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Increased Internet use and poorer ability to manage emotions in youth at high-risk for psychosis

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ABSTRACT

The relationship between Internet use and social behavior remains unknown. However, research indicates that Internet use (IU) may have some causal role in certain types of psychopathology and overall functioning. In contrast, other work suggests that IU may be protective and buffer against social isolation. Poorer emotional processing (EP) is characteristic of schizophrenia, and these deficits are present prior to illness onset (the ultra high-risk period (UHR)). UHR adolescents/young adults also fall within an age demographic characterized by extensive IU, which suggests that evaluating a link between IU and social behavior in this population may be especially informative. The present study examined the relationship between IU and emotional processing in 98 adolescents/young adults (52 UHR youth and 46 controls). UHR youth exhibited greater problematic IU ($\beta = -6.49$, $F(1,95) = 8.79$, $p = 0.002$) and social withdrawal/problems resulting from this use ($\beta = -3.23$, $F(1,95) = 11.43$, $p < 0.001$), as well deficits in emotional processing in comparison to healthy peers ($\beta = 4.59$, $F(1,94) = 5.52$, $p = 0.011$). Furthermore, the social problems resulting from IU were significantly related to the ability to process emotional information in the UHR group ($\beta = -0.51$, $t(1,48) = -2.10$, $p = 0.021$). UHR youth showed evidence of problematic IU relative to controls, and the social problems resulting from IU related to poorer EP. Findings replicate extant research involving other psychosis risk populations, while adding information regarding how social processes may relate to IU.

1. Introduction

Internet use (IU) rates continue to rise, with the past decade seeing a 152% increase in time spent online among Americans (Miniwatts Marketing Group, 2001-2015). Specifically, adolescents and young adults use the Internet roughly 17 h per week (Derbyshire et al., 2013; Harris Interactive and Teenage Research Unlimited, 2015). Due to this overall rise in usage, investigators have begun to carefully question the impact of spending time on the Internet. One rising area of concern involves the relationship between IU and mental or physical health. Although our understanding of this association remains limited, findings indicate that increased IU is associated with higher rates of anxiety, depression, negative social interactions/relationships, increased headaches, and impaired sleep (Anderson, 2001; Coniglio et al., 2006; Ko et al., 2012). Further, one study examined the causal nature of IU (assessing participants before and after increases in time spent online), and discovered higher rates of hostility, psychoticism, interpersonal difficulty, anxiety, and depression resulting from greater use (Dong et al., 2011). These findings highlight the need for continued examination of how IU is related to overall well-being.

Contrary to these findings, which suggest associated risk with IU, some studies propose that IU may serve as a buffer against social isolation, particularly for individuals with a diagnosis of schizophrenia who may exhibit impaired social behavior (Highton-Williamson et al., 2015; Miller et al., 2015; Spinzy et al., 2012). One study evaluated the Internet habits of psychotic patients, non-psychotic patients, and healthy controls and found that the individuals with psychosis create a greater amount of online relationships; the authors surmised that IU aids in bypassing the real-life social challenges that exist for individuals with psychosis (Spinzy et al., 2012). Another investigation surveyed individuals diagnosed with psychosis and showed that the majority of their sample reported that IU aided in their ability to interact socially and did not lead to worsening of psychotic symptoms (Miller et al., 2015). However, in this same study, of those who reported using the computer, email, and/or social media, roughly 16%–27% did not believe that these IU modalities aided in interactions with friends, family, or others, and around 35% endorsed believing that IU made them aware of increases in paranoia or suspiciousness (Miller et al., 2015). The available literature examining psychosis and IU is scarce, methodologies are variable, and studies are most often

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observational in nature (Highton-Williamson et al., 2015), making conclusions surrounding IU and psychosis difficult. In summary, the relationship between psychosis, social behavior and IU remains unclear — for individuals with psychosis, does IU relate to poorer clinical outcome or improved social connection? The answer to such a question would aid in clarifying whether chat rooms, social media, etc. would be useful as treatment interventions in their own right, as opposed to a risk factor for increased psychopathology.

One method that may aid in clarifying the relationship between IU and psychosis would be to empirically examine how time spent online relates to social behavior. Evaluating this relationship in a sample at clinical risk for psychosis may be especially enlightening, as these individuals are particularly helpful in aiding our understanding of how symptoms associated with schizophrenia arise (Insel, 2010). Youth at clinical risk for psychosis (termed being at ultra high-risk (UHR)) are individuals who exhibit symptoms indicative of having a greater likelihood of developing psychosis (e.g., experiencing sub-clinical levels of delusions, perceptual abnormalities, etc.). Roughly 10%–30% of UHR individuals will go on to develop a psychotic disorder in as little as 24 months (Cannon et al., 2008; Fusar-Poli et al., 2012; Woods et al., 2009). UHR youth also represent a putative prodromal stage to psychosis and often do not have confounds associated with schizophrenia such as neurotoxicity and long-term use of antipsychotic medication. The evaluation of IU and social behavior in UHR individuals may lend insight into the overall relationship between going online, social processes, and psychopathology.

Despite the potential value in examining IU and social behavior in the UHR period, there are no studies evaluating these areas in this critical group. This gap in the literature is noteworthy, as UHR individuals primarily fall into the adolescent and young adult age range. IU in this age range is almost universal, and there are growing concerns regarding Internet addiction and detrimental consequences of use in this particular age demographic (Moreno et al., 2011). This demographic also represents formative years whereby social and psychological development is pronounced and necessary for future success. Determining the impact of IU for this age group is particularly important, as any risks to healthy development are particularly concerning and deserve attention (Kaltiala-Heino et al., 2004). Of note, some studies suggest that IU confers some potential benefits for the psychosis spectrum individuals (Miller et al., 2015; Spinzy et al., 2012). As such, it is important to evaluate any promising new avenues for interventions, as the treatment options for UHR youth are currently limited (Kaur and Cadenhead, 2010). In sum, UHR youth represent a population where IU, social processes, and risk for psychopathology are at an important developmental point in time, and the relationship among these variables warrants investigation.

In regard to social behavior in UHR youth, these individuals tend to exhibit deficits in social processes (e.g., social communication, perception of others) (National Institue of Mental Health, 2013) relative to their unaffected peers (Cornblatt et al., 2012; Tarbox et al., 2014). Such impairment is similar to individuals with schizophrenia, albeit to a lesser extent (Fusar-Poli et al., 2012; Thompson et al., 2012). For example, research suggests that UHR youth exhibit deficits in their emotional processing (Fett et al., 2011; Phillips and Seidman, 2008). Emotional processing subsumes a wide experience of emotion, expression, and recognition and generally encompasses the neural processes necessary to take in, interpret, and respond to social and emotional information (Kohler and Martin, 2006; Ochsner, 2008). In particular, the domain of managing emotions (e.g., how an individual responds in emotional contexts) encompasses all of these areas of receiving social information, understanding it, and making a choice within this social framework. Research shows that the ability to manage emotions in regards to oneself and others is impaired in UHR youth relative to controls (Green et al., 2012). Therefore, examining the link between IU and social domains such as emotional processing in UHR youth may help to unravel how this relationship functions (i.e., whether going online corresponds to a potential avenue for intervention or risk for increased impairment).

Finally, UHR youth represent a clinical sample, and investigation into this group would aid in our ability to further hone in on the relationship between IU and psychopathology. One previous study from our group, which examined a distinct sample of youth diagnosed with schizotypal personality disorder (a group with psychosis vulnerability), showed that higher IU in this sample was linked to greater rates of depression (Mittal et al., 2007). Furthermore, another study from our team evaluated a distinct sample comprised of college students who experience very low levels of psychotic like experiences (e.g., fleeting auditory hallucinations such as one's name being called), and we showed elevated rates of addictive behavior and problematic usage in this group (Mittal et al., 2013). Other research shows a link between IU and mood and anxiety disorders (Dong et al., 2011; Ko et al., 2012; Shapira et al., 2003), and these symptoms also occur at elevated rates in UHR individuals (Fusar-Poli et al., 2014). Studies evaluating IU in psychosis risk samples are scarce, and there are none looking at UHR youth specifically. It would be beneficial to know whether UHR youth also show greater problematic IU and whether that is linked with comorbid increases in psychopathology. In summary, the investigation of IU and symptoms in an UHR sample would aid in clarifying how IU may relate to clinical symptoms of anxiety, depression and in particular, attenuated psychosis symptoms.

1.1. Aims of the study

The current investigation recruited a sizeable sample of UHR youth and age-matched controls (n = 98) to investigate IU and emotional processing. The aims of the study were to 1) determine whether IU was elevated and problematic, 2) if emotional processing was impaired in UHR youth relative to control peers, and 3) if problematic IU related to emotional processing.

2. Methods

2.1. Participants

Participants included 98 adolescents/young adults (52 UHR youth and 46 controls) (age range 12–21, mean age = 18.27, SD = 2.26), who were recruited at the University of Colorado Boulder's Adolescent Development and Preventive Treatment research program. Email, newspaper advertisements, Craigslist, and community referrals were used to recruit UHR participants. Control participants were recruited through flyers and newspaper announcements. Exclusion criteria for both groups included a history of head injury, neurological disorders and having a DSM-IV-TR Axis I psychotic disorder or current substance dependence. The presence of a psychotic disorder in a first-degree relative was exclusionary criteria for controls. The University of Colorado Boulder Institutional Review Board (IRB) approved the protocol and written informed consent procedures for the investigation. Parents/legal guardians provided written informed consent on behalf of participants under the age of 18, while the participants provided written assent for their participation in the study. A thorough discussion of study procedures and the voluntary nature of the study was provided to parents/legal guardians and participants to ensure a full understanding of the nature of the study before enrollment began. Study participants were either healthy controls or individuals at risk for a psychotic disorder who showed no fully psychotic symptoms or loss of touch with reality; therefore, all participants were determined to be fully competent to consent to

the study either alone or in conjunction with a guardian if they were a minor.

2.2. Procedure

The Structured Interview for Prodromal Syndromes (SIPS) (McGlashan et al., 2001) was administered to detect the presence of a prodromal syndrome. Based on this established measure, UHR participants met clinical criteria for a prodromal syndrome in three possible ways: 1) the presence of attenuated positive symptoms and/or 2) decline in global functioning accompanying the presence of schizotypal personality disorder and age <19 and/or 3) a family history of schizophrenia with decline in functioning (Miller et al., 1999). The Structured Clinical Interview for the Diagnostic and Statistical Manual was administered to determine the presence of psychosis and substance dependence exclusionary criteria (SCID-I) (First et al., 1995). Trained advanced graduate students conducted both SIPS and SCID-I administration.

The Internet Addiction Test (IAT) (Young, 1998) was used to determine the level and problematic nature of IU of study participants. The IAT is a self-report measure that consists of 20 items that are presented on a five-point Likert scale. Questions address how IU impacts daily life, social interactions, productivity, sleeping, and emotions. For example, questions include "How often do you find that you stay online longer than you intend", "How often do you check your e-mail before something else that you need to do" and, "How often do you lose sleep due to late-night logins?" [39]. Total scores (*IAT Total*) are generated ranging from 0 to 100, with higher scores corresponding to greater problematic IU. The IAT is validated in young adults and demonstrates strong internal reliability across studies (Widyanto and McMurran, 2004; Wright et al., 2005; Yang et al., 2010). Furthermore, research investigating the factor structure of the IAT is ongoing, with some studies observing a sub-dimension that taps into withdrawal and social problems resulting from Internet use (*Social Problems-Internet*). Given the focus of the present study, we elected to include this important domain in analyses as well. This factor highlights questions such as "How often do you choose to spend more time online over going out with others?" and "How often do you snap, yell, or act annoyed if someone bothers you while you are online?" (Chang and Man Law, 2008). As with the IAT total, higher scores indicate greater impairment in this domain.

Branch four of the Mayer–Salovey–Caruso Emotional Intelligence Test 2.0 (*MSCEIT*) (Mayer et al., 2003) was chosen by an expert panel to represent a standardized tool to assess social cognitive ability in psychosis-spectrum individuals (Nuechterlein et al., 2008). This test specifically examines how well individuals manage their emotions within themselves and in their relationships (*Emotional Processing*). For this test, an administrator presents a series of vignettes describing social situations and the participant is asked to indicate the best response for the person described in the respective vignette. For example, one vignette describes the situation of "Robert" who is cut off while driving on the highway, and becomes furious as a result. The participant is read this vignette and asked whether a subsequent set of responses would be most effective in dealing with his anger (e.g., is it effective to never drive on that highway again or cut the driver off a few miles later?). The MSCEIT demonstrates strong reliability and discriminant validity in individuals diagnosed with schizophrenia (Eack et al., 2009, 2010a; Kee et al., 2009) and it has also been utilized in UHR youth (Green et al., 2012). Total scores were computed and transposed to T-scores (uncorrected for age as done in previous research (Green et al., 2012)) to ease interpretation, allowing the results to indicate that average performance corresponds to a 50 with a standard deviation of 10, with lower scores corresponding to worse performance. Not all participants were able to complete the *Emotional Processing* assessment. A total of 1 control and 2 UHR participants were not administered this portion of the assessment due to scheduling conflicts.

2.3. Data analysis

In order to determine whether significant differences were apparent between the UHR group and controls and whether further analyses required additional controlling for confounds, we compared groups' age, sex, and parental education using linear regression. Differences in *IAT-Total*, *Social Problems-Internet*, and *Emotional Processing* scores were also evaluated using linear regression to determine whether group means were significantly different. These between group analyses involving the *IAT-Total*/*Social Problems-Internet* included 45 of the 46 controls and 51 of the 52 UHR group. One control scored higher than 3 standard deviations above the group mean and was determined to be an outlier and not representative of the sample. The one missing UHR participant did not endorse ever going on the Internet, and was therefore excluded from further analyses. For the *Emotional Processing* analyses, 45 of the 46 controls and 50 of the 52 UHR group were included, due to some participants not being able to complete the assessment, as noted above. The relationship between *IAT-Total*/*Social Problems-Internet* and *Emotional Processing* was evaluated with linear regression.

3. Results

3.1. Sample characteristics

There were no significant group differences in age ($F(1,97) = 2.40$, $p = 0.125$), sex ($F(1,97) = 1.85$, $p = 0.177$), and parental education ($F(1,95) = 1.30$, $p = 0.258$). Therefore, no further analyses required covarying for demographic variables. As expected due to sampling strategy, UHR youth showed elevated positive and negative symptoms relative to controls (Table 1).

3.2. Internet use and emotional processing

UHR participants showed elevated *IAT-Total* scores relative to controls ($\beta = -6.49$, $F(1,95) = 8.79$, $p = 0.002$). UHR participants also exhibited significantly increased *Social Problems-Internet* scores in comparison to their healthy counterparts ($\beta = -3.23$, $F(1,95) = 11.43$, $p < 0.001$). Between-group analyses revealed that UHR youth showed significant impairment on the *Emotional Processing* task when compared to controls ($\beta = 4.59$, $F(1,94) = 5.52$, $p = 0.011$) (Table 1).

Table 1
Sample Characteristics.

	Ultra High Risk (n = 52)	Control (n = 46)
% Male	61.50	47.80
Age	18.60 (1.8)	17.89 (2.7)
Parental Education (years)	23.21 (4.4)	22.01 (5.8)
SIPS Positives**	12.02 (4.5)	0.52 (1.2)
SIPS Negative**	9.69 (6.9)	0.39 (1.0)
IAT-Total*	21.08 (11.6)	14.59 (9.6)
Social Problems-Internet*	6.29 (5.6)	3.07 (3.2)
MSCEIT*	42.92 (9.8)	47.51 (9.2)

Note. Unless otherwise indicated, values are mean (standard deviation). SIPS (Structured Interview for Prodromal Syndromes); IAT (Internet Addiction Test); Social Problems-Internet (Internet Addiction Test-withdrawal and social problems dimension); MSCEIT (The Mayer–Salovey–Caruso Emotional Intelligence Test 2.0, branch four-managing emotions).

* $p < 0.05$.

** $p < 0.001$.

The relationship between *IAT-total* and the *Emotional Processing* score was significant, where greater problematic IU corresponded to poorer ability to manage emotions ($\beta = -0.18$, $t(1,92) = -1.95$, $p = 0.027$). This relationship was not significant when examining the UHR group alone ($\beta = -0.16$, $t(1,48) = -1.28$, $p = 0.103$). Similarly, greater *Social Problems-Internet* scores related to worse *Emotional Processing* performance ($\beta = -0.63$, $t(1,92) = -3.22$, $p = 0.001$) (Fig. 1), and this link was maintained in the UHR group ($\beta = -0.51$, $t(1,48) = -2.10$, $p = 0.021$) (Table 2).

Table 2
Associations between Internet use and emotional processing.

	MSCEIT		
	β	t	p
	Total Sample (n = 95)		
IAT-Total	−0.18	−1.95	0.027
Social Problems-Internet	−0.63	−3.22	0.001
	UHR (n = 50)		
IAT-Total	−0.16	−1.28	0.103
Social Problems-Internet	−0.51	−2.10	0.021

Note. IAT (Internet Addiction Test); IAT-Social (Internet Addiction Test-withdrawal and social problems dimension); MSCEIT (The Mayer–Salovey–Caruso Emotional Intelligence Test 2.0, branch four-managing emotions).

4. Discussion

Spending time online continues to rise and represents a widespread cultural change. Research has not been able to keep up with the rates of rapidly rising Internet use; this represents a gap in the literature where science is currently unable to inform how Internet use may impact individuals and relate to psychopathology. This missing evidence is especially important for adolescents and young adults, who utilize the Internet at ever-increasing rates and are in a sensitive developmental time point in their lives. Given that some studies suggest that Internet use may be related to mental health (whether for good or bad remains unknown), understanding the impact of IU in youth is warranted. In particular, UHR individuals represent an adolescent/young adult population with a variety of different symptomatology, making this group an excellent clinical sample with which to investigate the relationship between IU and psychopathology.

To our knowledge, this is the first study to examine IU in UHR youth. Group differences emerged with UHR youth exhibiting both elevated rates of problematic IU as well as social withdrawal and impaired interpersonal interactions resulting from use, relative to controls. Further, UHR individuals performed more poorly than controls on a cognitive test evaluating their ability to manage personal (e.g., how well does a particular action help you regulate your mood) and interpersonal (how well does a particular action help preserve your relationship with another person) emotions. Associations existed such that greater problematic IU and especially the related withdrawal and social problems domain were linked with poorer scores on the social cognition task. These results highlight that greater problematic IU is associated with decreased emotional processing performance. These findings further clarify how IU may relate to social behavior and psychopathology during formative years of development.

4.1. Group differences in Internet use and emotional processing

The current findings indicate elevated problematic IU (as evidenced by the *IAT-Total* score) in UHR youth relative to controls, consistent with the existing body of literature examining other psychosis spectrum samples (Mittal et al., 2007, 2013). The significant discrepancy between UHR youth and controls found here is in line with available evidence that suggests that problematic IU is associated with a variety of clinical diagnoses including anxiety and depression (Shapira et al., 2003). Specifically, results emphasize that social problems resulting from use are also evident in this sample of adolescents/young adults (the *Social Problems-Internet* score is roughly twice as high in the clinical group). Social isolation and withdrawal are commonly mentioned as one of the first warning signs of transition into a formal psychotic disorder (Piskulic et al., 2012), making social problems particularly important to recognize in this group. Although interpretation of the present correlational finding is limited, it seems likely that IU may simply be a reflection of already existing social impairment. As mentioned, social behavioral deficits are very common to the psychosis prodrome (Cornblatt et al., 2012; Thompson et al., 2012), and it may be that the current study highlighted another domain impacted by social difficulties experienced by UHR youth. The present study adds to the existing literature by showing that there are increased negative impacts on social

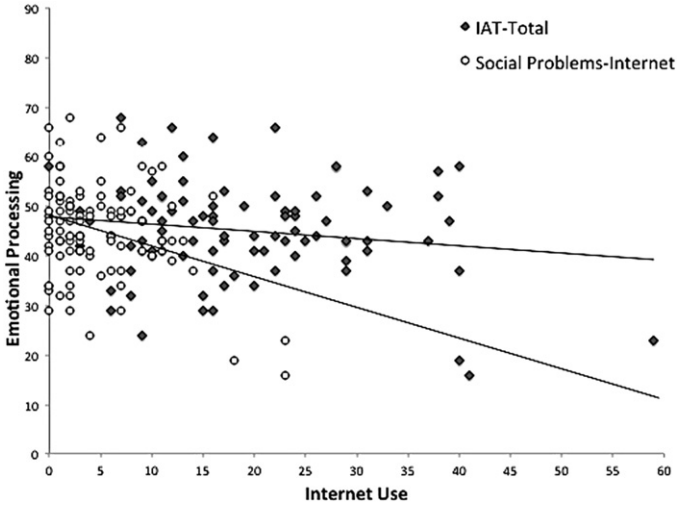

Fig. 1. Associations between Internet use and emotional processing.

well-being from using the Internet in UHR youth relative to their healthy peers. Future studies should examine more closely the causal nature of this relationship to determine how IU may directly impact social isolation and withdrawal and in turn, the development of psychosis.

Similar to other research with UHR youth and schizophrenia populations, the current study found that UHR youth exhibited impaired *Emotional Processing* ability relative to controls (Green et al., 2012; Serrani, 2011). Specifically, UHR youth showed poorer performance in their ability to manage their emotions, as evidenced through an assessment using vignette descriptions. For example, one vignette asks how to best maintain a relationship when a friend is moving away, and a participant who scores well on *Emotional Processing* may suggest ensuring that you and the other person have a method to stay in touch, while someone scoring low on *Emotional Processing* would endorse that if the person doesn't say anything to you directly, then you can assume that the friend is not worth your efforts (Mayer et al., 2003). This differential response is an example of how emotional processing may go awry in UHR youth and how *Emotional Processing* impairment may manifest.

Although deficits in emotional processing are commonly found in research assessing individuals with schizophrenia (Kimhy et al., 2012; Nuechterlein and Green, 2006), not all studies have found significant differences between UHR youth and controls groups in their emotional processing ability (Thompson et al., 2012). This mixed finding may be due to methodological differences, as the present study contained a larger sample than the investigation reporting null results in emotional processing (Thompson et al., 2012). In total, the current investigation adds to existing literature that shows that social cognitive impairment is already present to some extent in UHR youth relative to their unaffected peers. This result is notable, as UHR youth are in an age demographic that is characterized by extensive social development. Entering into this stage of life with impaired social cognitive ability is likely to cause further challenges for this group. For example, social cognition has been postulated as a risk marker for the development in psychosis (Eack et al., 2010b). Therefore, social cognitive ability, such as emotional processing, represents a critical target for future intervention.

4.2. The relationship between Internet use and emotional processing

In examining the link between IU and emotional processing in all participants, results showed that greater *IAT-Total* corresponded with impaired *Emotional Processing* performance. Similarly, when focusing on *Social Problems-Internet*, findings indicated that increased issues in this domain also related to poorer *Emotional Processing* ability. It is notable that the link between *Social Problems-Internet* and *Emotional Processing* deficits was apparent across the sample and within the UHR group alone. One possibility is that that those with poorer ability to manage emotions in real-life situations experience greater withdrawal and social problems resulting from their IU. One study, which evaluated college students, found that in examining symptom domains before and after becoming addicted to IU, individuals showed that increased IU caused them to experience increased interpersonal sensitivity (Dong et al., 2011). This meant that by increasing their use to a problematic level, they exhibited more discomfort and negative interpersonal interactions (Derogatis et al., 1976; Dong et al., 2011), which would support the idea that IU lends itself to increased social problems. However, this solitary study was conducted with a very different sample (i.e., Chinese college freshman), than the present study and there may have been many extraneous factors unexamined that actually caused the impaired interpersonal functioning noted. Overall, there does appear to be some support for the idea that IU causes poorer social behavior, but it is limited, and further evidence is needed to determine the causal nature of the association found in the current study.

Another interpretation of the link between emotional processing impairment and increased IU is that real-life emotion functioning deficits in UHR youth may simply carry over onto behavior on the Internet, but do not actually exacerbate existing social deficits. For example, social impairment is consistently shown in various other domains for UHR youth, such as overall less engagement with relationships, increased conflict with peers, and decreased intimate relationships (Cornblatt et al., 2007). Additionally, evidence suggests that social withdrawal is a pervasive problem reported among UHR youth who eventually developed a psychotic disorder (Piskulic et al., 2012). It is likely that the increased problems associated with IU in UHR youth are a manifestation of an already present difficulty with emotional processing. Therefore, although the current investigation does take an initial step by showing a clear link between increased IU and social impairment, further clarification in this population regarding whether IU (and whether a particular type of IU) actually worsens existing social impairment would be useful in light of the critical developmental window UHR youth inhabit.

UHR youth are representative of a vulnerable group, and understanding any potential additional risks or, depending on the exact function of IU, avenues for increased social connectedness would be extremely beneficial. The examination of this link in an even larger sample would aid in clarifying the nature of how attenuated psychotic symptoms and IU are related. Furthermore, adolescence and young adulthood represent the developmental time period where psychopathology often manifests, making the current results relevant for this broader age group as opposed to just UHR youth.

In line with a developmental perspective of UHR youth, there are also broader implications of exhibiting emotional processing deficits in this age range of adolescence/young adulthood. Adolescence is a developmental stage defined by growth, transitions, adjustment to changes, and an onslaught of social challenges (Crone and Dahl, 2012). The present result suggests that for this age group, exhibiting difficulty in managing emotions may link with experiencing problematic associations with using the Internet. This is particularly relevant as adolescents spend, roughly, the equivalent of a part-time job using the Internet per week (Derbyshire et al., 2013; Harris Interactive and Teenage Research Unlimited, 2015). Knowing that emotional processing deficits may be linked with problematic IU could inform individuals, families, and treatment providers as to the potential impact of IU for a particular adolescent.

The present findings surrounding psychopathology and IU are particularly relevant in the context of increasing Internet-based treatments. Current Internet based interventions targeting psychosis include a focus on psychoeducation and support, integrated therapy, and cognitive behavioral therapy, and the existing evidence suggests that these treatments are beneficial to improving symptoms and a sense of feeling connected socially, among other positive outcomes (Alvarez-Jimenez et al., 2014). These protocols emphasize structured online time, which is different than what the present study investigates (Alvarez-Jimenez et al., 2014). Here, we are evaluating every day usage and how that relates to existing emotional processing ability. Although not directly connected to online interventions, the present findings may have some implications for treatments utilizing the Internet. Specifically, if the treatment were intended for UHR youth or patients with schizophrenia, it would be important to keep in mind that these individuals would likely already be exhibiting problematic IU. With that in mind, providing some tools with which to counteract some of the potential negative associations with IU could be beneficial when prescribing time online for treatment purposes. For example, including skills to use if someone interrupts their time online and suggestions as to how to balance time spent

online with actual interpersonal contact could be useful to integrate into interventions. In sum, future online interventions could benefit from an increased awareness of the potential link between having difficulty managing emotions and problematic IU.

Several limitations to the present investigation should be acknowledged. First, the sample size in the present study was modest and future work with larger numbers would likely aid in our ability to fully understand the relationship between psychosis risk, IU, and *emotional processing*. Secondly, the control sample did not have current Axis I clinical diagnoses. While this heightening of differences between groups allowed us to maximize power in the present study, future studies would benefit from having a more continuous comparison group representative of the general population. This heterogeneous sample would also allow for future work to more broadly compare findings among UHR youth and other prodromal and/or clinical samples. There is also a limitation in that the present study did not exclude based on active substance abuse. This is likely to be more representative of the general population, but may confound results as there is some literature linking illicit drug use with alterations in social cognition (Preller et al., 2014; Schmid et al., 2014). It would also prove useful in future investigations to have a clearer breakdown regarding what the subjects were actually doing while using the Internet (e.g. chat rooms, social media, etc.), along with a novel measure of social functioning. This information could aid in clarifying whether specific Internet usage patterns are more problematic than others and whether there is a direct link to functioning. Additionally, the current study is cross-sectional and correlational in nature. A longitudinal design could enhance current findings by clarifying the causal influence of Internet use on social behavior and discovering how the relationship between these two areas may change over time.

The present study evaluated Internet use, emotional processing, and symptomatology in youth at clinical high-risk for psychosis and healthy controls. Similar to other clinical populations, the UHR group exhibited elevated rates of problematic Internet use relative to their control counterparts. Furthermore, this problematic usage was linked with poorer ability to manage emotions. This link suggests that individuals who exhibit emotional processing impairment likely also experience elevated rates of social problems resulting from using the Internet.

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Contributors

AP, LI, and VAM designed the study and were responsible for manuscript writing. AP and LI were involved in data collection and all authors were involved in the statistical analysis of the project. All authors participated in manuscript revision and approved the final version of the manuscript to be published.

Conflict of Interest

The authors declare that they have no conflicts of interest to report.

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