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An Exploratory Examination of At-Risk/Problematic Internet Use and Disordered Eating in Adults

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Abstract

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Purpose—At-risk/problematic Internet use (ARPIU) has been associated with impairment in multiple domains including psychopathology. The present study examined the relationship between ARPIU and disordered eating in a large community sample.

Methods—Participants (n=1000) completed an online survey about health behaviors. Two thresholds of ARPIU and disordered eating each were examined.

Results—The ARPIU and Sub-ED (subthreshold eating disorders) groups reported greater depressive symptoms and poorer self-control than the Control group; the Sub-ED group reported greater impulsivity than the Control group. The ARPIU and Sub-ED groups significantly differed in key features related to each condition. Finally, the co-occurrence of ARPIU and Sub-ED was associated with greater depression. In the second set of analyses based on more stringent thresholds, the Problematic Internet Use (PIU) and ED groups differed on all measures compared to the Control group. The PIU and ED groups also differed on key features related to each condition, but did not differ on measures of impulsivity or self-control. The co-occurrence of PIU and ED was associated with greater depressive symptoms than either PIU or ED independently.

Conclusions—ARPIU and Sub-ED share links to depression and poor self-control and these may represent possible therapeutic targets across Internet-use and disordered-eating behaviors. Co-occurring PIU and ED at either lenient or stringent thresholds is associated with greater depression. Future studies should examine the temporal nature of these associations and the extent to which targeting depression, Internet use, or disordered eating may lead to improvements across domains.

Keywords

Keywords: Internet Use; Problematic Internet Use; Eating Disorders

1. Introduction

Internet use may become excessive, and when it interferes with daily functioning, it may be considered problematic or possibly addictive. Various terms have been used to describe excessive Internet use including “at-risk/problematic Internet use” (ARPIU; Yau, Potenza, & White, 2013), “pathological Internet use” (Morahan-Martin & Schumacher, 2000), “problematic Internet use” (PIU; Liu, Desai, Krishnan-Sarin, Cavallo, & Potenza, 2011) and “compulsive Internet use” (Claes, Muller, Norre, Van Assche, Wonderlich, & Mitchell, 2012). Defining features of ARPIU have ranged from loss of control and associated distress (Shapira, Goldsmith, Keck, Khosla, & McElroy, 2000) to withdrawal symptoms, impairment, and conflicts surrounding Internet use (Claes et al., 2012). PIU has been defined as having features such as attempts to cut back Internet use, strong urges to use the Internet, and reductions in anxiety following Internet use (Liu et al., 2011). Given different operational definitions of ARPIU, prevalence estimates widely across studies (Rodgers, Melioli, Laconi, Bui, & Chabrol, 2013; Petry & O'Brien, 2013), ranging from less than 1% (Aboujaoude, Koran, Gamel, Large, Serpe, 2006) to over 50% (Yau, et al., 2013).

Problems with Internet use –defined previously in various ways- is controversial with some individuals having advocated for inclusion of an Internet use disorder in the DSM-5 (APA, 2013) and others not (Block, 2008; Petry & O'Brien, 2013). Although not considered a

formal psychiatric disorder, problems with Internet use are associated with psychopathology and other dysfunction including depressive symptoms (Kraut, Patterson, Lundmark, Kiesler, Mukophadhyay, & Scherlis, 1998; Young & Rogers, 1998), social, vocational and financial impairment (Shapira et al., 2000), poor self-control (Kim, Namkoong, Ku, & Kim, 2008), impulsivity (Lee, Choi, Shin, Lee, Jung, & Kwon, 2012), and psychiatric disorders relating to anxiety, attention deficits, substance use and disordered eating (Bernardi & Pallanti, 2009; Claes et al., 2012; Shapira et al., 2000; Tao & Liu, 2009; Yen, Ko, Yen, Chen, & Chen, 2009).

With respect to disordered eating, preliminary evidence in both outpatient (Claes et al., 2012) and community samples (Rodgers et al., 2013) suggests that ARPIU and eating disorders (EDs) may co-occur. Claes et al. (2012) found that in persons diagnosed with ED, approximately 12% met criteria for PIU. Conversely, in persons with PIU, approximately 15% met criteria for EDs (Shapira et al., 2000). The nature of the relationship between ARPIU and EDs, however, is still unclear. For example, individuals may eat in unhealthy fashions while engaged in Internet use in general or specific features (depressed mood, poor self-control, or elevated impulsivity) may link disordered eating and PIU. More research is needed to better understand this association including the extent of the co-occurrence as well as differences/similarities in correlates and associated functioning.

Given the lack of consistent thresholding with respect to PIU, the present study aimed to examine ARPIU, often defined as endorsing at least one problematic Internet feature, and PIU, a more stringently thresholded and perhaps more clinically relevant construct (Liu et al., 2011). There may be public health relevance for understanding behaviors/conditions that are more prevalent (such as at-risk behaviors) and clinical relevance for understanding behaviors or conditions that are more severe (more stringently thresholded) and thus associated with treatment seeking and treatment engagement. Therefore, in the current study, we compared individuals with ARPIU to a control group on various indices relating to depression, self-control and impulsivity, compared ARPIU to less stringently defined disordered eating (subthreshold ED or Sub-ED), and examined whether the combination of ARPIU and Sub-ED was characterized by poorer health (e.g., greater depression) than either group independently. We also compared PIU to more stringently defined disordered eating (ED) and examined whether the combination of PIU and ED is characterized by poorer health (e.g., greater depression) than either condition independently or to a control group. Given strong links between depression and both PIU and ED, we hypothesized that co-occurring PIU and ED at both stringently and leniently defined thresholds would be associated with greater depression and that PIU and ED groups at both thresholds would differ on measures related to the respective pathologies (e.g., Internet use for PIU and disordered eating for ED).

2. Materials and Methods

2.1. Participants

One thousand adults responded to online advertisement seeking volunteers aged 18 years or older for a survey of health behaviors (methodology described in Grilo, Masheb, & White, 2010; Yau et al., 2013). Participants included 132 (13.2%) males and 865 (86.8%) females

(3 did not report sex/gender); race/ethnicity was 77.7% ($n=775$) White, 6.8% ($n=68$) Hispanic, 6.2% ($n=62$) Black, 5.2% ($n=52$) Asian, and 4.0% ($n=43$) “other” or missing. Mean age and body mass index (BMI) were 34.0 ($SD=12.8$) years and 28.5 ($SD=7.9$), respectively. The ARPIU group was 14.4% ($n=75$) male and 85.6% ($n=446$) female (1 did not report sex/gender); race/ethnicity was 73.7% ($n=384$) White, 7.5% ($n=39$) Hispanic, 7.3% ($n=38$) Black, 7.3% ($n=38$) Asian, and 4.2% ($n=23$) “other” or missing. Mean age and BMI for the ARPIU group were 33.1 ($SD=12.5$) years and 28.4 ($SD=8.1$), respectively. The PIU group was 19.1% ($n=17$) males and 80.9% ($n=72$) females; race/ethnicity was: 72.7% ($n=64$) White, 10.2% ($n=9$) Hispanic, 5.7% ($n=5$) Black, 8.0% ($n=7$) Asian, and 3.4% ($n=4$) “other” or missing. Mean age and BMI for the PIU group were 30.7 ($SD=10.7$) years and 28.5 ($SD=7.8$), respectively.

2.2. Procedures and Assessments

Advertisements with keywords such as “health” or “weight/dieting” were placed on Craigslist Internet ads. Participants completed an anonymous online survey consisting of demographic information, self-reported height and weight, and self-report questionnaires through SurveyMonkey, a secure online data-gathering platform. The study was approved by the Yale Human Investigations Committee.

Body Mass Index (BMI) was calculated using self-reported height and weight (kg/m^2).

The *Eating Disorder Examination-Questionnaire* (EDE-Q; Fairburn & Beglin, 1994) assesses the frequency of objective bulimic episodes (OBEs; defined as feeling a loss of control while eating unusually large quantities of food; this definition corresponds to the *DSM-5* criteria for binge-eating), and inappropriate weight control and purging methods over the past 28 days; it comprises four subscales and a global total score. The EDE-Q has good test-retest reliability (Reas, Grilo, & Masheb, 2006), convergence with the EDE interview (Grilo, Masheb, & Wilson, 2001a; Mond, Hay, Rodgers, & Owen, 2007a), and good performance in community studies (Mond et al., 2007a).

The *Yale Food Addiction Scale* (YFAS; Gearhardt, Corbin, & Brownell, 2009) is a 25-item self-report measure of addictive eating. Items correspond to substance-dependence criteria from *DSM-IV* (APA, 1994). The YFAS has adequate internal reliability, convergent validity, and incremental validity in predicting binge-eating problems (Gearhardt, Corbin, & Brownell, 2009; Gearhardt, White, Masheb, Morgan, Crosby, & Grilo, 2012; Gearhardt, White, Masheb, & Grilo, 2013).

The *Beck Depression Inventory* (BDI; Beck & Steer, 1987) assesses depressive symptoms and levels; it has strong psychometric support (Beck, Steer, & Garbin, 1988) and performs well as a marker for severity and distress (Grilo, Masheb, & Wilson, 2001b).

The *Barratt Impulsiveness Scale -11* (BIS-11; Patton, Stanford, & Barratt, 1995) consists of thirty items measuring three domains of impulsivity: attentional, motor, and non-planning impulsivity. Higher scores are indicative of greater impulsivity.

The *Brief Self-Control Scale* (BSCS; Tangney, Baumeister, & Boone, 2004) consists of thirteen items measuring self-control over thoughts, emotions, impulse control, performance regulation and habit breaking. Higher scores are indicative of better self-control.

2.3. Creation of study groups

In the first set of analyses, groups were created based on “at-risk” behaviors. The ARPIU group was created based on endorsement of at least one of the following six features previously used to assess ARPIU (Yau et al., 2013; Yau, Pilver, Steinberg, Rugle, Krishnan-Sarin, & Potenza, 2014; Yau, Potenza, Mayes, & Crowley, 2015): 1) Have you ever tried to cut back on your Internet use?, 2) Has a family member ever expressed concern about the amount of time you use the Internet?, 3) Have you ever missed school, work, or important social activities because you were using the Internet?, 4) Do you think you have a problem with excessive Internet use?, 5) Have you ever experienced an irresistible urge or uncontrollable need to use the Internet?, and 6) Have you ever experienced a growing tension or anxiety that can only be relieved by using the Internet?

The subthreshold eating disorder (Sub-ED) study group was created based on responses to the EDE-Q. Participants endorsing ED behavioral features of binge-eating disorder (i.e., binge-eating episodes), bulimia nervosa (i.e., binge-eating and purging behavior), and purging disorder (i.e., compensatory behaviors without binge-eating) were categorized as the Sub-ED group. The first set of analyses compared ARPIU and Sub-ED groups rather than more stringently thresholded ED or PIU groups. A control group was also created to allow for a four-group comparison; this “Control-1” group did not meet criteria for ARPIU or Sub-ED. The ARPIU group met criteria for ARPIU and not Sub-ED; the Sub-ED group met criteria for Sub-ED and not ARPIU; the Comorbid ARPIU/Sub-ED group met criteria for both ARPIU and Sub-ED.

In the second set of analyses, groups were created based on stringent thresholds. The PIU group was created based on endorsement of three specific features that represent core features of impulse-control disorders previously used to examine PIU (Liu et al., 2011). The items were: 1) Have you ever tried to cut back on your Internet use?, 2) Have you ever experienced an irresistible urge or uncontrollable need to use the Internet?, and 3) Have you ever experienced a growing tension or anxiety that can only be relieved by using the Internet? The Eating Disorder (ED) group was created based on responses to the EDE-Q per *DSM-5* criteria. Participants who met full threshold criteria for binge-eating disorder, bulimia nervosa, or purging disorder (including overvaluation of weight and shape) were categorized in the ED group. Similar to the aforementioned creation of four-groups with less stringent thresholds, the following four groups with more stringent thresholds were created for the second set of analyses. The “Control-2” group did not meet criteria for PIU or ED; the PIU group met criteria for PIU and not ED; the ED group met criteria for ED and not PIU; and the Comorbid PIU/ED group met criteria for both PIU and ED.

2.4. Statistical analysis

Chi-square and Analysis of Variance (ANOVA) statistics were performed for categorical and dimensional variables, respectively. ANOVAs were performed to compare the four groups

on the dimensional demographic and clinical measures. When ANOVAs revealed significant group differences, Scheffe post-hoc tests were used to analyze specific group differences. ANCOVAs were performed to co-vary for demographic variables that significantly differed across study groups. Given the study's exploratory nature, significance was set at $p < 0.05$ two-sided. Effect sizes, partial η^2 , were calculated.

3. Results

3.1. At-risk behaviors

Most participants reported at least one ARPIU feature ($n=522$; 52.2%), while 47.8% ($n=478$) did not report any. Specifically, 20.1% ($n=201$) reported only one ARPIU feature, 12.8% ($n=128$) reported two, 7.0% ($n=70$) reported three, 5.8% ($n=58$) reported four, 4.0% ($n=40$) reported five, and 2.5% ($n=25$) reported six. Of those meeting ARPIU criteria, 51% ($n=267$) also met criteria for Sub-ED (Figure 1).

3.2. Group differences using at-risk thresholds

Of all participants, 27.6% ($n=276$) were classified in the Control-1 group, 25.5% ($n=255$) in the ARPIU group, 20.2% ($n=202$) in the Sub-ED group, and 26.7% ($n=267$) in the Comorbid ARPIU/Sub-ED group. The groups differed significantly on age and race (Table 1). Scheffe post-hoc tests revealed that the ARPIU group was significantly younger than the Control-1 group. Separate 2×2 chi-square analyses for race (white versus non-white) revealed that the Control-1 group had more white participants than both the ARPIU and ARPIU/Sub-ED groups; the Sub-ED group also consisted of more white participants than the ARPIU group.

The four groups differed significantly on all clinical measures (Table 2). The three at-risk groups differed significantly from the Control-1 group on behavioral features specific to them (Internet-use or disordered-eating variables) and on associated measures. Scheffe post-hoc tests revealed a number of specific significant differences between the at-risk and Control-1 groups. As hypothesized, the four groups significantly differed on daily Internet use: the ARPIU and Comorbid ARPIU/Sub-ED groups were significantly more likely to report at least 2 hours of daily Internet use than the Control-1 group. The Control-1 and ARPIU groups had significantly lower scores on all eating-related measures (OBEs, subjective bulimic episodes, and EDE-Q Global, and YFAS scores) than both the Sub-ED and ARPIU/Sub-ED groups. The Control-1 group had significantly lower BDI scores than all other groups. The Sub-ED and ARPIU/Sub-ED groups reported significantly greater BIS-11 and lower BSCS scores than the Control-1 group; the ARPIU also reported significantly lower BSCS scores than the Control-1 group.

When comparing the three at-risk groups, the ARPIU group was more likely to report at least two hours of daily Internet use than the Sub-ED group, while the Comorbid ARPIU/Sub-ED group was more likely to report at least two hours of daily Internet use than the Sub-ED group. The Sub-ED and ARPIU/Sub-ED groups had higher BMI than the ARPIU group. The ARPIU/Sub-ED group had greater BDI scores than all other groups; only the ARPIU and Sub-ED groups did not differ significantly on BDI scores. Finally, the ARPIU/

Sub-ED group reported greater BIS-11 scores and lower BSCS scores than the ARPIU group. Partial eta squared ranged from .021 (BMI) to .273 (YFAS), signifying small to large effect sizes. Findings did not change when controlling for BMI. When controlling for age, only two findings changed. First, the Control-1 group had a lower BMI than the ARPIU/Sub-ED group and the ARPIU/Sub-ED group continued to have a higher BMI than the ARPIU group; the ARPIU and Sub-ED groups no longer remained significantly different in BMI after controlling for age. Second, the ARPIU and ARPIU/Sub-ED groups no longer differed on BIS-11 scores, but the difference between the Control-1 group and both the Sub-ED and ARPIU/Sub-ED groups remained significant.

3.3. Stringent thresholding

Of all participants, 8.9% ($n=89$) met criteria for PIU. Of those meeting PIU criteria, 22.5% ($n=20$) also met ED criteria (Figure 2).

3.4. Group differences based on stringent thresholds

Of all participants, 72.9% ($n=729$) were classified in the Control-2 group, 6.9% ($n=69$) in the PIU group, 18.2% ($n=182$) in the ED group, and 2.0% ($n=20$) in the Comorbid PIU/ED group. The groups differed significantly on age, with the PIU group younger than the Control-2 group (Table 3).

The four groups differed on all measures except BMI (Table 4). As hypothesized, the groups differed on daily Internet use: the PIU and Comorbid PIU/ED groups were more likely to report at least 2 hours of daily Internet use than the Control-2 group. Both the Control-2 and PIU groups had lower scores on all eating-related measures (OBEs, subjective bulimic episodes, EDE-Q Global score, and YFAS score) than both the ED and Comorbid PIU/ED groups; the PIU group reported higher YFAS scores than the Control-2 group. Furthermore, the Control-2 group had lower BDI and BIS-11 scores than all other groups. Finally, the ED and Comorbid PIU/ED groups reported lower BSCS scores than the Control-2 group.

The three clinical groups significantly differed on all measures except the BIS-11 and BSCS. As hypothesized, the three groups differed on daily Internet use, with a greater percentage of PIU and Comorbid PIU/ED respondents reporting at least 2 hours of Internet use daily relative to ED respondents. In addition, the PIU groups reported lower scores on all eating-related measures (OBEs, subjective bulimic episodes, EDE-Q Global score, and YFAS score) than both the ED and Comorbid PIU/ED groups. The Comorbid PIU/ED group had greater BDI scores than both the PIU and ED groups. Partial eta squared ranged from .003 (BMI) to .228 (OBE), signifying small to large effect sizes. When controlling for age, the Comorbid PIU/ED group had a greater frequency of OBEs than the ED group, but the Comorbid PIU/ED group no longer differed from the PIU group on YFAS or BDI scores.

4. Discussion

The present study had two primary aims. The first was to examine ARPIU relative to Sub-ED in a large community sample of 1,000 adults, and the second was to compare a more stringent thresholding of PIU and ED. The first set of analyses yielded three primary findings. First, at-risk behaviors were prevalent; 52% of respondents met criteria for ARPIU

and this group endorsed greater depression and poorer self-control compared to the Control-1 group. As expected, at-risk eating disordered behaviors were also common (Mond et al., 2007b) and associated with greater pathology than the Control-1 group. Second, ARPIU and Sub-ED groups showed key similarities and differences in associated measures. Finally, there was substantial cooccurrence between ARPIU and Sub-ED, and the co-occurrence was associated with greater depression scores. Importantly, these primary findings held after controlling for age and BMI. Using a more stringent thresholding, a stronger relationship between depressive features and comorbid PIU/ED was observed, indicating a relationship between depression, Internet use, and disordered-eating behaviors across a severity spectrum.

It is noteworthy that the ARPIU group reported greater depressive symptoms and poorer self-control than the non-ARPIU groups. These disturbances parallel findings of alcohol and drug addictions, in which depression and poor self-control are common (Ali, Seitz-Brown, & Daughters, 2015; Conner, Pinquart, & Gamble, 2009; Lindgren, Neighbors, Westgate, & Saleminck, 2014). There were also shared clinical features between ARPIU and Sub-ED. Specifically, ARPIU and Sub-ED were comparable in levels of depression, impulsivity, and self-control. Targeting these shared features may be important when intervening with at-risk Internet-use or disordered-eating behaviors. Finally, the co-occurrence of ARPIU and Sub-ED was associated with greater depression than either risk behavior independently. While the nature of the relationship between Sub-ED and ARPIU is unclear with respect to etiology and temporal progression, recent evidence suggests that more time spent on the Internet, specifically on Facebook, is associated with greater eating-disorder pathology (Latzer, Spivak-Lavi, & Katz, 2015; Mabe, Forney & Keel, 2014). Therefore, future research should explore the type of Internet use (e.g., online gaming or social media) that is problematic, specifically among those with co-occurring ARPIU and Sub-ED.

Findings based on more stringent thresholding paralleled findings based on at-risk behaviors, particularly with respect to depressive features. The Control-2 group differed from other groups on all measures. When comparing PIU and ED groups, the two differed on core features related to each construct. For instance, the PIU and Comorbid PIU/ED groups reported greater Internet use than the ED group, while the ED and Comorbid PIU/ED groups reported greater eating pathology than the PIU group. Despite the differences in eating disorder pathology, the three groups did not differ in BMI. Importantly, after controlling for age, the Comorbid PIU/ED group reported greater frequency of binge-eating episodes than the ED group. The Comorbid PIU/ED group also reported more depression than all other groups, with the Comorbid PIU/ED group reporting moderate levels and the PIU and ED groups reporting mild levels. Taken together, the co-occurrence of PIU and ED may represent a more severe clinical group as evidenced by more ED and depressive symptoms, with the latter associated with greater distress (Grilo, Masheb, & Wilson, 2001b).

The study has strengths and limitations. A strength was the large sample size. Nonetheless, results may not generalize to the general population or Internet users not interested in research participation; however, the demographics of our study group participants were consistent with those who generally use the Internet, namely women and individuals under the age of 65 (Baker, Wagner, Singer, & Bundorf, 2003; Rice, 2006). There was a low

proportion of males, and the mean age of participants was, on average, middle-aged. Findings may not generalize to men, who are less likely than women to experience EDs, or to younger adults, who may be at greater risk for EDs (Hudson, Hiripi, Pop, & Kessler, 2007). Future research should examine men, gender-related differences, and younger adults to better understand these behavioral problems. In terms of age, we do note that recent evidence suggests that disordered eating, particularly binge-eating, and associated features are quite prevalent among middle-aged women (Gagne, Von Holle, Brownley, et al., 2012; Mangweth-Matzek, Hoek, Rupp, et al., 2014), which comprised the majority of this study group. Furthermore, self-report measures were used; however, use of anonymous online self-report measures may facilitate honest disclosures of sensitive or embarrassing behaviors. While the EDE-Q is considered to be a less rigorous assessment method than the EDE interview, research supports the use of the EDE-Q as an effective method for screening and assessing eating disorder pathology in community studies (Mond, Hay, Rodgers, Owen, & Beumont, 2004). Additionally, lack of consensus regarding the definition and criteria for PIU and ARPIU (Yau et al., 2013; Petry & O'Brien, 2013) is a limitation. Findings should be interpreted with caution as varying thresholds of ARPIU make comparisons across studies difficult (Petry & O'Brien, 2013). However, current findings indicate that meeting at least *one* feature of PIU is associated with clinically relevant measures. Finally, the present study did not collect information on the type of Internet use (e.g., for gaming, shopping, gambling, pornography viewing, social networking or other reasons) that is risky or problematic and that may differ by gender or other factors (Beutel, Braehler, Glaesmer, Kuss, Wolfling, & Muller, 2011).

4.1. Conclusions

In sum, the present findings provide evidence to support the clinical significance of ARPIU and PIU. Both ARPIU and Sub-ED and PIU and ED co-occurrences are associated with greater depression than either Internet-use or eating behavior alone. Future research is needed to better understand the temporal relationships that underlie the co-occurrences and the clinical utility of targeting constructs (e.g., depression, poor self-control) that are associated with Internet-use and ED risk behaviors and pathologies.

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Highlights

- Examined at-risk/problematic Internet use (ARPIU/PIU) and eating disorders (EDs)
- ARPIU/PIU and subthreshold/full ED groups reported greater pathology than controls
- ARPIU/PIU and Sub-ED/ED share links to depression and poor self-control
- Co-occurrence of ARPIU and subthreshold ED was associated with greater depression
- Co-occurrence of PIU and ED was associated with greater depression

Figure 1. Venn diagram of rates for At-Risk/Problematic Internet Use (ARPIU), Subthreshold Eating Disorder (Sub-ED), both ARPIU and Sub-ED, and neither (Control). BN=Bulimia Nervosa; BED=Binge-eating Disorder; PD=Purging Disorder; EDNOS=Eating Disorder Not Otherwise Specified

Figure 2. Venn diagram of rates for Problematic Internet Use (PIU), Eating Disorder (ED), both PIU and ED, and neither PIU or ED (Control-2) BN=Bulimia Nervosa; BED=Binge-eating Disorder; PD=Purging Disorder

Table 1

Demographic characteristics of participants by ARPIU and Sub-ED grouping

	Control-1 N=276		ARPIU N=255		Sub-ED N=202		Comorbid ARPIU/Sub-ED N=267		Test Statistic	η^2	Posthoc
Age, mean (SD)	35.4	(13.02)	32.0	(12.1)	34.4	(13.3)	34.2	(12.8)	F(3, 867)=2.80 *	.010	a
Female, No (%)	236	(85.8%)	220	(86.6%)	183	(91.0%)	226	(84.6%)	χ^2 (3, n=997)=4.47	.067	ns
White, No (%)	227	(82.5%)	186	(73.2%)	164	(81.6%)	198	(74.2%)	χ^2 (3, n=997)=23.13 *	.152	acd

Note. N=1,000. ARPIU = At-risk/Problematic Internet Use; Sub-ED = Subthreshold Eating Disorder.

*
p<.05

Separate 2x2 chi-square analyses for Race (White versus Non-White).

a: Control vs. ARPIU; b: Control vs. Sub-ED; c: Control versus Comorbid; d: ARPIU vs. Sub-ED; e: ARPIU vs. Comorbid; f: Sub-ED vs. Comorbid.

Table 2
Group comparisons of clinical characteristics by ARPIU and Sub-ED grouping

	Control-1 N=276		ARPIU N=255		Sub-ED N=202		Comorbid ARPIU/Sub-ED N=267		ANOVA	η^2	Age	BMI	Posthoc
	M	sd	M	sd	M	sd	M	sd					
Internet Hours (>2 hours/day) ^a	126	(45.8%)	172	(67.7%)	83	(41.3%)	183	(69.3%)	62.39 ^{***}	.251	--	--	acdf
BMI	28.0	(7.6)	27.0	(7.3)	29.4	(7.9)	29.8	(8.6)	6.92 ^{***}	.021	.018	--	de
OBE	0.0	(0.0)	0.0	(0.0)	6.4	(9.9)	5.1	(6.7)	85.97 ^{***}	.206	.245	.204	bcde
SBE	0.5	(2.1)	0.7	(1.7)	7.2	(10.6)	6.0	(7.0)	80.03 ^{***}	.195	.218	.193	bcde
EDE-Q ^b	2.0	(1.3)	2.0	(1.2)	3.5	(1.2)	3.4	(1.2)	108.45 ^{***}	.247	.236	.234	bcde
YFAS	1.9	(1.4)	2.2	(1.6)	4.1	(2.0)	4.1	(2.0)	124.63 ^{***}	.273	.266	.262	bcde
BDI	9.4	(8.7)	12.8	(9.2)	14.6	(9.3)	18.2	(10.8)	38.65 ^{***}	.105	.104	.096	abcef
BIS-11	60.8	(11.7)	63.8	(11.9)	66.6	(12.3)	68.4	(12.9)	12.75 ^{***}	.056	.053	.055	bce
BSCS	43.1	(8.9)	39.5	(9.2)	37.7	(8.6)	35.8	(7.9)	23.88 ^{***}	.094	.099	.092	abce

Note. N=1,000. ARPIU = At-Risk/Problematic Internet Use; Sub-ED = Subthreshold Eating Disorder; BMI = Body Mass Index; OBE = Objective Bulimic Episodes (binge-eating frequency); SBE = Subjective Bulimic Episodes (loss of control eating frequency); EDE-Q = Eating Disorder Examination – Questionnaire Global; YFAS = Yale Food Addiction Scale; BDI = Beck Depression Inventory; BIS-11 = Barratt Impulsivity Scale; BSCS = Brief Self-Control Scale.

^a Chi-square statistic reported as No(%), (3, n=994); Separate 2×2 chi-square analyses for Internet Hours (>2 hours/day vs. 2 hours/day).

^b EDE-Q subscale findings paralleled EDE-Q total score findings

 p<.0001, df (3,649) for BIS and (3,691) for BSCS; otherwise df ranged from (3,986) to (3,996).

Posthoc tests (Scheffe) for ANOVAs indicate significant group differences as follows: a: Control-1 vs. ARPIU; b: Control-1 vs. Sub-ED; c: Control-1 versus Comorbid; d: ARPIU vs. Sub-ED; e: ARPIU vs. Comorbid; f: Sub-ED vs. Comorbid.

Table 3
Demographic characteristics of participants by PIU and ED grouping

	Control-2 N=729	PIU N=69	ED N=182	Comorbid PIU/ED N=20	ANOVA	η^2	Posthoc
Age, mean (SD)	34.3 (13.1)	29.5 (10.0)	34.3 (12.8)	35.8 (12.6)	$F(3, 867)=2.94^*$	.010	a
Female, No (%)	626 (86.2%)	55 (79.7%)	167 (91.8%)	17 (85.0%)	$\chi^2(3, n=997)=7.18$	.085	ns
White, No (%)	573 (78.8%)	51 (75.0%)	138 (75.8%)	13 (65.0%)	$\chi^2(3, n=997)=16.13$	.127	ns

Note. PIU = Problematic Internet Use; ED = Eating Disorder.

*
p<05

η^2 represents partial eta squared for ANOVA and phi for chi-square analyses.

a: Control-2 vs. PIU; ns = not significant

Table 4
Group comparisons of clinical characteristics by PIU and ED grouping

M	Control-2 N=729		PIU N=69		ED N=182		Comorbid PIU/ED N=20		ANOVA		ANCOVA Covary Age	
	sd	M	sd	M	sd	M	sd		η^2	η^2	Posthoc	
Internet Hours (>2 hours/day) ^a	404	(55.6%)	50	(73.5%)	94	(52.2%)	16	(80.0%)	14.07 ^{***}	.119	--	acdf
BMI	28.4	(7.9)	27.8	(7.1)	29.0	(8.0)	30.8	(9.8)	1.05	.003	.000	ns
OBE	1.2	(4.8)	1.3	(2.1)	8.2	(7.6)	11.7	(13.5)	98.20 ^{***}	.228	.335	bcde
SBE	1.8	(5.4)	1.8	(2.5)	9.1	(8.3)	11.1	(12.9)	80.21 ^{***}	.195	.263	bcde
EDE-Q ^b	2.4	(1.3)	2.6	(1.3)	3.8	(1.1)	4.2	(1.0)	67.17 ^{***}	.169	.161	bcde
YFAS	2.5	(1.8)	3.3	(1.9)	4.7	(1.9)	5.0	(2.1)	79.74 ^{***}	.194	.194	abcde
BDI	12.0	(9.3)	17.5	(10.0)	17.2	(10.5)	27.0	(13.1)	31.55 ^{***}	.088	.079	abcef
BIS-11	63.0	(11.8)	69.7	(12.3)	68.2	(13.7)	78.0	(9.9)	13.77 ^{***}	.060	.054	abc
BSCS	40.5	(9.0)	36.8	(8.3)	35.5	(8.4)	31.0	(4.8)	16.40 ^{***}	.066	.072	bc

Note. PIU=Problematic Internet Use; ED=Eating Disorder; BMI=Body Mass Index; OBE=Objective Bulimic Episodes (binge-eating frequency); SBE=Subjective Bulimic Episodes (loss of control eating frequency); EDE-Q=Eating Disorder Examination–Questionnaire Global; YFAS=Yale Food Addiction Scale; BDI=Beck Depression Inventory; BIS-11=Barratt Impulsivity Scale; BSCS=Brief Self-Control Scale.

 $p=.01$

 $p<.0001$. df (3,649) for BIS and (3,691) for BSCS; otherwise df ranged from (3,986) to (3,996).

^b EDE-Q subscale findings paralleled EDE-Q total score findings

^a Chi-square statistic reported as No(%). (3, n=994); Separate 2×2 chi-square analyses for Internet Hours (>2 hours/day vs. 2 hours/day). Posthoc tests (Scheffe) for ANOVAs indicate significant group differences as follows: a: Control-2 vs. PIU; b: Control-2 vs. ED; c: Control-2 vs. Comorbid PIU/ED; d: PIU vs. ED; e: PIU vs. Comorbid PIU/ED; f: ED vs. Comorbid PIU/ED.