos of their family and friends; 93% use their smartphone as an alarm and 65% as a watch, thus showing that smartphones are now an indispensable device for everyday life.

A Pearson's r correlation found a significant relationship between smartphone use and levels of depression, stress and anxiety; when one increased so too did the other. A series of Independent samples t-tests indicated that both males and females are likely to exhibit similar excessive patterns of smartphone use and symptoms of depression, stress and anxiety. A one way between groups analysis of variance discovered that all age groups questioned, experienced equal measure of smartphone use and similar levels of stress, anxiety and depression resulting from the overuse of the device.

With mental health issues on the rise in recent years and mobile phone addiction considered the biggest non-drug addiction of the 21st century, it is of critical importance that future research attempts to gain a more in depth analysis of smartphone overuse and the psychological health effects arising from this.

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Appendix 1 - Cover Letter of Questionnaire

January 2016

Dear participant,

As part of the requirement for the completion of a Higher Diploma in Arts in Psychology at Dublin Business School, I am conducting a study examining smartphone attachment. This research is intended to provide information that will be of benefit not only to the smartphone users, and their family and friends, but also the wider psychological community.

Participation in this research involves completing an online questionnaire which should take you approximately 10-15 minutes. Please answer all questions as honestly as you can. Please note that your responses will remain anonymous. You are under no obligation to participate in this research, as involvement is completely voluntary. Participation in this research is open to all smartphone users aged 18 years and over.

There are no foreseeable risks in participating in this research, however, in the event that you do experience unexpected distress, please see the information posted at the end of this survey.

The completion and submission of your questionnaire will indicate that you have provided informed consent for your participation in this survey. You can withdraw from the study before your responses to the questionnaire have been submitted, however, once the questionnaire has been submitted it will be impossible to identify and remove the data, as responses are anonymous.

Participation in this research is completely anonymous as participants are not required to provide their name or any other identifiable data. The results of this questionnaire will be used in preparation of a research project which constitutes a requirement for students in the Higher Diploma of Arts in Psychology program. Data will be securely stored.

If you have any concerns regarding this study, please contact the principal researcher Kate Langan, by email: 10122085@mydbs.ie. Alternatively you can contact the research supervisor, Dr. Pauline Hyland, by email: pauline.hyland@dbs.ie

Thank you for taking the time to read this information sheet and for your participation in this survey.

Consent to participate *
Clicking "agree" below indicates that you have read the above research information and you voluntarily agree to participate. If you do not wish to participate in the research study, please decline participation by clicking the "disagree" button.

Agree (continue with survey) ⬭
Disagree (exit) ⬭

What is your age? *
Please enter your age in numbers

_____

Appendix 2 – Questionnaires

Do you own a smartphone? *

Please select one of the following options

Yes ⬭

No ⬭

What is your gender?

Please select one of the following options

Female ☐

Male ☐

When do you usually turn your phone on?

Please select one of the following options

Before I leave the house in the morning ⬭

When I leave the house (e.g. for work/college/other) ⬭

When I arrive at work/college/other ⬭

I never turn it off ⬭

Other ⬭

If you answered ***'Other'*** to the above question, please provide further details:

_____

When do you usually turn your phone off?

Please select one of the following options

When I leave the office/college/other ⬭

When I get home from work/college/other ⬭

When I sit down for dinner ⬭

I never turn it off ⬭

Other ⬭

If you answered ***'Other'*** to the above question, please provide further details:

_____

Please rate the following smartphone functions in the order that describes how much you use them.
1 indicates that you use that function most and 7 indicates you use that function least Mark only one oval per row.

	1(most)	2	3	4	5	6	7(least)
Internet (except for social networking)							
Social networking (Facebook, Twitter, etc.)							
Personal phone/calls/ messaging							
Work emails/ phone calls							
Media (Music/Movies/TV shows/Camera)							
Tools (Calendar/Notepad/ Calculator)							
Games/Other Apps							

Please indicate which of these apply to you.
Select as many as are applicable

My smartphone is my alarm	
My smartphone is my watch	
My smartphone holds pictures and videos of my family and friends	
I sleep with my smartphone next to my bed	

Smartphone Problematic Use Questionnaire (Rush, 2011)

Please indicate the degree to which you agree with the following statements.
Select one option per question

	Strongly Disagree	**Somewhat Disagree**	**Neither Agree nor Disagree**	**Somewhat Agree**	**Strongly Agree**
My smartphone makes me feel connected to others					
My family have complained about how much I use my smartphone					
I would rather lose my wallet than my smartphone					
I only need a smartphone to do my job well					
I compare my smartphone with other people's phones					
If I lost my smartphone, I would order a replacement the same day where possible					
My friends have complained about how much I use my smartphone					
I get upset when my family complain about how much I use my smartphone					
I do not go anywhere without my smartphone					
I worry about my reliance on my smartphone					
I have personalised my smartphone with pictures or ringtones					
My smartphone is great for when I am bored					
My smartphone makes me less productive					
I think about what I am missing when my smartphone is turned off or out of reach					
I attend to my smartphone at the dinner table					

I am addicted to my smartphone					
I am happier since getting a smartphone					
My smartphone makes me more productive					
I enjoy having the latest technology					
My smartphone makes me look successful					
I think about missed emails when my smartphone is turned off or out of reach					
I have never lost my smartphone					
My smartphone makes me feel successful					
I have thought about damaging my smartphone to get an upgraded model					
When friends complain about how much I use my smartphone, I get upset					
I have been unsuccessful at attempts to limit use of my smartphone after work hours					
Apart from when I sleep, my smartphone is always at arm's length					
I would rather lose my little toe than lose the use of my smartphone					
I use my smartphone to escape from situations I don't want to be in					
I don't feel guilty about turning my smartphone off					
I always have my smartphone with me					
I never think about missed phone calls when my smartphone is turned off or out of reach					
I would not interrupt social interaction to answer my smartphone					
My smartphone is just a tool to help me in my 9-5 work					

I find it difficult to turn off my smartphone					
The thought of being separated from my smartphone does not make me feel distressed					
I use my smartphone to find answers to questions					
When my smartphone runs out of battery and I don't have a charger, I feel distressed					
I feel pressured to leave my phone on after work hours					
My smartphone is an integral part of my life					
I don't think my smartphone makes me look successful					
My colleagues have complained about my smartphone use in meetings					
I have tried to stop myself checking my smartphone					
I answer my smartphone when I am talking to friends					

DASS 21 Questionnaire (Gomez, 2014)

Please read each of the statements below and select 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.

	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 good part of the time (OFTEN)	3 - Applied to me very much, or most of the time (ALMOST ALWAYS)
I found it hard to wind down				
I was aware of dryness of my mouth				
I couldn't seem to experience any positive feeling at all				
I experienced breathing difficulty (e.g. excessively rapid breathing, breathlessness in the absence of physical exertion)				
I found it difficult to work up initiative to do things				
I tended to over-react to situations				
I experienced trembling (e.g. in the hands)				
I felt that I was using a lot of nervous energy				
I was worried about situations in which I might panic and make a fool of myself				
I felt that I had nothing to look forward to				
I found myself getting agitated				
I found it difficult to relax				

I felt down-hearted and blue				
I was intolerant of anything that kept me from getting on with what I was doing				
I felt I was close to panic				
I was unable to become enthusiastic about anything				
I felt I wasn't worth much as a person				
I felt that I was rather touchy				
I was aware of the action of my heart in the absence of physical exertion (e.g. sense of heart rate increase, heart missing a beat, etc.)				
I felt scared without any good reason				
I felt that life was meaningless				

Appendix 3 – Questionnaire Outro Page

Thank you for your participation. Your response has been recorded.

If you have been affected by any of the content in this survey, please visit:

http://www.aware.ie/

http://www.yourmentalhealth.ie/

http://grow.ie/

Or free call Samaritans on 116 123

Thank you,

Kate Langan