Theses and Dissertations

August 2016

Examining Heightened Sense of Incompleteness as a Candidate Endophenotypic Marker for Skin Picking Disorder

Ivar Snorrason
University of Wisconsin-Milwaukee

EXAMINING HEIGHTENED SENSE OF INCOMPLETENESS AS A CANDIDATE

ENDOPHENOTYPIC MARKER FOR SKIN PICKING DISORDER

by

Ivar Snorrason

A Dissertation Submitted in

Partial Fulfillment of the

Requirements for the Degree of

Doctor of Philosophy

in Psychology

at

The University of Wisconsin-Milwaukee

August 2016

ABSTRACT

EXAMINING HEIGHTENED SENSE OF INCOMPLETENESS AS A CANDIDATE
ENDOPHENOTYPIC MARKER FOR SKIN PICKING DISORDER

by

Ivar Snorrason

The University of Wisconsin-Milwaukee, 2016
Under the Supervision of Professor Han Joo Lee

Excoriation (skin-picking) disorder (SPD) shares genetic underpinnings with obsessive-compulsive disorder, and the phenomenology of both disorders is characterized by heightened sense of incompleteness or "not just right" experiences. The aim of the study was to examine if a general tendency for heightened sense of incompleteness (trait incompleteness) can serve as an endophenotypic maker of SPD.   Individuals with SPD (n=32) and matched healthy controls (n=42) completed two validated self-report measures of trait incompleteness and rated photographs designed to evoke a sense of incompleteness. Additionally, unaffected first-degree relatives of the SPD group (n=18) and the control group (n=22) completed the same set of measures. The results showed that scores on all the trait incompleteness measures were significantly higher in the SPD group compared to the control group. However, the relatives of the SPD group did not show elevated scores on the incompleteness measures, compared to the control relatives. These data suggest that even though trait incompleteness is a correlate of SPD diagnosis, it does not co-segregate with SPD in families and is therefore not a promising candidate endophenotype for SPD.

TABLE OF CONTENTS

iii

LIST OF FIGURES

LIST OF TABLES

Introduction

Because of the complex etiological structure of most psychiatric disorders, and lack of biological validity of existing diagnostic categories, traditional strategies that aim to identify genes that contribute to psychiatric phenotypes have met with limited success. In recent years, optimism has emerged surrounding the possibility of unraveling genetic underpinnings of psychiatric disorders by linking genes to endophenotypes – intermediary variables that lay somewhere on the causal pathway between genetic influence and full phenotypic expression. It is believed that identifying endophenotypic markers will simplify the search for contributory genes, as the endophenotypes presumably have simpler genetic structure than the full-blown psychiatric disorders. The aim of the current study was to begin the process of searching for endophenotypic markers for excoriation (skin-picking) disorder (SPD).

SPD is a psychiatric condition characterized by excessive picking at one's skin in the absence of an underlying dermatological problem. This problem is usually chronic and persists despite negative consequences such as repeated infections, disfigurement, emotional distress and social avoidance.   SPD is currently classified as an obsessive-compulsive and related disorder in DSM-5 (APA, 2013) and studies show that SPD shares genetic etiology with obsessive-compulsive disorder (OCD) and other OC spectrum conditions (Bienvenu et al., 2009; 2012; Monzani et al., 2014). Researchers have traditionally highlighted important clinical and phenomenological differences between SPD and OCD (e.g., Grant et al., 2010). Most notably, it has been emphasized that skin-picking behavior is never associated with harm avoidant cognitions, which have traditionally been considered a core motivator of compulsive behaviors in OCD (e.g., "I am contaminated; therefore I need to wash my hands"). However, research increasingly shows that many OCD patients do not report harm avoidant cognitions, but rather inexplicable feelings of incompleteness or "not just right" experiences (e.g., "I need to complete the compulsive act until it feels just right"). This

1

phenomenological feature appears to be shared by individuals with SPD. For example, skin picking is often triggered by the sight or feel of skin imperfections, and individuals with SPD often feel compelled to pick at the skin until it feels perfectly smooth or "just right" (Ferrao, Miguel, & Stein, 2009; Grant & Odlaug, 2010; Hajcak, Franklin, Simons, & Keuthen, 2006; Tucker et al., 2011).

A growing body of research indicates that error-related negativity might be a promising candidate endophenotypic marker of OCD. Error-related negativity is an event-related brain potential that is evoked by error/performance monitoring (Endrass & Ullsperger, 2014; Manoach et al., 2013; Riesel et al., 2011; Riesel et al., 2015) and has been linked specifically with incompleteness symptoms in OCD (Endrass & Ullsperger, 2014; Tops and Wijers, 2012). Given that SPD also appears to be characterized by incompleteness experiences, it is possible that this marker reflects the shared genetic influence between OCD and SPD.

Even though neurobiological research (e.g., EEG and neuroimaging studies) hold great promise of identifying endophenotypes for psychiatric problems, they are costly and burdensome and rarely yield sample sizes large enough to detect small genetic effects in a single study (Button et al., 2013). Fortunately, emerging literature suggests that self-report measures of temperament, personality traits and other stable individual differences may also serve as useful endophenotypic markers for psychiatric phenotypes. For example, Jonas and Markon (2014) recently conducted a meta-analysis of 106 studies that examined genetic influence on different markers of impulsivity, including trait impulsivity questionnaires and diagnosis of attention deficit/hyperactivity disorder. The results showed that the impulsivity questionnaires had significantly stronger genetic effects than full-blown diagnosis of attention deficit/hyperactivity disorder. Although preliminary, these and other data suggest that self-report inventories can be used to measure traits that lay closer to the gene action than

2

diagnosis of psychiatric disorders.

The aim of the current study was to examine if self-report measures of general tendency to experience heightened sense of incompleteness (i.e., trait incompleteness) can be used as an endophenotypic marker for SPD. Before describing the study, we first provide a comprehensive literature review. We begin by providing a historical overview of SPD research and review the current literature on symptom presentation, clinical characteristics, prevalence, morbidity, relation with other psychiatric disorders, and etiology. Next, we introduce the endophenotype concept and discuss properties of useful endophenotypic markers. We then review the literature on trait incompleteness and evaluate to what extent data support its usefulness as an endophenotypic marker. We end by describing a study where trait incompleteness is examined in individuals with and without SPD as well as unaffected relatives of individuals with SPD.

Skin Picking Disorder: Historical Overview

In the year 1875, Sir Erasmus Wilson, a dermatologist, was the first to use the term neurotic excoriation to describe a behavioral syndrome characterized by recurrent picking of one's skin in the absence of a dermatological problem (Wilson, 1875). In the decades that followed, several other dermatologists described patients with this problem (Adamson, 1912, 1915; MacKee, 1920; Pusey & Senear, 1920). MacKee (1920) provided the following description:

…the habit is not controllable and the person finds it difficult, if

not impossible, to avoid picking at little islands of epithelial

débris, follicular plugs, comedones, stubby hairs, acne lesions,

milia, crusts etc. The point to be emphasized in this type is that

3

the patient has no reason, other than a nervous habit, for
interfering with nature. It is the same impulse that makes one
bite the nails, chew the mustaches, bite the lips, suck the thumb
etc. (p. 256)

Many of the early descriptions emphasized the severity of the condition. One clinician noted that sometimes the habit "becomes a fixed obsession which no amount of psychiatric care seems to change" (Wrong, 1954, p.581). According to Pusey and Senear (1920), a wife of one patient reported: "he would stand in the middle of the night before the mirror as much as five hours at a time digging at his face. He had lost so much sleep in this way that he had become unable to hold his position (p. 274)".

These early dermatologists took care to differentiate SPD from factitious disorder where an individual produces skin lesions in order to gain sympathy or monetary reward (dermatitis artefacta) and skin picking due to delusions about parasites under the skin (delusions of parasitosis or acarophobia). They also differentiated between SPD and skin picking/scratching due to dermatological problems, but noted that some "neurotic" individuals with dermatological problem can develop the tendency to pick or scratch the skin excessively:

There is still another type of excoriation, namely, that associated with
chronic itching dermatoses such as dermatitis herpitiformis, prurigo,
chronic urticaria, pediculosis, etc. Here, however, there is no habit or
mania, but simply vigorous attempts at relief from severe itching.
Such cases cannot be classified as neurotic excoriations. On the other
hand, there are instances, in neurotic individuals, in which the itching

4

accompanying a mild urticaria or pruritus is markedly intensified by

the peculiar temperament, and in which the scratching and digging is

entirely out of proportion to the subjective symptoms. Such cases can

very properly be classified under neurotic excoriations – a secondary

type (MacKee, 1920, p.257)

In the year 1898, shortly after Wilson first described neurotic excoriation, Louis

Brocq, a French dermatologist, provided detailed descriptions of patients who repeatedly

picked at their acne, or produced acniform lesions by picking at minor acne or healthy skin

(Brocq, 1889).   Brocq noted that patients were often concerned with either imaginal or minor

acne and picked at them in order to correct appearance of the skin. These patients were

typically adolescent females and Brocq named the condition l'acné excoriée des jeunes filles

(literally means acne produced by young females). Later authors pointed out that this

condition is not restricted to females or adolescents but agreed with Brocq that the behavior

typically occurs in the absence of significant acne problem:

The striking feature of the appearance of the patent's face is that

numerous very superficial crusts are present, together with brownish

stains and superficial scars. On close examination, there is frequently a

complete lack of the typical lesions of acne vulgaris, comedo, papule and

pustule… (p. 577; Wrong, 1954).

Even though Brocq and others discussed acne excoriée as a distinct problem, many of

the early dermatologists included this condition under the umbrella of neurotic excoriation

(Adamson, 1912, 1915; MacKee, 1920), although it was acknowledged that the type of skin

5

damage tends to be slightly different between the two conditions (Wilson, 1875; Wrong, 1954). It has also been pointed out that sometimes individuals begin by picking at acne and then over time develop a more general picking habit involving other skin lesions (Wrong, 1954; Wilhelm et al., 1999).

While dermatologists, in both Europe and the United States, began describing patients with SPD in late 1800s and early 1900s, the problem was neglected within psychology and psychiatry until recently. By the middle of the twentieth century, psychodynamic authors had attempted to explain and treat SPD (Hollander, 1951; Zaidens, 1951), and by the early 1970s, behaviorists had developed treatments for habit behaviors, including skin picking (Azrin & Nunn, 1973). In the past three decades, there has been growing empirical interest in skin picking problems, especially among psychiatrists and psychologists, and a mounting literature has documented the clinical characteristics, prevalence, morbidity and etiology of SPD. These efforts eventually lead to the inclusion of SPD as a distinct diagnosis in the DSM-5.

Skin Picking Disorder: Current Literature

Symptom Presentation

Studies show that most SPD sufferers engage in skin picking every day or almost every day typically in one or several intermittent episodes (Arnold et al., 1998; Snorrason et al., 2011; Tucker et al., 2010; Wilhelm et al., 1999). The average time spent picking per day ranges from 84 to 109 minutes (Odlaug & Grant, 2008; Snorrason et al., 2011; Tucker et al., 2010; Wilhelm et al., 1999). A survey among 760 individuals with SPD (Tucker et al., 2010) showed that the majority of responders picked at multiple body areas, and the most common picking sites were the face (74%), scalp (50%), arms (49%), legs (45%), chest (40%) and fingers/cuticles (36%). Individuals with SPD typically use their fingernails to pick or dig into the skin, but about one-third uses implements (e.g., tweezers or needles) as well (Snorrason et

6

al., 2011; Wilhelm et al., 1999). Commonly, an individual will pick at multiple spots and let sores heal after picking them. Some individuals become fixated on a particular excoriation for extended periods and do not let them fully heal between episodes, which often results in increasingly large excoriation. Many will engage in certain habits before and after picking (e.g., play with and scrutinize the pulled skin, rolling it between the fingers etc.), and about one-third will eat the picked skin (Snorrason et al., 2011; Wilhelm et al., 1999). Some individuals admit to occasionally picking skin of other people (Snorrason et al., 2011; Odlaug & Grant, 2008; Wilhelm et al., 1999).

Gender Ratio, Age at Onset and Course

The majority (75-90%) of individuals seeking treatment for SPD are females (e.g., Keuthen et al., 2010; Snorrason, Belleau, & Woods, 2012; Wilhelm et al., 1999). Data from psychiatric samples have consistently shown that the most common age at SPD onset is during adolescence, however, three studies in dermatology settings have shown mean age at onset later in adulthood (Snorrason, Belleau, et al., 2012). The course of SPD is typically chronic, without long symptom free periods. Many sufferers report waxing and waning symptoms with greater severity during stress (Grant, Odlaug, & Kim, 2007; Snorrason, et al., 2011; Wilhelm et al., 1999).

Distress and Impairment

Skin picking often causes discomfort and nuisance because of skin problems, such as bleedings, soreness and temporary large excoriations (Simeon et al., 1997). Infections due to picking are common (Arnold et al., 1998; Nezirouglu et al., 2008; Odlaug & Grant, 2008; Snorrason et al., 2011; Wilhelm et al., 1999), and studies show that between 16 to 35% of patients report a history of antibiotic treatments due to picking-related infections (Odlaug &

7

Grant, 2008; Snorrason et al., 2011). Many individuals suffer notable skin damage, scarring or permanent disfigurement due to the behavior (Arnold et al., 1998; Odlaug & Grant, 2008; Snorrason et al., 2011; Wilhelm et al., 1999). Odlaug and Grant (2008) interviewed 60 individuals with SPD and found that all had visible excoriations. About one-third had a more severe ulceration, and seven participants (28.3%) had undergone laser therapy to repair picking-related skin damage. Neziroglu and colleagues (2008) reported that 6% of their SPD sample had needed corrective surgery due to skin picking, and two cases (3.3%) in the Odlaug and Grant (2008) sample required multiple skin grafts. In rare cases, individuals with SPD suffer life-threatening medical complications due to picking wounds that extend through all dermal layers (Kim, Garrison & Thompson, 2013; O'Sullivan et al., 1999; Sahin et al., 2004).

Most patients experience embarrassment and distress because of the skin damage or the inability to control the behavior; and depression, helplessness and low self-esteem are frequently reported (Arnold et al., 1998; Keuthen et al., 2001; Tucker et al., 2010; Wilhelm et al., 1999). Social interference is common and may include intense fear of being "found out", time-consuming cover up routines (e.g., applying makeup etc.) and avoidance of situations or activities in which the problem or the skin damage may be exposed (Flessner & Woods, 2006; Keuthen et al., 2001; Simeon et al., 1997; Tucker et al., 2010). Arnold and colleagues (1998) found that almost half of their sample (44%) reported social avoidance and 18% "confined themselves to their home most of the time" (p. 510). Studies have also documented significant impairment in academic and occupational functioning (Tucker et al., 2010) as well as detrimental economic impact due to the disorder (Flessner & Woods, 2006). Odlaug, Kim and Grant (2010) administered a standardized quality of life questionnaire to 59 individuals with SPD and found that nearly 40% reported "low" or "very low" quality of life. The results also showed that the SPD sample reported significantly lower quality of life

8

compared to a healthy control sample, even after controlling for the effect of comorbid affective disorders.

Prevalence

  General population. SPD has not been included in large-scale epidemiological studies, but several researchers have attempted to document the prevalence of SPD. Keuthen et al. (2000) surveyed 105 American college students and found that 3.8% reported currently engaging in recurrent skin picking resulting in skin damage, distress or impairment. The same research group found that a similar proportion of German college students met these criteria, however, the prevalence reduced to 2.2% when picking due to dermatological illness or other mental disorders were excluded (Bohne et al., 2002). A later survey among 245 Turkish college students, used the full criteria including exclusionary criteria, and found a 2.04% lifetime prevalence of SPD (Calikusu et al., 2012). A survey among Icelandic college students (N=554; 98% response rate) also showed a 2% prevalence of SPD, using strict DSM-5 criteria (Snorrason et al., unpublished data). Hayes et al. (2009) surveyed individuals in the general US population and found a prevalence of 5.4%; however, the sample may have been biased, as participants were approached in public settings and asked to participate. Keuthen et al. (2010) conducted a survey involving phone interviews in a random sample of the adult US population (N=2,513). Results showed that 1.4% met diagnostic criteria for SPD. Finally, in a study of female twins from community sample in the UK (N=2,191), it was found that 1.2% met a cut-off score on the skin picking scale, indicating probable diagnosis of SPD (Monzani et al., 2012).

  In addition to survey data, several studies have documented the prevalence of SPD in well defined samples in behavioral genetic studies (i.e., studies where diagnoses were made by supervised doctoral level interviewers using semi-structured interview with good inter

9

rater reliability). These studies have shown a 4 to 6% prevalence of "probable" or "definite" lifetime diagnosis of SPD among healthy control cases or relatives of healthy control cases (e.g., Bienvenu et al., 2012).

Psychiatric/medical populations. Several studies have documented the prevalence of SPD in a variety of psychiatric/medical populations, including general psychiatric inpatients, OCD patients, bipolar disorder patients, obese patients and more. All studies used semi-structured interviews and assessed criteria similar to the DSM-5 criteria (sometimes also including requirement of preceding tension and subsequent arousal).

Table 1

Prevalence of Skin Picking Disorder (SPD) in Psychiatric/Medical Populations

Citation	Sample	Prevalence	
		Current %	Lifetime %
General Psychiatric settings			
Grant et al. (2007)	102 consecutive	11.8	---
Müller et al. (2011)	234/275 consecutive (85%)	6.8	7.3
Other psychiatric populations			
Flessner et al. (2009)	202 youth with OCD	---	15.9
Grant et al. (2010)	70 consecutive youth with OCD	12.8	14.3
Lovato et al. (2012)	901 adults with primary OCD	----	16.3
Grant et al. (2010)	293 consecutive adults with OCD	7.8	8.9
Fontenelle et al. (2005)	45 adults with OCD	---	13.3
Karakus & Tamam (2011)	124 consecutive adult patients with bipolar I	---	10.5
General medical settings			
Schmidt et al. (2012)	100 adult obese bariatric surgery candidates	8.0	9.0

Dermatologic populations. In an early study, Griesmer (1978) interviewed 4,576 consecutive patients who were seeking help from a dermatologist and found that 2% had

10

SPD. A more recent survey among 102 dermatologists showed that 24% had referred at least one patient with excessive skin picking/scratching to a psychiatrist (Jefferany et al., 2010a, 2010b). Another study (Ehsani et al., 2009) interviewed patients in a dermatology clinic who were thought to have at least one of four psychocutaneus disorders (i.e., SPD, hair pulling disorder, dermatitis artefacta, and delusion of parasitosis). Of the 178 patients interviewed, 72% were diagnosed with SPD, suggesting that SPD is among the most common psychocutaneus disorders. More methodologically sound studies are needed to better understand the prevalence of SPD in dermatology clinics, but the available evidence suggests that SPD is not uncommon in these settings.

Phenomenology

The majority of individuals with SPD (around 80%) experience mounting tension or arousal before picking or gratification/relief while performing the behavior (Arnold et al., 1998; Odlaug & Grant, 2008; Snorrason et al., 2010; Wilhelm et al., 1999). Studies also show the behavior serves to regulate aversive emotional states, such as tension, stress, anxiety and boredom (Snorrason et al., 2010; Wilhelm et al., 1999). Certain perfectionist experiences are often reported (Gupta, Gupta and Schork, 1996), and can variously be expressed as a need to finish what was started, desire for certain outcome, a sense of accomplishment when able to obtain it, or frustration when unable to do so (see further discussion of incompleteness experiences and skin picking below). Picking frequently occurs outside of reflective awareness (e.g., Wilhelm et al., 1999), and it has been proposed that SPD includes two skin-picking styles (Walther et al., 2009). One style is characterized by "automatic picking", in which the individual picks without reflective awareness, typically during sedentary activities. Another is characterized by "focused picking", in which the individual picks in full awareness, typically in response to an impulse or negative internal state.

11

Classification of Skin Picking Disorder

Among other things, SPD has been conceptualized as an impulse control disorder, behavioral addiction, stereotypic movement disorder and self-injurious behavior. In recent years, SPD is increasingly viewed as an obsessive-compulsive spectrum disorder (Arnold et al., 2001; Stein, Hutt, Spitz, & Hollander, 1993). Even though SPD and OCD have important differences in clinical characteristics (e.g., age at onset, gender ratio) and phenomenology (e.g., absence of harm avoidance fears in SPD) (Grant et al., 2010), the two disorders have certain clinical features in common (e.g., both involve repetitive tension-reducing behaviors), often co-occur and aggregate together in families (see below). SPD also appears to be related to body dysmorphic disorder (BDD), a disorder that is thought to be closely related to OCD. For example, Grant, Menard, and Phillips (2006) interviewed 176 BDD patients and found that 45% had lifetime history of pathological skin picking.

Evidence suggests that SPD may be closely related to hair pulling disorder (HPD; trichotillomania) as the two disorders have strikingly similar symptom presentation, often co-occur (Snorrason, Belleau, et al., 2012), and share common genetic underpinnings (see below). Several authors (Stein et al., 2010) have argued that SPD and HPD may be best conceptualized as "grooming disorders" or as forms of body focused repetitive behavior disorders (BFRBDs), a diagnostic concept that assumes relatedness and shared etiology between different habits directed to the body, including pathological hair pulling, skin picking, nail biting, nail picking, and cheek biting. Emerging literature suggests that different BFRBDs often co-occur and may share etiology (Snorrason, Ricketts, et al., 2012), however, limited empirical data have been collected so far. Evidence suggest that BFRBDs and OCD share similarities and to some extent aggregate in the same families (Bienvenu et al., 2012). Thus, BFRBDs have been construed as "motoric obsessive-compulsive spectrum disorders" (Phillips et al., 2010). In DSM-5, both HPD and SPD are classified as *Obsessive-Compulsive*

and Related Disorders, and other BFRBDs are specifically mentioned as examples of *Other Specified Obsessive-Compulsive and Related Disorder* (APA, 2013).

Etiology of Skin Picking Disorder

A study of 2,191 female twin pairs from the general UK population (Monzani et al., 2012) showed that additive genetic factors explained 40% of the variance in self-reported SPD severity and the remaining 60% were explained by individual-specific (non-shared) environmental factors. Monzani et al. (2014) closely replicated these findings in a larger sample (N=5,409) from the same population. Monzani et al. (2014) further explored the shared genetic and environmental influence on self-reported symptoms of SPD, HPD, OCD, BDD and hoarding disorder. All five disorders appeared to have mostly unique environmental influence, but some shared genetic underpinning. In brief, the data supported two distinct liability factors. One factor reflected a non-specific genetic vulnerability, as it was largely heritable and loaded on all five disorders. The other factor, also largely heritable, loaded exclusively on HPD and SPD. Interestingly, the genetic variance was entirely shared between the two disorders, suggesting the possibility that SPD and HPD are simply different phenotypic expressions of the same underlying genotype.

Family studies have generally shown that HPD and SPD run in the same families (Snorrason, Belleau et al., 2012), although the largest family study conducted so far failed to find elevated rates of SPD among first-degree relatives of HPD patients (Keuthen et al., 2014). Evidence suggests that both SPD and HPD co-occur and aggregate in families with OCD. Bienvenu and colleagues (2012) examined data from the OCD Collaborative Genetics Study and compared rates of SPD and HPD between four groups of participants: OCD probands (n=382), their first-degree relatives (n=974), probands without OCD (n=73) and their first-degree relatives (n=233). As expected, rates of "probable diagnosis" of SPD and

13

HPD were significantly higher among OCD cases (SPD=31%; HPD=11%) compared to controls (SPD=6% and HPD=1%). Furthermore, rates of SPD and HPD were significantly higher among relatives of OCD cases (SPD=17%; HPD=4%), compared to relative of control cases (SPD=4%; HPD=0%).

Little is known about specific genes that contribute to the development of SPD. The only candidate studied so far is the *Sapap3* gene, which is strongly expressed in the striatum, a brain region consistently implicated with OCD and related disorders (Burguiere et al., 2015). Mice with deletion of the *Sapap3* gene (Welch et al, 2007) engage in excessive grooming behavior that is not caused by any cutaneous defects and results in skin lesions and hair loss. Bienvenu and colleagues (2009) found an association between variations within the *Sapap3* gene and diagnosis of BFRBD (i.e., SPD, HPD and pathological nail biting) in the sample from the OCD Collaborative Genetics Study, which included individuals with and without OCD (N=1618). *Sapap3* was not associated with OCD diagnosis in the sample; however, a large proportion of the BFRBD subjects had comorbid OCD. Thus, the authors did not want to "rule out the possibility that *Sapap3* is relevant to a pathological grooming-related subtype of OCD" (p. 716).

Summary

Research over the past decades indicates that SPD is relatively common and often a severe psychiatric problem. Etiology of SPD is poorly understood, although emerging literature suggest moderate genetic influence that are at least partly shared with OC spectrum disorders, including OCD, HPD, and other BFRBDs.

The Endophenotype Approach

Because most psychiatric disorders are caused by numerous interacting environmental and genetic factors, traditional strategies that aim to link contributory genes to a specific phenotype (i.e. a specific psychiatric disorder) have met with limited success. It is now better appreciated than ever that in most cases, several genes with small effects, rather than few genes with large effects, contribute to the cause of psychiatric disorders, often in complex interaction with environmental or other genetic factors. This makes identification of contributory genetic influence that more challenging.

Gottesman and Shields (1973) anticipated this challenge and developed the concept of endophenotype to aid in the search of genetic contribution to complex psychiatric disorders. The concept, originally conceived in insect biology (Bernard & Lewis, 1966), refers to an intermediary marker (a measurable trait) that forms a link on the causal pathway between genes and overt expression of a disorder (the phenotype). In brief, genes typically exert their effects on behavior through complex causal pathways (or networks; see Miller & Rockstroh, 2013) that involve numerous intermediary links. The aim of the endophenotype approach is to identify markers for these intermediary links. It is believed that identification of such markers will facilitate discovery of genetic contributions, because the intermediary links are assumed to lay closer to the genotype (i.e. closer to the level of gene action) and therefore have a simpler genetic underpinning than the phenotype (Gottesman & Gould, 2003).

Definition of Endophenotype

Table 2 shows Gottesman and Gould's (2003) definition of an endophenotype.

15

Table 2

Gottesman and Gould's (2003) Definition of Endophenotype

1. The endophenotype is associated with illness in the population
2. The endophenotype is heritable [20% or greater]
3. The endophenotype is primarily state independent (manifests in an individual whether or not illness is active)
4. Within families, endophenotype and illness co-segregate
5. The endophenotype found in affected family members is found in nonaffected family members at a higher rate than in the general population

The definition assumes that the endophenotype has a genetic etiology that is partly shared with the phenotype, and thus should be heritable and co-segregate with the phenotype within families. The definition also assumes that the endophenotype is a trait-like characteristic that is present whether or not the disorder is active. Both assumptions predict that the endophenotypic marker should be found at elevated rates among unaffected family members of individuals with the disorder (i.e., individuals who share the endophenotype but not the phenotype).

It has been pointed out that the definition does not distinguish between endophenotypes that are mediational variables and risk indicators (Kendler & Neale, 2010; Walther & Owen, 2007). It is often assumed that a trait that meets the definition of endophenotype mediates the effects of genes on the phenotype (as an "intermediary phenotype"). However, another possibility is that the trait is a risk indicator that happens to share genetic etiology with the phenotype, but is causally unrelated to it. Thus, a risk indicator may not be useful in the development of interventions in the same way a mediator might be. Nonetheless, both risk indicators and mediators can facilitate discovery of genetic underpinnings of a disorder, because both represent a risk for the disorder, share genetic etiology with it, and presumably have simpler genetic architecture than that the full-blown

16

disorder. Determining whether a trait is a mediator or a risk indicator is possible but quite challenging in practice (Kendler & Neale, 2010). Arguably, a more important initial task in establishing endophenotypic markers is to demonstrate that the trait is "associated with causes rather than effects of disorders" (Cannon & Keller, 2006, p. 274). To rule out the possibility that a marker is simply a consequence of the illness, one must demonstrate that the trait a) occurs prior to the onset of the illness and b) is elevated in unaffected relatives of individuals with the illness (Cannon & Keller, 2006).

Properties of Good Endophenotypic Markers

It is generally agreed that an endophenotypic marker may involve variables at any levels of analysis. Gottesman and Gould (2003), for example, offered the following statement when introducing their definition: "an endophenotype may be neuropsychological, biochemical, endocrinological, neuroanatomical, cognitive, or neuropsychological (including configured self-report data) in nature" (p. 636). However, several authors have identified properties that good candidate markers should have (Cannon and Keller, 2006; Kendler & Neale, 2010; Miller & Rockstroh, 2013), in addition to fulfilling the definition in Table 2. First, many authors agree that dimensional markers are superior to categorical markers, since psychopathology tends to be dimensional (Cannon and Keller, 2006; Kendler & Neale, 2010; Miller & Rockstroh, 2013). For example, Cannon and Keller (2006) argued that "endophenotypes should vary continuously in the general population" (p. 276). Among other things, the authors pointed out that if the distribution of the trait is in fact dimensional in the population (as most psychopathology is), then statistical methods involving dimensional variables have more power than statistical methods involving categorical variables (See also Kendler & Neale, 2010).

It is also widely accepted that an endophenotype should optimally be assessed across

several levels of analysis (Cannon & Rosso, 2002). Endophenotypic markers differ in terms of where they lay on the gradient between the genotype and the phenotype (e.g., genetic disposition, neural circuit dysfunction, cognitive deficits, and behavioral symptoms). Assuming a causal pathway from genetic predisposition and upstream toward phenotypic expression, documenting an endophenotype at more than one level provides convergent validity for the proposed causal pathway.

Transdiagnostic Endophenotypes

It has become increasingly clear that DSM/ICD diagnostic categories, and traditional disorder boundaries, may not be biologically valid. Decades of research have failed to find a reasonable match between known dysregulation in neurobiological systems and specific disorder categories. In reaction to these and other problems with the DSM/ICD approach, the NIMH launched the Research Domain Criteria (RDoC) initiative, which is largely based on the endophenotype approach, and ultimately aims to create classification schemes informed by underlying causal mechanisms rather than overt signs and symptoms (Insel et al., 2010).

Given the lack of biological validity of traditional diagnostic categories, many authors have cautioned against relying on them when validating endophenotypes, and emphasized the potential value in discovering transdiagnostic markers (e.g., Miller & Rockstroh, 2013). For example, identifying an endophenotype associated with two or more genetically related disorders may help clarify the nature of the shared genetic influence. Thus, Cannon and Keller (2010) pointed out that "endophenotypes that affect multiple disorders should be found for genetically related disorders" (p. 277).

Summary

SPD is a moderately heritable psychiatric phenotype that is presumably caused by

18

complex networks of interacting genetic and environmental factors. Identifying an endophenotype for SPD may help simplify and facilitate etiological (genetic) research, and, in the case of transdiagnostic markers, promote understanding of the etiological relations between SPD and genetically related OC disorders.

Heightened Sense of Incompleteness as an Endophenotype

A potential transdiagnostic endophenotypic marker underlying OC spectrum disorders, including SPD, is a tendency to experience a strong sense of incompleteness (hereafter trait incompleteness). A sense of incompleteness has been described as "the troubling and irremediable sense that one's actions or experiences are not just right" (Summerfelt, 2004, p. 1156). The sense of incompleteness can occur in any sensory modality and commonly involves visual perceptions (e.g., objects don't look symmetrical enough), tactile perceptions (e.g., a surface doesn't feel smooth enough), and proprioceptive perceptions (e.g., a movement doesn't feel quite completed). In clinical populations, incompleteness is typically accompanied by a need to relieve the associated discomfort by performing a behavior until the "just right" feeling is obtained.

Studies show that a sense of incompleteness often precipitates and accompanies compulsive/repetitive behaviors in OC spectrum conditions, including OCD (Taylor et al., 2014), obsessive-compulsive personality disorder (Ecker, Kupfer, & Gunner, 2013), tic disorders (Leckman et al., 1994), autism spectrum disorders (Kloosterman et al., 2013) and SPD (Ferrao, Miguel, & Stein, 2009; Grant & Odlaug, 2010; Hajcak, Franklin, Simons, & Keuthen, 2006). Harm avoidance cognitions have traditionally been recognized as core determinants of compulsive behaviors in OCD (e.g., "if I don't check the stove, my house will burn down"). However, data consistently show that large proportions of OCD patients do not report harm avoidance thoughts preceding their compulsions (e.g., Foa et al., 1999).

19

In fact, more than 50% of patients describe an inexplicable sense of incompleteness, or things feeling "not just right" as important motivator (Summerfeldt et al., 2014). Summerfeldt and colleagues (e.g., Summerfeldt et al., 2014) pointed out the limitation of subtyping OCD according to overt symptoms (e.g., checking, washing, etc.), and argued that harm-avoidance and incompleteness represents two core motivational dimensions that cut across overt symptoms.

Individuals with SPD rarely if ever have thoughts of harm avoidance when picking skin, however, the sense of incompleteness is frequently reported (Ferrao, Miguel, & Stein, 2009; Hajcak, Franklin, Simons, & Keuthen, 2006). Skin picking is often triggered by the sight or feel of skin imperfections (Grant & Odlaug, 2010) and patients typically describe inexplicable "not just right" feelings and a longing to "fix" the skin or "smooth" its texture even though they know picking at it tends to make it worse in the end. Most patients report a sense of gratification or relief during picking (Snorrason et al., 2010), and the degree of gratification/relief often depends on the extent to which the desired outcome is achieved (e.g., "smooth" skin).

In summary, even though overt symptoms of OCD, SPD and other OC spectrum disorders are quite variable, they may have in common incompleteness as a precipitating factor, although the precise nature of incompleteness experiences may differ somewhat between disorders.

Incompleteness as a Genetic Predisposition to OC Pathology

Pierre Janet (1903) originally conceived of the incompleteness concept at the turn of the 20th century on the bases of extensive clinical observations of patients with OCD and related conditions (see Pitman, 1987). Janet (1903) theorized that the "most basic factor in the illness" is the "psychasthenic state" characterized by feelings of "incompleteness" or an

20

"inner sense of imperfection". He further proposed that the psychasthenic state emerges prior to the onset of full-blown OC pathology, and that it is necessary for a disorder to develop (Jakes, 1996; Pitman, 1987). Extending this notion, using modern terminology, heightened trait incompleteness can be construed as a genetic predisposition to OC pathology. According to this view, trait incompleteness reflects a basic tendency that can promote different behavioral expressions (e.g., OCD, SPD, HPD or no psychopathology) depending not only on other etiological factors, but also on the individual's adaptation to the trait itself and to external influences (e.g., dermatological problems). We argue that such predisposition could potentially be a useful transdiagnostic endophenotype for OC spectrum disorders. Below we critically examine empirical data that can shed light on the validity and usefulness of trait incompleteness as an endophenotypic marker in SPD.

Trait Incompleteness

Trait incompleteness is typically measured with self-report questionnaires or *in vivo* experimental tasks. We will briefly describe these measures before reviewing the literature on trait incompleteness.

Measures. Coles and colleagues (Coles et al., 2003; 2005) developed the "Not Just Right" Experiences Questionnaire-Revised (NJRE-Q-R), which is a self-report questionnaire designed to assess trait incompleteness. First, responders are provided with a description of the phenomena along with several examples. They are then presented with a list of ten common incompleteness experiences (e.g., "when placing a book back onto a shelf, I have had the sensation that it did not look just right with the other books"), and asked to indicate (yes/no) if they have had them in the past month. Next, responders are instructed to write down their most recent incompleteness experience, and rate its intensity/severity on seven items (e.g., intensity of the experience, distress caused by it, difficulty thinking about

21

something else, urge to correct etc.). Typically, the sum of these seven items are used as an indicator of trait incompleteness.

Summerfelt and colleagues (2014) developed a self-report scale that assesses general tendency to experience incompleteness (OC-CDQ-I; 10 items) and harm avoidance thoughts (OC-CDQ-H; 10 items). Unlike the NJRE-Q-R, items on OC-CDQ-I do not refer to specific actions or stimuli but ask more generally about experience of incompleteness (e.g., "I must do things in a certain way or I will not fell right"). The sum of the ten OC-CDQ-I items are thought to reflect trait incompleteness. Studies have shown significant, but moderate, positive correlation ($r=.47$, $p<.05$) between NJRE-Q-R and OC-CDQ-I (Cougle et al., 2013; Study 2), suggesting the two scale may assess somewhat different aspect of the construct.

Several authors have successfully evoked a sense of incompleteness among healthy volunteers using *in vivo* experimental tasks (Coles et al., 2005). In general, scores on OC-CDQ-I and NJRE-Q-R are moderately correlated with self-rated experiences of incompleteness, distress or urge to fix the stimuli during such tasks. For instance, Cougle, Fitch, Jacobson and Lee (2013) asked 38 undergraduates to complete a stove-checking task, and found that self-rated urge to check afterwards was significantly correlated with scores on the OC-CDQ-I ($r=.39$, $p<.05$) and the NJRE-Q-R ($r=.40$, $p<.05$), and the correlations remained significant after negative affect and harm avoidance were controlled for. In another study (Summers et al., 2014), 284 undergraduates underwent four different *in vivo* tasks designed to evoke the sense of incompleteness by stimulating different sensory modalities. The participants were asked to 1) view cluttered table (visual), 2) wear oversized lab coat and asymmetrically button it (tactile), 3) wipe non-dominant hand with moist cloth, but leave the dominant hand dry (tactile), and 4) listen to a nursery rhyme out of tune (auditory). Participants were asked to rate their discomfort and urge to correct the stimuli during the tasks. With few exceptions, both OC-CDQ-I and NJRE-Q-R had a moderate correlation with

22

discomfort and urge ratings, even after controlling for general negative affect. Finally, Cougle, Goetz, Fitch and Hawkins (2011) recorded how long undergraduates (n=133) washed their hands after emerging their hands into a dirt mixture. NJRE-Q-R had significant correlation with duration of hand washing (r=.25, p<.01). In conclusion, studies have consistently showed a moderate correlation between trait measures of incompleteness and incompleteness-driven actions or experiences triggered by *in vivo* tasks.

Prevalence in healthy populations. Coles and colleagues (2005) asked undergraduate students (n=46) to document occurrences of incompleteness experiences for seven days, and found that the average number of experiences were about on per day. Several studies have presented participants with a standard list of ten common incompleteness experiences (from the NJRE-Q-R). Approximately 80% of adolescents and adults will report having had at least one of the experiences the past month (Coles et al., 2003; Ghisi et al., 2010; Ravid, Franklin, Khanna, Storch, & Coles, 2014). Another study (Fergus, 2013), defined incompleteness more broadly and used a more comprehensive item pool, and found that 95% of adults reported at least one incompleteness experience the past month. Thus, the sense of incompleteness is a common experience in psychiatrically healthy populations. Typically, the feeling of incompleteness is benign and only one quarter of people will report an urge to do something to alleviate it, and even less proportion actually performs a neutralizing act (Coles et al., 2003; Ravid et al., 2014).

Temporal stability. Sica and colleagues (2012) administered NJRE-Q-R along with other self-report measures to 187 college students at baseline, 6-month- and 12-month follow-up. Results showed that baseline NJRE-Q-R scores had high test-retest correlations with scores at six-month and 12-month follow-up (r = .70 and r = .75 respectively), suggesting that trait incompleteness is stable over time.

23

Is Trait Incompleteness Heritable?

The heritability of trait incompleteness has not been investigated directly in behavioral genetic (twin) studies. However, indirect evidence suggests the trait is heritable. First, studies show that incompleteness runs in families, as scores on the NJRE-Q-R correlate between psychiatrically healthy parents and offspring in the general population (Sica et al., 2013). Second, twin research has demonstrated heritability of scores on questionnaires that include items that assess incompleteness. For example, Tozzi and colleagues (2004) examined a large sample of female twin pairs who completed the Frost Multidimensional Perfectionism Scale, a questionnaire that includes a subscale that assesses aspects of trait incompleteness (doubts about actions). Results showed that scores on the subscale were moderately heritable. In addition, Moore and colleagues (2010) reported substantial genetic contribution to scores on the Short Layton Obsessional Inventory-Child version, a questionnaire where four of 11 items assess "obsessions/incompleteness", although findings were only significant for males (60% of the variance caused by genetic factors). Twin studies have also shown that genetic factors explain substantial variance in traits that are conceptually related to incompleteness, including sensory over-responsivity (38-52%; Goldsmith et al., 2006) and three major dysfunctional OC beliefs: 1) perfectionism/intolerance of uncertainty, 2) over importance of one's thoughts and 3) inflated personal responsibility/overestimation of threat (32-40%; Taylor et al., 2011). Taken together, existing evidence suggests trait incompleteness is likely heritable.

Is Trait Incompleteness Associated with Skin Picking Disorder?

At least two studies have examined the link between trait incompleteness and SPD among individuals with OCD. Flessner et al. (2009) found that children with OCD and comorbid BFRBD (including SPD) were more likely to endorse a frequent sense of

incompleteness compared to children with only OCD. Ferrao et al. (2012) compared OCD

patients with and without sensory phenomena, a broader concept that includes

incompleteness and related experiences. The results showed that OCD patients who endorsed

sensory phenomena had numerically higher rates of SPD compared to OCD patients that did

not endorse sensory phenomena, although the trend did not reach statistical significance

(p=.053), possibly due to over-inclusiveness of the sensory phenomena construct used in the

study. However, no study has examined trait incompleteness in pure samples of individuals

SPD.

Conclusion

The empirical literature is limited but existing data suggest that trait incompleteness

might be a promising candidate endophenotype for SPD. First, the majority of the general

population endorses incompleteness experiences in the absence of OC pathology. Second,

the tendency for incompleteness is stable over time, and can be reliably measured. Third,

existing data suggest that trait incompleteness is heritable. However, no study has directly

examined if individuals with SPD are characterized by heightened trait incompleteness and

no study has examined if trait incompleteness is elevated among unaffected relatives of those

with SPD.

The Current Study

The main aim of the current study was to examine if trait incompleteness is elevated

in individuals with SPD and their unaffected relatives compared to healthy controls. Thus,

several measures of trait incompleteness were administered to four groups of participants: 1)

individuals with SPD (SPD group), and 2) their unaffected first-degree relatives (SPD-

relatives group), 3) individuals without history of SPD (control group), and 4) their

25

unaffected first-degree relatives (control-relatives group).

Aims and Hypotheses

The first aim of the study was to examine if trait incompleteness, measured in several different ways, was elevated among individuals with SPD compared to healthy controls. The second aim was to examine if trait incompleteness was elevated in unaffected first-degree relatives of individuals with SPD. If incompleteness is an endophenotype for SPD, the trait should be elevated not only among SPD subjects, but also among their unaffected first-degree relatives (regardless of the current illness status). The third aim is to examine if trait incompleteness runs in families. If trait incompleteness runs in families, scores on incompleteness measures should be positively correlated between family members. Thus, we made the following predictions:

1. The SPD group will obtain significantly higher scores than the control group on all incompleteness measures.
2. The SPD-relatives group will obtain significantly higher scores than the control-relatives on all the incompleteness measures.
3. All incompleteness measures will be positively correlated between relatives, i.e., between SPD subjects and their relatives and between control subjects and their relatives.

Method

Participants

The study included four participant groups: 1) students with SPD (SPD group; *n*= 32), 2) students without SPD (Student Control Group; *n*= 42), 3) unaffected first-degree relatives

of the SPD group (SPD Relatives Group; *n*= 18) and 4) unaffected first-degree relatives of the control group (Control Relatives Group; *n*= 22).

Measures

Diagnostic Interviews

Diagnostic Interview for Skin Picking Problems (DISP; Snorrason et al., in preparation). The DISP is a 16-item semi-structured diagnostic interview designed to assess DSM-5 diagnostic criteria and clinical features of SPD. To determine diagnostic criteria for SPD the interviewer assesses whether picking behaviors result in (a) skin lesions, (b) emotional distress, (c) impairment in functioning, (d) desire to stop or reduce picking, and (e) attempts at stopping or reducing picking. The interviewer also assesses if skin-picking behavior is solely due to a medical condition (e.g., dermatological problem) or another psychiatric disorder (e.g., concerns about appearance in body dysmorphic disorder). Other clinical features assessed include body areas picked, picking frequency/duration, and the course of the skin picking habit (e.g. age at onset, and the longest period gone without picking). The interview also assesses similar diagnostic criteria and clinical features of HPD and other BFRBs, as well as family history of SPD, HPD and other BFRBs.

Mini International Neuropsychiatric Interview (MINI; Sheehan et al., 1997). MINI was designed as a brief semi-structured diagnostic interview that determines diagnoses for psychiatric disorders according to DSM-IV. MINI assesses the following psychiatric disorders: major depressive disorder, dysthymic disorder, bipolar disorder, panic disorder, agoraphobia, social phobia, simple phobia, obsessive-compulsive disorder, posttraumatic stress disorder, alcoholic dependence/abuse, substance dependence/abuse, generalized anxiety disorder, anorexia nervosa, and bulimia nervosa.

The Incompleteness Survey

All participants completed an online survey that included a picture-rating task, a picture recognition task and two sets of questionnaires in the following order:

Questionnaires (Set#1). 1) *Background variables*. Age, gender, ethnicity, educational level, current medication use, and psychiatric history (have you ever been diagnosed with psychiatric disorder? If yes, what disorder?) and current stress level (how much stress are you experiencing, at this very moment?). 2) *Not Just Right Experiences-Questionnaire-Revised* (NJRE-Q-R; Cole et al., 2003, 2005*)*. The NJRE-Q-R is a 19-item questionnaire designed to assess a general tendency for not just right experiences (i.e., sense of incompleteness). First, participants are shown a list of 10 common NJREs and asked to indicate (yes=1/no=0) whether they have experiences them in the past month. Then participants are asked to select the most recent NJRE and rate it on seven severity items (e.g., how intense was this NJRE?). The sum of these items yields NJRE-Q-R Severity score. 3) *Obsessive–Compulsive Trait Core Dimensions Questionnaire* (OC-TCDQ; Summerfeldt et al., 2014*)*. The OC-TCDQ includes two subscales designed to assess tendencies for harm avoidance (10 items) fears and feelings of incompleteness (10 items). Items are rated from 0 (*never applies to me*) and 4 (*always applies to me*). Both scales have been shown to have good psychometric properties (Summerfelt et al., 2014).

Picture Rating Task (designed for the current study). Participants were presented with 21 photographs designed to evoke a sense of incompleteness. The first 11 photographs (General Incompleteness Pictures; GIP) were designed to evoke incompleteness unrelated to skin picking (e.g., a crooked painting on a wall, hole in clothes etc.). The next ten photographs (see Schuck, Keijsers, & Rinck, 2012) show skin imperfections and are designed to evoke a skin picking-specific incompleteness (Skin Imperfection Pictures; SIP). Each photograph was presented one at a time and participants asked to view the picture and notice

28

any affective reactions. After a three second delay, the following items were presented below the picture: 1) this gives me a strong "not just right" feeling, 2) the incompleteness really bothers me, 3) I have an urge to fix/correct this, and 4), it is hard to stop thinking about how this is "not just right". Each item was rated on a scale ranging from 0 (not at all true) to 7 (very true). A global GIP score was obtained by summing up the four incompleteness items for the nine GIPs (GIP score). Similarly, a global SIP score was obtained by summing up the four incompleteness items for the ten SIPs (SIP score).

       Questionnaires (Set#1). *1) Obsessive Compulsive Inventory-Revised* (OCI-R; Foa et al., 2002). The OCI-R is an 18-item scale that assesses impact of various obsessive-compulsive symptoms over the past month. The instrument yields a total scores and scores for six subscales: obsessions, washing, checking, ordering, neutralizing and hoarding. The scale has good psychometric properties (Foa et al., 2002). 2) *Dysmorphic Concerns Questionnaire* (DCQ; Jorgensen et al., 2001). This is an 8-item self-report scale designed to assess dysmorphic concerns. Items are rated on a 4-point scale from *not at all* to *much more than most people*. Previous studies have shown good psychometric properties of the scale (Jorgensen et al., 2001). 3) *Depression Anxiety Stress Scale 21-item version* (DASS-21; Antony et al., 1998). The DASS-21 is a 21-item questionnaire designed to measure symptoms of depression, anxiety, and stress in clinical and non-clinical populations. Each domain contains seven items in which the respondent is asked to indicate the extent to which a statement applies to them using a 4-point Likert scale. The DASS-21 is a widely used instrument and studies show that all three scales have good psychometric properties. 4) *Skin Picking Scale-Revised* (SPS-R; Snorrason, Olafsson et al., 2012). The SPS-R is an 8-item self-report scale that assesses clinical severity of pathological skin picking the past week. The SPS-R includes two subscales: symptom severity scale (frequency of urges, intensity of urges, frequency of skin picking and controllability of the behavior) and impairment scale

(emotional distress, functional impairment, social avoidance and skin damage). Items are rated on a 5-point rating scale ranging from 0 (*none*) to 4 (*extreme*). Previous study demonstrated good psychometric properties of this scale (Snorrason et al., 2012). 5) *Current Skin Complaints* (CSC; Halvorsen et al., 2008). This is a 5-item questionnaire asking participants about skin complaints the past week. The scale has been shown to have high correlation with results from a comprehensive dermatological examination (Halvorsen et al., 2008).

Picture Recognition Task. This was a surprise recognition task were participants were shown the photographs from the picture rating task along with slightly modified versions of those photographs. First, 9 of the 11 general incompleteness photographs were presented interspersed with 9 modified versions of those photographs. Next, the ten skin picking-related incompleteness photographs are presented, also interspersed with ten slightly modified version of those photographs. For each photograph, participants were asked to indicate as fast as they could whether they thought the photograph was changed or unchanged. Research show that information that is experienced as incomplete or unfinished is remembered better than information that is complete (The Zeigarnik effect; see e.g., Rothermund, 2003). We therefore assumed that higher levels of incompleteness during the initial picture ratings would have positive correlation with recognition performance later.

Procedure

Recruitment of Student Participants. Student participants were recruited from a large pool of students at the University of Wisconsin-Milwaukee. Each semester all students at the psychology department are offered to complete a screening survey that determines eligibility for various research studies (via the SONA research management system). Over two semesters (fall 2014/spring 2015), the survey included screening item for excessive skin

picking (Table 3). Responders who endorsed option A (control group) or options D-E (SPD

group) were offered (by email invitation) to participate in a study session in exchange for

extra credit and a small compensation ($20). The session included the Incompleteness survey,

the diagnostic interviews and other activities unrelated to the current study. The study

protocol was approved by the University's IRB and informed consent was obtained at the

outset of the session.

Table 3

Screening Item for Excessive Skin Picking

Have you ever had an excessive skin picking habit that is not due to dermatological
problems?

    A. No never

    B. No (I sometimes pick my skin but never excessively)

    C. Yes, in the past, I had a skin picking habit

    D. Yes, currently, I excessively pick skin, and it bothers me.

    E. Yes, currently, I excessively pick skin, and it cause problems.

        Recruitment of First-Degree Relatives. Students that participated in the testing

session (both SPD and control subjects) were asked to nominate one or more of their first-

degree biological relatives (i.e., parents, siblings, or children) to participate in an online

study. Nominated relatives were then sent email invitation to participate in the

Incompleteness Survey online (and complete cognitive tasks to the current study) in exchange

for small compensation ($10 gift card).

        Inclusion and Exclusion Criteria for Student Participants. SPD subjects were

included if they were at least 18 years old and met our criteria for SPD in the DISP. We

defined SPD as a current excessive skin picking habit that is not due to a dermatological

problem or another psychiatric disorder and results in a least two of the following: (a) skin

31

lesion, (b) emotional distress, (c) impairment in functioning, (d) desire to stop or reduce

picking, and (e) attempts at stopping or reducing picking. Student control subjects were

included in the study if they are at least 18 years old and reported no history of excessive skin

picking in the DISP. Participants in both groups were excluded if they met criteria for

bipolar disorder, any psychotic disorder, OCD, HPD, BDD or current depressive disorder

(i.e., major depressive disorder or dysthymia).

   Inclusion and Exclusion Criteria for Relatives. Student participants were asked to

only nominate relatives that were 1) at least 18 years old and 2) did not have a) current major

depression, or alcohol/substance use problems (past problems are allowed), and b) past or

current SPD, HPD, OCD, BDD, bipolar disorder, schizophrenia, pervasive developmental

disorder (e.g., autism spectrum disorder), dementia or traumatic brain injury. Relatives were

also excluded if they self-reported diagnosis of bipolar disorder, any psychotic disorder,

OCD, HPD, BDD or current depressive disorder (i.e., major depressive disorder or

dysthymia). Finally, given the low sensitivity of a single item asking about psychiatric

diagnoses we also excluded relatives who indicated psychopathology on previously validated

symptom questionnaires. First, relatives were excluded if they exceeded an OCI-R cutoff

score for probable diagnosis of OCD (i.e., score above 21; Foa et al., 2002). Second,

relatives were excluded if they reported "severe" or "extremely severe" problems on the

Depression (score of 21+), Anxiety (score of 20+) or Stress (score of 26+) subscales of

DASS-21 (Antony et al., 1998).

Statistical Approach

   Given that the relative groups differ from the student groups in terms of study

procedures (e.g., relatives complete the study on their home computers) as well as important

background variables (relatives were mostly parents and therefore significantly older), we did

32

not compare all four groups. We only compared the SPD group with the student control group, and the SPD relatives with control relatives. We used independent sample t-tests to examine group differences and logistic regression analyses to examine unique effects of more than one predictors on SPD diagnosis. To examine mediation effects we used Baron and Kenny's (1986) approach. Significance threshold was *p*<.05.

Results: Students

Participants

SPD Group. Out of the 2,763 responders that completed the online pre-screening survey, 50 endorsed problematic or bothersome skin-picking habit and participated in the study session. Thereof, 17 individuals were excluded. Four participants did not meet our criteria for problematic skin picking (two had only benign skin-picking habit, one had a past picking habit, and one primarily picked at the nails). Fourteen participants met criteria for at least one exclusionary diagnosis including history of bipolar disorder (*n*=2), current major depression/dysthymia (*n*=5), OCD (*n*=5) or BDD (*n*=4). The demographic data for the remaining 32 participants are presented in Table 4.

Control Group: Forty-nine students participated in the control group.   Seven individuals were excluded because of at least one of the following: a) reported an excessive scratching habit (*n*=1), b) met criteria for OCD (*n*=2) or bipolar disorder (*n*=2) or c) reported having a relative with SPD (*n*=2). The demographic information for the remaining sample (*n*=42) is reported in Table 4.

33

Table 4

Demographic Information for the Control Group and the Skin Picking Disorder (SPD) Group

	SPD Group n=32	Control Group n=42	t / χ^2	p
Age (*M; SD*)	21.7 (4.1)	20.5 (1.9)	1.61	.109
Female Gender	30 (94%)	40 (95%)	.08	.779
Ethnicity			-9.21	.027
Caucasian	25 (78%)	39 (93%)		
Hispanic	6 (19%)	0		
Asian	0	1 (2%)		
Multiracial	1 (3%)	2 (5%)		

Clinical Characteristics in the SPD Group

All the SPD subjects reported a skin picking habit that was chronic and persistent. The average age of onset was 11.2 years (*SD*=5.6, range 2 to 24 years) and the average duration of the problem was 11.5 years (*SD*=6.5, range 1 to 33 years). About half (54%) of the sample had never stopped picking for more than seven days, and the majority (93%) had never stopped picking for more than three months. All participants reported currently picking skin every day (*n*=29; 90.6%) or every other day (i.e., at least four times per week; *n*=3; 9.4%). The average total duration of skin picking per day the past month was 36 minutes (*SD*=43), the average number of picking episodes per day was eight (*SD*=11.8), and the average number of minutes per episode was 12 (*SD*=23.0). The majority of the sample reported experiencing an urge or an impulse to pick (90.3%), or gratification/relief during the act of picking (93.1%). About two-third (68.8%) of the sample reported picking more than one body area (*M*=2.1; *SD*=1.1; range 1 to 5). Table 5 shows the number of participants that reported different body areas.

34

Table 5

Picking Sites

Body Areas	*n* (%)
Face	18 (56.3)
Fingers	15 (46.9)
Legs	8 (25.0)
Arms	7 (21.9)
Scalp/head	5 (15.6)
Shoulders	4 (12.5)
Back	4 (12.5)
Lips	3 (9.4)
Hands	2 (6.3)
Feet/Toes	1 (3.1)
Chest	1 (3.1)

Is Sense of Incompleteness Elevated among Individuals with SPD?

   Questionnaire Measures. As shown in Table 6, the SPD group obtained significantly

higher scores than the control group on all the questionnaires. The effect sizes for negative

affect scales and OC related problems were larger than the effect sizes for the incompleteness

questionnaires.

Table 6

Questionnaire Measures in the Control Group and the Skin Picking Disorder (SPD) Group

	SPD Group n=32	Control Group n=42	t	Effect Size (d)
Skin Picking Symptoms				
SPS-R Severity	8.31 (2.93)	.38 (1.08)	14.55***	3.59
SPS-R Impairment	3.72 (2.57)	.17 (.58)	7.68***	1.91
Skin Complaints	8.03 (2.28)	6.43 (1.23)	3.60**	.87
Negative Affect				
Current Stress	3.34 (1.64)	2.74 (1.58)	1.61^{ns}	----
DASS Stress	19.75 (9.41)	7.14 (6.82)	6.41***	1.53
DASS Anxiety	13.25 (7.34)	3.81 (4.84)	6.31***	1.52
DASS Depression	15.93 (11.41)	5.38 (7.62)	4.51***	1.09

OC Related Problems

DCQ	17.00 (5.17)	11.17 (3.52)	5.48***	1.32
OCI-R	18.72 (12.06)	7.10 (6.68)	4.91***	1.19
OC-ODQ-H	27.50 (8.45)	19.26 (7.94)	4.26***	1.01

Incompleteness

OC-ODQ-I	27.81 (9.60)	20.33 (8.83)	3.48***	.81
NJRE-Q-R	23.87 (9.30)	17.88 (8.27)	2.93**	.68

SPS-R=Skin Picking Scale-Revised; DASS= Depression Anxiety Stress Scales; DCQ=Dysmorphic Concerns Questionnaire; OCI-R=Obsessive-Compulsive Inventory-Revised; OC-CDQ-H = Obsessive-Compulsive Core Dimensions Questionnaire Harm Avoidance Subscale; OC-CDQ-I = Obsessive-Compulsive Core Dimensions Questionnaire Incompleteness Subscale; NJRE-Q-R=Not Just Right Experiences Questionnaire Revised; [ns]= not significant; **=$p<.001$; ***=$p<.0001$.

Picture Rating Task. Compared to the control group, the SPD group reported significantly greater sense of incompleteness in response to all the general incompleteness pictures and all the skin imperfection pictures (Table 7). Overall, the effect sizes tended to be larger for the skin imperfection pictures.

Table 7

Picture Ratings the Control Group and the Skin Picking Disorder (SPD) Group

	SPD Group *n*=32	Control Group *n*=42	*t*	Effect Size (*d*)
General Imperfections				
Picture#1	11.41 (5.17)	7.98 (3.65)	3.20**	.77
Picture#2	10.28 (3.71)	8.07 (4.32)	2.32*	.55
Picture#3	8.69 (3.90)	6.62 (3.01)	2.55*	.59
Picture#4	12.94 (4.63)	9.05 (4.01)	3.87***	.90
Picture#5	10.31 (4.77)	7.67 (3.55)	2.74**	.63
Picture#6	10.50 (5.53)	7.98 (4.40)	2.12*	.50
Picture#7	10.47 (4.74)	7.52 (3.38)	2.99**	.72
Picture#8	9.72 (4.35)	7.36 (3.86)	2.47*	.57
Picture#9	11.81 (5.18)	9.00 (4.90)	2.39*	.56
Picture#10	14.19 (4.55)	10.36 (4.56)	3.58**	.84
Picture#11	9.00 (3.69)	6.21 (2.91)	3.63**	.84
GIP Score	119.31 (38.57)	87.81 (32.66)	3.81***	.88
Skin Imperfections				
Skin Picture#1	15.22 (4.79)	9.57 (4.61)	5.11***	1.46
Skin Picture#2	12.19 (5.31)	7.36 (3.89)	4.34***	1.04
Skin Picture#3	10.44 (4.60)	6.17 (3.64)	4.32***	1.03

Skin Picture#4	17.09 (3.61)	10.45 (4.51)	6.82***	1.63
Skin Picture#5	14.84 (4.90)	8.40 (4.32)	5.99***	1.39
Skin Picture#6	11.09 (4.59)	7.26 (4.84)	3.45***	.81
Skin Picture#7	11.41 (4.55)	6.17 (3.48)	5.62***	1.29
Skin Picture#8	12.94 (4.79)	7.48 (4.22)	5.21***	1.21
Skin Picture#9	10.25 (4.88)	6.86 (4.27)	3.18**	.74
Skin Picture#10	11.22 (5.09)	6.40 (4.19)	4.35***	1.03
SIP Score	126.69 (40.92)	76.12 (37.22)	5.55***	1.29

GIP=General Imperfection Pictures; SIP=Skin Imperfection Pictures; *=$p<.05$; **=$p<.001$; ***=$p<.0001$.

Psychometric Analysis of the GIP and SIP Scores. In the whole student sample, Cronbach's alpha coefficient indicated an excellent internal consistency of the GIP score (α = .94) and the SIP score (α = .98). The GIP and SIP scores also showed good convergent validity via correlations with the previously established questionnaire measures of trait incompleteness. In particular, there was a significant positive correlation between GIP score and the NJRE-Q-R (r=.49, $p<.0001$) and OC-ODQ-I (r=.56, $p<.0001$). Similarly, the SIP showed showed significant correlations with these measures (NJRE-Q-R: r=.47, $p<.0001$; OC-ODQ-I: r=.51, $p<.0001$). Also, within the SPD sample, the GIP score tended to have greater correlation with the quesionnaires (NJRE-Q-R: r=.28, p=.12; OC-ODQ-I: r=.24, p=.19) than the SIP scores had (NJRE-Q-R: r=.10, p=.57; OC-ODQ-I: r=.02, p=.94), although the correlations did not reach statistical significance. These data provide preliminary support for the adequate psychometric properties of GIP and SIP scores as an indicator of trait incompleteness.

Picture Recognition Task. All participants completed an unexpected recognition task approximately 15 minutes after the picture-rating task. Table 8 shows the percentage of participants in in each group, and the whole sample, that responded correctly to each of the incompleteness pictures. A correct response was defined as accurately identifying a picture as changed or unchanged. In order to compere the performance of the two groups, we created a recognition performance index (RPI) by summing up correct responses to the pictures (separate RPI were created for general and skin pictures). Note that the RPIs only included

37

pictures that yielded correct responses by 60 to 95% of participants in the whole sample. (Correct responses less than 60% of the time reflects performance that is close to chance level. It is therefore likely that responses to pictures with less than 60% correct responses do not reflect recognition performance. Similarly, close to perfect performance may not adequately discriminate between participant's recognition performances).

Out of the 18 general pictures, 12 were correctly identified as changed or unchanged by 60 to 95% of the whole sample. Independent sample t-test indicated no significant difference between the general picture RPI in the control group (*M*=10.0; *SD*=1.7) and the SPD group (*M*=10.4; *SD*=1.4), *t*(72)=-1.7, *p*>.05. Similarly, out of the 20 skin imperfection pictures, 11 were correctly identified as changed or unchanged by 60 and 95% of the whole sample. Again, independent sample t-test showed no difference in skin picture RPI between the control group (M=8.4; SD=1.4) and the SPD group (M=8.3; SD=1.8), *t*(72)=1.0, *p*>.05. These findings suggest that SPD and control subjects were equally effective in determining whether the pictures were changed or unchanged during the unexpected recognition task.

Table 8

Percentage of Participants that Responded Correctly to the Incompleteness Pictures

	SPD Group (*n*=32)		Control Group (*n*=42)		Whole Sample (*n*=74)	
	Un-changed %Correct	Changed %Correct	Un-changed %Correct	Changed %Correct	Un-changed %Correct	Changed %Correct
General Pictures						
Picture#1	84.4	40.6	92.9	33.3	89.2[a]	36.5
Picture#2	96.9	62.5	95.2	73.8	95.9	68.9[a]
Picture#3	90.6	71.9	78.6	57.1	83.8[a]	63.5[a]
Picture#4	84.4	96.9	88.1	90.5	86.5[a]	93.2[a]
Picture#5	96.9	96.9	88.1	95.2	91.9[a]	95.9
Picture#6	93.8	93.8	92.9	92.9	93.2[a]	93.2[a]
Picture#7	96.9	40.6	88.1	52.4	91.9[a]	47.3
Picture#8	93.8	71.9	90.5	61.9	91.9[a]	66.2[a]
Picture#9	31.1	28.1	54.8	35.7	33.8	43.2
Skin Pictures						
Skin Picture#1	53.1	43.8	64.3	69.0	59.5	58.1

38

Skin Picture#2	59.4	31.3	85.7	28.6	74.3[a]	29.7
Skin Picture#3	68.8	59.4	61.9	57.1	64.9[a]	58.1
Skin Picture#4	93.8	87.5	100	85.7	97.3	86.5[a]
Skin Picture#5	90.6	59.4	90.5	42.9	90.5[a]	50.0
Skin Picture#6	90.6	62.5	69.0	59.5	78.4[a]	60.8[a]
Skin Picture#7	75.0	53.1	83.3	45.2	79.7[a]	48.6
Skin Picture#8	78.1	56.3	73.8	42.9	75.7[a]	48.6
Skin Picture#9	87.5	53.1	81.0	42.9	83.8[a]	47.3
SkinPicture#10	68.8	65.6	81.0	64.3	75.7[a]	64.9[a]

[a]=included in the recognition performance indices.

Psychometric Analysis of the Picture Recognition Task. Cronbach's alpha coefficient indicated a very poor internal consistency of the general picture RPI ($\alpha = .43$) and the skin imperfection RPI ($\alpha = .21$). The data also did not support the construct validity of these indices. We hypothesized that incompleteness experiences during the picture-rating task would enhance performance in the later picture recognition-task. In other words, those individuals who had strong sense of incompleteness in response to the pictures were expected to remember them well and therefore be able to recognize if they were changed or unchanged during the recognition-task. To test this hypothesis we calculated correlations between incompleteness ratings of each picture and correct recognition of that picture.

In most cases, there was not a significant correlation between incompleteness ratings and correct recognition. For general pictures in the whole sample, there was a significant, or close to significant, positive correlation between incompleteness ratings and recognition of the following pictures: changed version of picture#3 ($r=.29$, $p=.012$), changed version of picture#6 ($r=.21$, $p=.076$), and unchanged version of picture#8 ($r=.22$, $p=.065$). There was also significant negative correlation between incompleteness ratings and recognition of unchanged picture#9 ($r=-.29$, $p=.014$). For the skin imperfection pictures in the whole sample, there was a marginally significant positive correlation between incompleteness ratings and recognition of unchanged version of picture#6 ($r=.19$, $p=.099$) and picture#8 ($r=.20$, $p=.085$). There was also a marginally significant negative correlation between

39

incompleteness ratings and recognition of unchanged version of picture#4 (r=-.21, p=.070).

In summary, only three of the 18 correlations of general pictures, and only two of the 20 correlations of skin imperfection pictures were significant, or marginally significant, and in the positive direction. Overall, these findings do not support the hypothesis that incompleteness experiences during the picture ratings facilitated later recognition performance.

Correlation with SPD Severity Indices. As shown in Table 9 there was no significant correlations between the incompleteness variables and SPD symptom severity indices in the SPD group. However, when time spent picking at specific body areas was examined, there was a significant positive correlation between time spent picking at the face and the SIP score (r=.37, p=.038). No other incompleteness variable was correlated with duration of picking at specific body areas.

Table 9

Correlations between Incompleteness and Symptom Severity Indices in the Skin Picking Disorder Group (n=32)

	NJRE-Q-R	OC-CDQ-I	GIP Score	SIP Score
SPS-R Severity	.11^{ns}	.20^{ns}	-.05^{ns}	-.20^{ns}
SPS-R Impairment	.13^{ns}	.01^{ns}	.10^{ns}	.14^{ns}
Number of Episodes Per Day	-.05^{ns}	.19^{ns}	-.20^{ns}	-.12^{ns}
Min Per Episode	.17^{ns}	-.17^{ns}	.33^{ns}	.28^{ns}
Total Duration Per Day	.22^{ns}	.13^{ns}	.01^{ns}	.01^{ns}
Duration of the SPD	.01^{ns}	-.05^{ns}	-.17^{ns}	.03^{ns}

SPS-R=Skin Picking Scale-Revised; NJRE-Q-R=Not Just Right Experiences Questionnaire Revised; OC-CDQ-I = Obsessive-Compulsive Core Dimensions Questionnaire Incompleteness Subscale; GIP=General Imperfection Pictures; SIP=Skin Imperfection Pictures; ^{ns}=not significant.

Controlling for Negative Affect. To examine if the relationship between the incompleteness variables and SPD diagnosis is independent of stress, anxiety and depression,

we conducted a series of logistic regression analyses where each of the incompleteness variable was entered as a predictor along with each of the DASS-21 scales. Diagnostic status was entered as a dependent variable (control group=0; SPD group=1).

As shown in Table 10, the NJRE-Q-R significantly predicted SPD diagnosis after controlling for Depression and marginally after controlling for Anxiety, but not after controlling for Stress. The OC-CDQ-I marginally predicted SPD after controlling for Depression, but not after controlling for Anxiety or Stress. The GIP score added to the prediction of SPD after controlling for Depression, but not after controlling for Anxiety or Stress. Finally, the SIP score significantly predicted SPD diagnosis after all negative affect variables were controlled for.

Table 10

Summary of Hierarchical Regression Analyses Predicting Skin Picking Disorder (SPD) Diagnosis (SPD group = 1; Control group = 0)

Predictors	B	S.E.	*p*	Odds Ratio Exp (B)	95% Confidence Interval for Exp (B)
NJRE-Q-R					
-With DASS Stress	.042	.036	.242	1.043	.972-1.119
-With DASS Anxiety	.067	.039	.084	1.069	1.140-1.423
-With DASS Depression	.068	.033	**.037**	1.070	1.047-1.182
-With all DASS scales	.054	.040	.177	1.055	.976-1.140
OC-CDQ-I					
-With DASS Stress	.012	.038	.747	1.012	.940-1.090
-With DASS Anxiety	.015	.036	.688	1.015	.945-1.089
-With DASS Depression	.057	.031	.069	1.058	.996-1.125
-With all DASS scales	-.002	.040	.952	.998	.922-1.079
GIP Score					
-With DASS Stress	.013	.009	.140	1.013	.996-1.032
-With DASS Anxiety	.015	.009	.102	1.015	.997-1.040
-With DASS Depression	.020	.008	**.013**	1.020	1.004-1.037
-With all DASS scales	.011	.010	.236	1.011	.993-1.031
SIP Score					
-With DASS Stress	.021	.008	**.005**	1.021	1.006-1.037
-With DASS Anxiety	.021	.007	**.005**	1.021	1.006-1.036
-With DASS Depression	.025	.007	**.001**	1.025	1.011-1.040
-With all DASS scales	.020	.008	**.010**	1.020	1.005-1.035

41

NJRE-Q-R=Not Just Right Experiences Questionnaire Revised; OC-CDQ-I = Obsessive-Compulsive Core Dimensions Questionnaire Incompleteness Subscale; GIP=General Imperfection Pictures; SIP=Skin Imperfection Pictures.

The Mediational Role of Stress Symptoms. Given the strong association between stress-reactions and SPD diagnosis in the current sample and previous evidence linking stress-reactions with SPD symptoms (Roberts et al., 2015; Snorrason et al., 2010; Teng et al., 2004), we conducted additional analyses to explore the role of stress-reactions in the relation between incompleteness and SPD.

We used Baron and Kenny's (1986) method to examine if Stress statistically mediated the relationship between incompleteness variables and SPD diagnostic status. As summarized in Figure 1, the results showed that NJRE-Q-R significantly added to the prediction of SPD diagnosis and Stress. However, only Stress, not NJRE-Q-R, predicted SPD diagnoses when both variables were entered together as predictors. These results suggest that Stress fully mediates the relationship between NJRE-Q-R and SPD diagnosis. Very similar findings emerged when the OC-CDQ-I (Figure 2) or the GIP score (Figure 3) were used as indicators of trait incompleteness. These models suggest that trait incompletes increases the risk for SPD only by increasing stress-reactions that promote the development of SPD.

Figure 1. Model of Mediation Effect. Entries in the parentheses shows the association when the moderator is controlled for (Sobel=3.32, *p*<.001). NJRE-Q-R = Not Just Right Questionnaire-Revised; DASS = Depression Anxiety and Stress Scales; SPD= Skin Picking Disorder.

Figure 2. Model of Mediation Effect. Entries in the parentheses shows the association when the moderator is controlled for (Sobel=3.80, *p*<.001). OC-CDQ-I = Obsessive-Compulsive Core Dimensions Questionnaire Incompleteness Subscale; DASS = Depression Anxiety and Stress Scales; SPD= Skin Picking Disorder.

Figure 3. Model of Mediation Effect. Entries in the parentheses shows the association when the moderator is controlled for (Sobel=3.41, *p*<.001). GIP=General Imperfection Pictures; DASS = Depression Anxiety and Stress Scales; SPD= Skin Picking Disorder.

The Mediational Role of Incompleteness Evoked by Skin Imperfections. We also
found that ratings of skin imperfections mediated the relationship between trait
incompleteness and SPD diagnosis. According to this model, trait incompleteness underlays
incompleteness experiences evoked by skin imperfections, which in turn increases the risk of
developing SPD (see Figure 4, 5, and 6).

44

Figure 4. Model of Mediation Effect. Entries in the parentheses shows the association when the moderator is controlled for (Sobel=3.633, *p*<.001). NJRE-Q-R=Not Just Right Experiences Questionnaire-Revised; SIP=Skin Imperfection Pictures; SPD= Skin Picking Disorder.
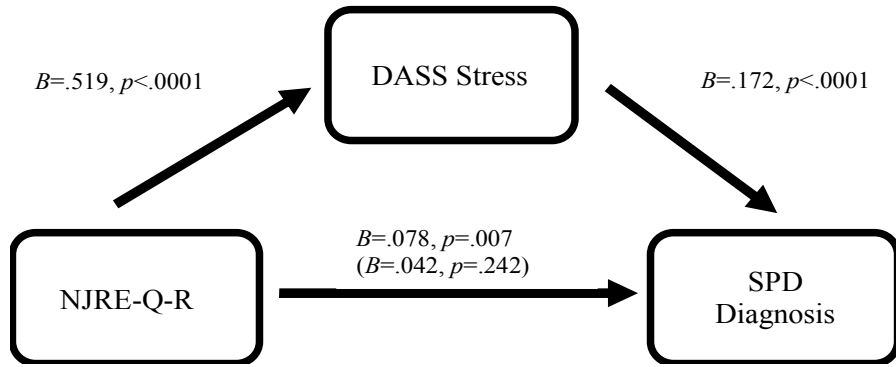

Figure 5. Model of Mediation Effect. Entries in the parentheses shows the association when the moderator is controlled for (Sobel=3.698, *p*<.001). OC-CDQ-I=Obsessive-Compulsive Core Dimensions Questionnaire- Incompleteness subscale; SIP=Skin Imperfection Pictures; SPD= Skin Picking Disorder.
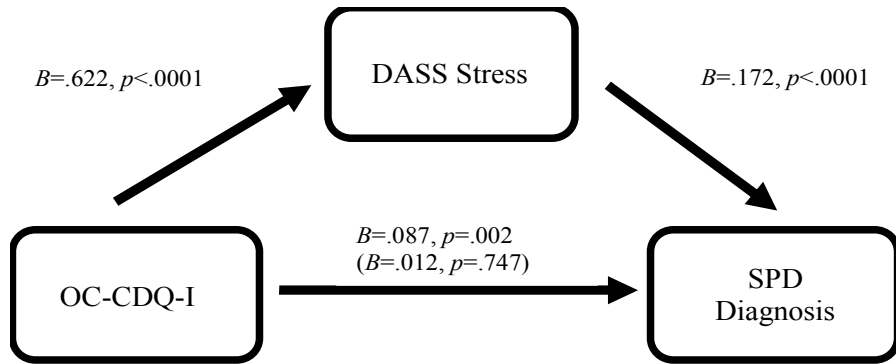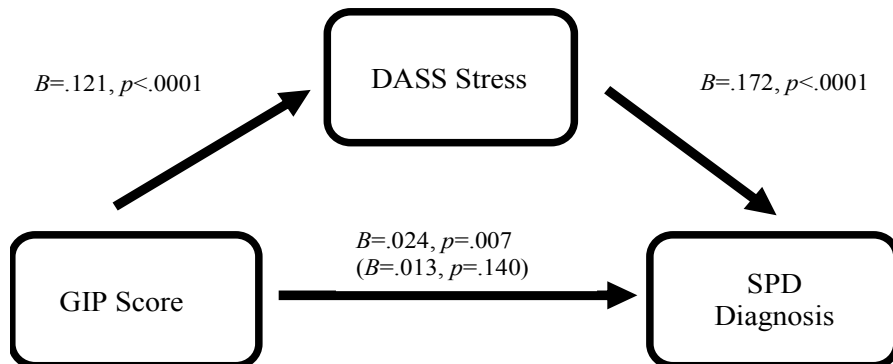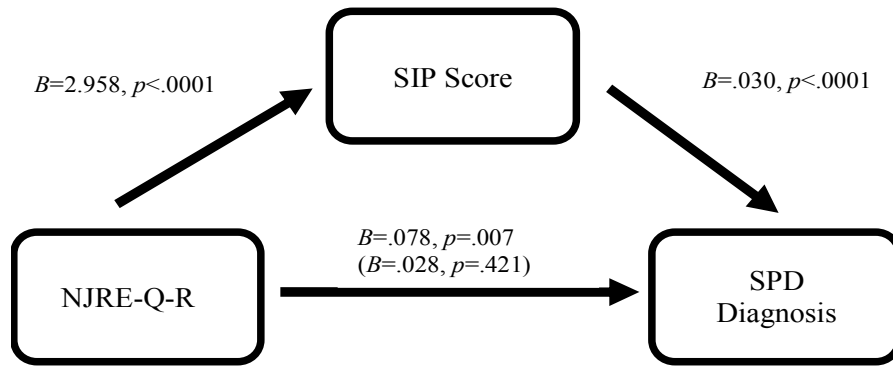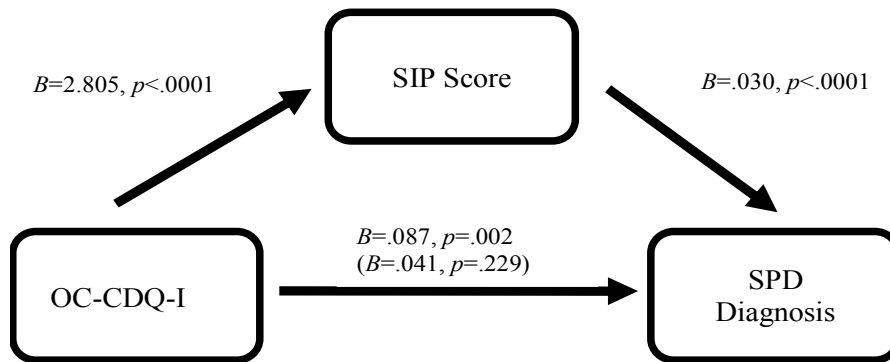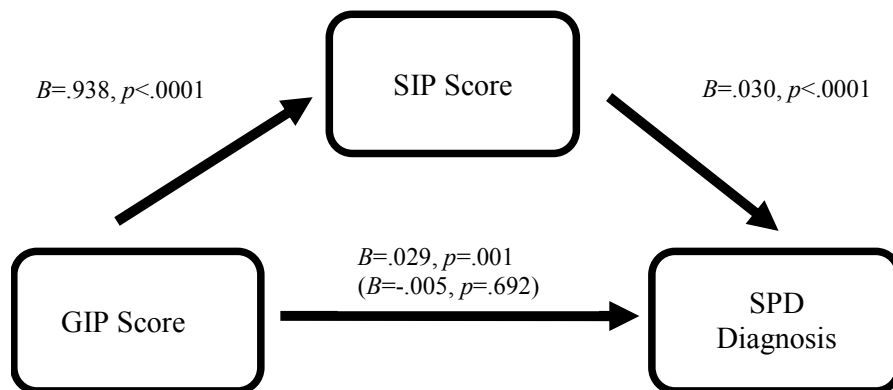

Figure 6. Model of Mediation Effect. Entries in the parentheses shows the association when the moderator is controlled for (Sobel=4.087, *p*<.001). GIP=General Imperfection Pictures; SIP=Skin Imperfections Pictures; SPD= Skin Picking Disorder.

Participants

       SPD Relatives. Twenty-two relatives of students in the SPD group participated in the online survey. Five were excluded because they reported experiencing current diagnosed MDD (*n*=2), or endorsed problematic hair pulling (n=1). Two were excluded because they exceeded cut-scores on OCI-R or DASS-21. The demographic information for the remaining 18 relatives is shown in Table 11.

       Control Relatives. Thirty-five relatives of the students in the control group participated. Thereof, six were excluded because they reported diagnosis of bipolar disorder (*n*=1), or current major depression (*n*=1). Four were excluded because of incomplete or invalid data and eight were excluded because they exceeded cut-scores on the OCI-R or DASS-21. Table 11 shows the demographic information on the remaining 22 relatives.

Table 11

Demographic Information

	SPD Relatives *n*=18	Control Relatives *n*=22	t/χ^2	*p*
Age *M*(*SD*)	39.89 (16.64)	43.41 (12.03)	.78	.443
Female Gender n(%)	15 (83.3%)	14 (63.6%)	-1.93	.165
Ethnicity n(%)			5.43	.143
Caucasian	14 (77.8%)	22 (100%)		
Hispanic/Latino	2 (11.1%)	0		
Native American	0	0		
African American	1 (5.6%)	0		
Multiracial	1 (5.6%)	0		
Education n(%)			1.33	.723
High School	5 (27.8%)	8 (36.4%)		
Technical/Associate	6 (33.3%)	4 (18.2%)		
Bachelor's or 4 year	6 (33.3%)	8 (36.4%)		
Master's degree	1 (5.6%)	2 (9.1%)		
Relation n(%)			3.42	.332
Mother	9 (53.8%)	12 (54.5%)		
Father	2 (11.8%)	5 (22.7%)		
Sister	5 (29.4%)	2 (9.1%)		
Brother	1 (5.9%)	3 (13.6%)		

Is Sense of Incompleteness Elevated among Relatives of SPD subjects?

Questionnaires Measures. The SPD relative group scored significantly higher than the control relative group on DASS Depression, but the two groups did not differ on any other questionnaire measure (Table 12).

Table 12

Questionnaire Measures

	SPD Relatives n=18	Control Relatives n=22	t	Effect Size (d)
Skin Picking Symptoms				
SPS-R Severity	1.83 (2.33)	.82 (1.65)	1.61[ns]	----
SPS-R Impairment	.33 (.77)	.18 (.66)	.67[ns]	----
Skin Complaints	5.9 (1.16)	5.32 (1.46)	1.48[ns]	----
Negative Affect				
Current Stress	2.61 (1.46)	2.41 (1.37)	.45[ns]	----
DASS Stress	8.44 (5.51)	6.45 (5.48)	1.14[ns]	----
DASS Anxiety	4.77 (5.49)	2.45 (2.96)	1.71[ns]	----
DASS Depression	6.22 (4.98)	2.46 (3.01)	2.94**	.92
OC Related Problems				
DCQ	11.17 (3.24)	9.86 (3.14)	1.29[ns]	----
OCI-R	8.11 (6.16)	8.27 (4.87)	.09[ns]	----
OC-CDQ-H	20.50 (4.56)	20.91 (7.39)	.21[ns]	----
Incompleteness				
OC-CDQ-I	21.33 (4.97)	23.41 (7.92)	.97[ns]	----
NJRE-Q-R	19.33 (8.92)	17.00 (10.17)	.76[ns]	----

SPS-R=Skin Picking Scale-Revised; DASS= Depression Anxiety Stress Scales; DCQ=Dysmorphic Concerns Questionnaire; OCI-R=Obsessive-Compulsive Inventory-Revised; OC-CDQ-H = Obsessive-Compulsive Core Dimensions Questionnaire Harm Avoidance Subscale; OC-CDQ-I = Obsessive-Compulsive Core Dimensions Questionnaire Incompleteness Subscale; NJRE-Q-R=Not Just Right Experiences Questionnaire Revised; [ns]= not significant; **=$p<.001$.

Picture Rating Task. General picture#9 evoked significantly more incompleteness experiences among control relatives compared to SPD relatives. No other picture was rated significantly different in the two groups, and GIP and SIP scores were not significantly different (Table 13).

Table 13

Incompleteness Ratings of Pictures

	SPD Relatives n=18	Control Relatives n=22	t	Effect Size (d)
General Imperfections				
Picture#1	8.06 (3.31)	8.45 (4.87)	$.30^{ns}$	----
Picture#2	10.17 (4.63)	10.0 (3.60)	$-.13^{ns}$	----
Picture#3	8.33 (3.56)	8.68 (4.40)	$.27^{ns}$	----
Picture#4	10.44 (4.15)	11.86 (4.92)	$.97^{ns}$	----
Picture#5	7.22 (3.47)	8.09 (4.63)	$.66^{ns}$	----
Picture#6	7.50 (4.16)	8.59 (4.82)	$.76^{ns}$	----
Picture#7	8.39 (3.35)	9.14 (4.64)	$.57^{ns}$	----
Picture#8	9.00 (3.53)	9.82 (4.72)	$.61^{ns}$	----
Picture#9	8.00 (2.62)	10.64 (4.52)	2.19^{*}	.71
Picture#10	11.61 (4.47)	13.22 (4.10)	1.19^{ns}	----
Picture#11	7.17 (2.98)	8.55 (3.92)	1.23^{ns}	----
GIP Score	95.88 (25.47)	107.05 (32.70)	1.18^{ns}	----
Skin Imperfections				
Skin Picture#1	11.11 (5.32)	11.32 (5.51)	$.12^{ns}$	----
Skin Picture#2	7.83 (3.41)	9.27 (5.22)	1.01^{ns}	----
Skin Picture#3	6.72 (2.97)	7.64 (3.87)	$.82^{ns}$	----
Skin Picture#4	11.94 (5.16)	12.36 (6.09)	$.23^{ns}$	----
Skin Picture#5	9.05 (4.54)	10.13 (4.79)	$.73^{ns}$	----
Skin Picture#6	8.05 (5.21)	9.68 (5.29)	$.97^{ns}$	----
Skin Picture#7	6.83 (3.01)	7.45 (3.80)	$.56^{ns}$	----
Skin Picture#8	7.89 (3.63)	8.09 (4.43)	$.16^{ns}$	----
Skin Picture#9	7.67 (3.79)	8.41 (4.35)	$.57^{ns}$	----
Skin Picture#10	7.50 (3.33)	8.14 (4.04)	$.54^{ns}$	----
SIP Score	84.61 (35.04)	92.50 (43.03)	$.63^{ns}$	----

GIP=General Imperfection Pictures; SIP=Skin Imperfection Pictures; ^{ns}=not significant; *=p<.05.

Psychometric Analysis of the GIP and SIP Scores. In the whole relative sample, Cronbach's alpha coefficient indicated an excellent internal consistency of the GIP score (α = .87) and the SIP score (α = .97). Also the GIP score had a significant positive correlation

with the NJRE-Q-R (r=.45, p<.01) and OC-ODQ-I (r=.43, p<.01), and the SIP score showed

similar correlations with these measures (NJRE-Q-R: r=.41, p<.0001; OC-ODQ-I: r=.42,

p<.0001).

Picture Recognition Task. Table 14 shows the percentage of participants who

responded correctly to each of the pictures in the picture recognition task. As in the student

sample, RPIs were created by summing up correct responses to pictures that yielded correct

responses by 60 to 95% of the sample. Out of the 18 general pictures, 12 were correctly

identified as changed or unchanged by 60 to 95% of the whole relative sample. There was no

significant difference between the general picture RPI in the control relative group (*M*=10.5;

SD=1.26) and the SPD relative group (*M*=9.25; *SD*=2.98), t(33)=1.59, p=.126. Out of the 20

skin pictures, 10 were correctly identified as changed or unchanged by 60 to 95% of the

whole relative sample. Again, there was no significant difference between the skin picture

RPI in the control relative group (*M*=7.95; *SD*=1.43) and the SPD relative group (*M*=7.63;

SD=2.66), t(33)=.46, p=.651.

Table 14

Percentage of Relatives that Responded Correctly to the Incompleteness Pictures

	SPD Relatives (*n*=18)		Control Relatives (*n*=22)		Whole Sample (*n*=40)	
	Un-changed %Correct	Changed %Correct	Un-changed %Correct	Changed %Correct	Un-changed % Correct	Changed %Correct
General Pictures						
Picture#1	76.5	47.1	86.4	42.9	80.6[a]	42.9
Picture#2	82.4	76.5	100.0	50.0	91.4[a]	61.1[a]
Picture#3	64.7	35.3	81.8	38.1	77.8[a]	37.1
Picture#4	64.7	88.2	81.8	100.0	72.2[a]	94.4[a]
Picture#5	76.5	100.0	100.0	95.2	88.9[a]	97.1[a]
Picture#6	70.6	94.1	90.9	85.7	80.6[a]	88.6[a]
Picture#7	70.6	58.8	85.7	45.5	77.1[a]	55.6
Picture#8	76.5	64.7	81.8	42.9	77.8[a]	51.4
Picture#9	76.5	70.6	23.8	28.6	48.6	51.4
Skin Pictures						
Skin Picture#1	47.1	58.8	54.5	45.5	52.8	50.0

Skin Picture#2	76.5	52.9	72.7	38.1	72.2[a]	45.7
Skin Picture#3	64.7	58.8	86.4	28.6	75.0[a]	42.9
Skin Picture#4	82.4	94.1	100.0	66.7	91.7[a]	77.1[a]
Skin Picture#5	70.6	58.8	85.7	18.2	77.1[a]	36.1
Skin Picture#6	88.2	58.8	76.2	31.8	82.9[a]	44.4
Skin Picture#7	64.7	29.4	76.2	38.1	71.4[a]	34.3
Skin Picture#8	76.5	41.2	71.4	13.6	71.4[a]	25.0
Skin Picture#9	76.5	76.5	81.8	38.1	80.6[a]	54.3
Skin Picture#10	82.4	47.1	81.8	54.5	83.3[a]	47.2

[a]=included in the recognition performance indices.

Psychometric Analysis of the Picture Recognition Task. Cronbach's alpha coefficient indicated a poor internal consistency of the general picture RPI ($\alpha = .75$) and the skin imperfection RPI ($\alpha = .66$). In the relative whole sample, only one picture out of the possible 39 pairs had significant positive correlation. For general pictures, there was a significant negative correlation between incompleteness rating and recognition of changed version of picture#6 ($r=-.35$, $p=.041$). For the skin imperfection picture there was significant positive correlation between ratings and recognition of unchanged version of skin picture#2 ($r=-.33$, $p=.050$) but negative correlation for changed version of skin picture#5 ($r=-.33$, $p=.047$).

Does Trait Incompleteness and Negative Affect run in Families?

Table 15 shows correlations between SPD subjects and their relatives. There was a significant positive correlation between OC-CDQ-I scores of the SPD relatives and NJRE-Q-R scores of the SPD subjects. DASS stress of the SPD relatives had significant positive correlation with DASS stress, OC-CDQ-I, OC-CDQ-H, and OCI-R of the SPD subjects. Finally, DASS depression in SPD relatives had significant positive correlations with OC-CDQ-H, and OCI-R in the SPS subjects. No other correlations reach the level of statistical significance. As shown in Table 16, there was no significant correlation between control subjects and their relatives.

Table 15

Correlations between SPD Subjects and Their Relatives (n=18)

	Relatives						
Students	NJRE-Q-R	OC-CDQ-I	GIP Score	SIP Score	DASS Stress	DASS Anxiety	DASS Depression
NJRE-R-Q	$.21^{ns}$	$.53*$	$.39^{ns}$	$.41^{ns}$	$.17^{ns}$	$-.14^{ns}$	$.25^{ns}$
OC-CDQ-I	$-.08^{ns}$	$.30^{ns}$	$.30^{ns}$	$.01^{ns}$	$.65**$	$.10^{ns}$	$.50^{ns}$
GIP Score	$.28^{ns}$	$-.23^{ns}$	$.23^{ns}$	$.12^{ns}$	$.22^{ns}$	$.25^{ns}$	$.40^{ns}$
SIP Score	$.30^{ns}$	$-.20^{ns}$	$.38^{ns}$	$.23^{ns}$	$.30^{ns}$	$.49^{ns}$	$.15^{ns}$
DASS Stress	$.13^{ns}$	$.30^{ns}$	$.34^{ns}$	$.31^{ns}$	$.56*$	$.10^{ns}$	$.27^{ns}$
DASS Anxiety	$-.01^{ns}$	$.24^{ns}$	$-.13^{ns}$	$.05^{ns}$	$.46^{ns}$	$.11^{ns}$	$.41^{ns}$
DASS Depression	$-.07^{ns}$	$.40^{ns}$	$.14^{ns}$	$.12^{ns}$	$.24^{ns}$	$.11^{ns}$	$.24^{ns}$
DCQ	$-.08^{ns}$	$-.23^{ns}$	$.27^{ns}$	$.15^{ns}$	$.00^{ns}$	$-.19^{ns}$	$-.04^{ns}$
OC-CDQ-H	$.29^{ns}$	$.36^{ns}$	$.24^{ns}$	$.34^{ns}$	$.56*$	$.11^{ns}$	$.53*$
OCI-R	$.09^{ns}$	$-.31^{ns}$	$.26^{ns}$	$.19^{ns}$	$.58*$	$.27^{ns}$	$.52*$
Skin Concerns	$-.30^{ns}$	$.44^{ns}$	$-.07^{ns}$	$.21^{ns}$	$-.08^{ns}$	$-.12^{ns}$	$-.22^{ns}$

NJRE-Q-R=Not Just Right Experiences Questionnaire Revised; DASS=Depression Anxiety Stress Scales; DCQ=Dysmorphic Concerns Questionnaire; OCI-R=Obsessive-Compulsive Inventory-Revised; OC-CDQ-H = Obsessive-Compulsive Core Dimensions Questionnaire Harm Avoidance Subscale; OC-CDQ-I = Obsessive-Compulsive Core Dimensions Questionnaire Incompleteness Subscale; GIP Score=General Incompleteness Pictures; SIP Score= Skin Imperfection Pictures; ^{ns}=not significant; $*=p<.05$.

Table 16

Correlations between Control Subjects and Their Relatives (n=22)

	Relatives						
Students	NJRE-Q-R	OC-CDQ-I	GIP Score	SIP Score	DASS Stress	DASS Anxiety	DASS Depression
NJRE-Q-R	$-.07^{ns}$	$.12^{ns}$	$.01^{ns}$	$-.03^{ns}$	$.08^{ns}$	$.07^{ns}$	$.09^{ns}$
OC-CDQ-I	$-.13^{ns}$	$.19^{ns}$	$-.08^{ns}$	$-.21^{ns}$	$-.02^{ns}$	$-.13^{ns}$	$-.05^{ns}$
GIP Score	$.08^{ns}$	$.28^{ns}$	$-.01^{ns}$	$-.09^{ns}$	$-.04^{ns}$	$-.04^{ns}$	$-.14^{ns}$
SIP Score	$-.10^{ns}$	$.11^{ns}$	$-.12^{ns}$	$-.27^{ns}$	$.08^{ns}$	$.01^{ns}$	$-.02^{ns}$
DASS Stress	$-.17^{ns}$	$.10^{ns}$	$-.06^{ns}$	$-.01^{ns}$	$.15^{ns}$	$-.02^{ns}$	$.07^{ns}$
DASS Anxiety	$-.09^{ns}$	$.17^{ns}$	$.07^{ns}$	$.02^{ns}$	$.02^{ns}$	$-.06^{ns}$	$-.04^{ns}$
DASS Depression	$-.12^{ns}$	$.03^{ns}$	$-.15^{ns}$	$-.08^{ns}$	$.01$	$-.11^{ns}$	$-.13^{ns}$
DCQ	$-.11^{ns}$	$.16^{ns}$	$.10^{ns}$	$.04^{ns}$	$.18$	$.03^{ns}$	$.16^{ns}$

OC-CDQ-H	-.04 [ns]	.26 [ns]	-.05 [ns]	-.20 [ns]	-.04	-.16 [ns]	-.09 [ns]
OCI-R	-.09 [ns]	.24 [ns]	-.06 [ns]	-.16 [ns]	.25	.16 [ns]	.23 [ns]
Skin Concerns	.07 [ns]	.06 [ns]	.22 [ns]	.14 [ns]	-.12	-.05 [ns]	-.13 [ns]

NJRE-Q-R=Not Just Right Experiences Questionnaire Revised; DASS= Depression Anxiety Stress Scales; DCQ=Dysmorphic Concerns Questionnaire; OCI-R=Obsessive-Compulsive Inventory-Revised; OC-CDQ-H = Obsessive-Compulsive Core Dimensions Questionnaire Harm Avoidance Subscale; OC-CDQ-I = Obsessive-Compulsive Core Dimensions Questionnaire Incompleteness Subscale; GIP Score=General Incompleteness Pictures; SIP Score= Skin Imperfection Pictures; [ns]=not significant.

Discussion

Measuring the Sense of Incompleteness

The aim of the study was to examine the association between SPD and trait incompleteness – a general tendency for heightened sense of incompleteness or "not just right" experiences. We measured the tendency for incompleteness with two previously validated questionnaires (NJRE-Q-R and OC-CDQ-I), a picture rating task and a picture-recognition task. The picture recognition task was not included in the analyses because it yielded unreliable responses, and therefore invalid data. In contrast, preliminary analyses suggested that the picture-rating task had adequate psychometric properties. Both the GIP and the SIP scores showed excellent internal consistency, and had moderate to high positive correlations with the previously validated trait incompleteness questionnaires. We also found partial support for the prediction that the questionnaires would have greater association with GIP than SIP scores, since SIP scores assesses a more specific skin related incompleteness and the other three measures assesses a general trait incompleteness. However, we only found support for this prediction in the SPD group. It appears that skin related incompleteness is more distinct from general incompleteness among SPD subjects than healthy controls.

Is General Trait Incompleteness associated with SPD?

The endophenotype concept predicts that trait incompleteness is elevated among

52

individuals with SPD compared to controls, but unrelated to symptom severity. The results showed that the SPD group obtained significantly higher scores than the control group on all the incompleteness measures. Also, within the SPD group there was no correlation between general trait incompleteness and severity indexes, including symptom severity, psychosocial impairment, frequency/duration of picking episodes and duration of the SPD problem. Together, these findings suggest that individuals with SPD are characterized by a general tendency to experience sense of incompleteness, but this trait does not seem to play a direct role in producing skin picking symptoms.

The SPD group also scored higher than the control group on scales measuring negative affect, and the relationship between general trait incompleteness and SPD diagnoses was not significant after symptoms of stress (and anxiety) were controlled for. It is therefore possible that trait incompleteness is associated with SPD only by virtue of its relationship with stress-reactions. Further analyses showed that stress-reactions fully mediated the association between trait incompleteness and SPD diagnosis. According to this model, trait incompleteness contributes to the risk for SPD only by exacerbating stress-reactions that promote the development of SPD. Previous evidence support the prediction that stress-reactions exacerbate skin picking behaviors (Roberts et al., 2015; Snorrason et al., 2010; Teng et al., 2004) and our data further suggest that trait incompleteness may underlay stress-reaction in this population. However, the cross-sectional design of our study precludes any conclusion regarding the temporal order of trait incompleteness, stress-reactions and the development of SPD. Longitudinal and experimental data are needed to determine if trait incompleteness in fact precedes and influences stress-reactions among individuals with SPD.

Is Skin Related Incompleteness Associated with SPD?

In contrast to general trait incompleteness, skin related incompleteness (i.e., the SIP

score) predicted SPD diagnosis even after negative affect was controlled for. We also found that the SIP score had positive correlations with time devoted to picking at the face. Thus, unlike general incompleteness, skin related incompleteness appears to be associated with SPD severity, and could perhaps be construed as a symptom of the disorder. Further mediational analyses showed that skin related incompleteness fully mediated the relationship between trait incompleteness and SPD diagnosis. These findings suggest that trait incompleteness promotes skin-related incompleteness reactions, which in turn contributes to SPD. In other words, the model suggests that general trait incompleteness triggers more situational perception of skin-specific incompleteness, which in turn directly induces skin-picking symptoms. Again, these findings need to be interpreted cautiously given the cross sectional design of the study and further research is necessary to elucidate this potential meditational path. Also, it is unclear if the SIP score reflects incompleteness evoked by skin imperfections or simply concerns about skin or appearance more generally. Future studies using control stimuli with smooth skin could determine the extent to which the imperfections themselves underlay the incompleteness ratings.

Is General Trait Incompleteness an Endophenotype for SPD?

Even though the findings supported the hypothesis that general trait incompletes is a correlate of and possibly a risk factor for SPD diagnosis, there was no correlation between relatives on any of the incompleteness measures. These findings are inconsistent with previous data supporting the hereditability of trait incompleteness and related constructs (e.g., Sica et al., 2013). However, our sample of relatives may not have been large enough to detect small effects and it is therefore premature to conclude that trait incompleteness is not heritable. Moreover, the small sample size and the high number correlations tested may have resulted in false positive chance findings. Further research with larger sample sizes is clearly

54

needed to determine the heritability of this trait.

We also did not find any evidence for elevated trait incompleteness among unaffected first-degree relatives of SPD subjects. The relatives of the SPD group did not obtain higher scores than relatives of the control group on the incompleteness questionnaires, or the incompleteness picture ratings. In general, both relative groups reported similar levels of incompleteness as the student control group. These findings suggest that trait incompleteness and SPD do not co-segregate in families. Thus, the data do not support the hypothesis that trait incompleteness is an endophenotype for SPD.

Is Negative Affect an Endophenotype for SPD?

Compared to the control relatives, the SPD relatives had significantly higher scores on a measure of depressive symptoms, and numerically higher scores on measures of stress and anxiety symptoms. Also, as noted above negative affect was significantly elevated among SPD subjects compared to controls. These findings showing higher negative affect in SPD subjects, and their psychologically healthy first-degree relatives, suggest that a tendency for negative affect and SPD may co-segregate in families. Interestingly, several lines of evidence suggest that both pathological skin picking and depressed mood are frequently triggered by daily stress (Conway et al., 2011; Roberts et al., 2015; Snorrason et al., 2010; Teng et al., 2004). Data further suggest that neuroticism represents a genetic risk factor that enhances the likelihood of stress-induced depression (e.g., Wichers et al., 2007). Thus, given that previous research show enhanced emotional reactivity among individuals with SPD (Snorrason et al., 2010), future studies may want to examine if neuroticism or other genetic vulnerabilities to stress-induced psychopathology contributes to the development of SPD.

What is the Nature of the Relationship between Trait Incompleteness and SPD?

General trait incompleteness was not elevated in unaffected relatives of SPD subjects, which suggest that this trait does not reflect a genetic vulnerability that is independent of current SPD diagnosis. However, trait incompleteness scores were significantly associated with SPD diagnosis. At least two hypotheses could be explored in future work to further clarify this association. First, future studies should examine the role of trait incompleteness as a risk factor for SPD. Our preliminary cross-sectional analyses suggested that stress-reactions as well as skin related incompleteness may be more immediate contributors to SPD, but it remains possible that trait incompleteness serves as a risk factor for SPD through its influence on these factors.

Secondly, it remains possible that heightened sense of incompleteness is a *consequence* of SPD. A chronic daily skin picking habit – that often involves searching for and "smoothing out" skin imperfections – may promote incompleteness experiences and over time elevate the individual's general sensitivity and tendency for them. However, we did not find correlations between trait incompleteness and duration of SPD, which is inconsistent with this hypothesis. Nonetheless, this possibility cannot be ruled out and should be explored in future studies.

Treatment Implications

Research consistently shows that behavior therapies (e.g., habit reversal treatment) are effective in treating SPD. Emerging evidence also suggest that the most effective treatment for SPD is the combination of traditional behavior therapy and interventions that focus on internal experiences that trigger picking, including cognitive therapy, acceptance and commitment therapy and dialectical behavioral therapy (Snorrason, Berlin and Lee, 2015). These therapies typically help the client manage picking urges and negative affect because these internal states are known to trigger picking episodes. Our findings suggest that a sense

56

of (skin-related) incompleteness may also be an important trigger of skin picking, or stress-reactions that lead to skin picking. Thus, some individuals with SPD may benefit from interventions that focus on managing incompleteness experiences as well as stress-reactions evoked by incompleteness experiences.

Limitations

The study has several limitations. First, the sample size of the relative groups may not have been big enough to detect small effects. This is true for the correlations within families and comparisons of the relative groups. Second, the student samples consisted mostly of young college-aged females, but the relative samples were significantly older and had a more even gender ratio. Given the small sample size, we were unable to explore the effects of gender and age. Considering gender in future studies may be particularly important because of the strong female preponderance in SPD, and previous evidence suggesting that the familial relation between trait incompleteness and OC symptoms is moderated by gender (Sica et al., 2013). Thirdly, all the data from the relative samples were collected online. We were therefore unable to verify relative status and psychiatric diagnoses. This is a significant limitation that should be addressed in future research. Finally, the SPD sample consisted largely of individuals with subclinical SPD, and it is unclear to what extent these findings generalize to treatment seeking samples.

57

References

Adamson, H.G. (1915). Acne urticata and other forms of "neurotic excoriations". *British Journal of Dermatology, 27*, 1-11.

Adamson, H.G. (1912). Case of acne urticata (neurotic excoriations – one type). *Proceedings of the Royal Society of Medicine, 6* (Dermatol sect), 21-22.

American Psychiatric Association (2013). *Diagnostic and statistical manual of mental disorders (5th edition)*. Washington, DC: Author.

Antony, M. M., Bieling, P. J., Cox, B. J., Enns, M. W., & Swinson, R. P. (1998). Psychometric Properties of the 42-item and 21-item versions of the depression anxiety stress scales in clinical groups and a community sample. *Psychological Assessment, 10,* 176-181.

Arnold, L.M., McElroy, S.L., Mutasim, D.F., Dwight, M.M., Lamerson, C.L., & Morris, E.M. (1998). Characteristics of 34 adults with psychogenic excoriation. *Journal of Clinical Psychiatry, 59*, 509-514.

Arnold, L.M., Auchenbach, M.B. & McElroy, S.L. (2001). Psychogenic Excoriation: Clinical features, proposed diagnostic criteria, epidemiology and approaches to treatment. *CNS Drugs, 15*, 351-359.

Azrin, N.H., & Nunn, R.G. (1973). Habit-reversal: A method of eliminating nervous habits and tics. *Behaviour Research and Therapy, 11*, 619-628.

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*, 1173-1182.

Bernard, J., & Lewis, K.R. (1966). Chromosome variability and geographic distribution in insects. *Science, 152*, 711-721.

Bohne, A., Wilhelm, S., Keuthen, N. J., Baer, L.,& Jenike, M. A. (2002). Skin picking in

German students: Prevalence, phenomenology, and associated characteristics. *Behavior Modification, 26*, 320–339.

Bienvenu, O.J., Samuels, J.F., Wuyek, L.A., Liang, K.Y., Wang, Y., Grados, M.A., … Nestadt, G. (2012). Is obsessive-compulsive disorder an anxiety disorder, and what, if any, are spectrum conditions? A family study perspective. *Psychological Medicine, 42*, 1-13.

Bienvenu, O.J., Wang, Y., Shugart, Y.Y., Welch, J.M., Grados, M.A., Fyer, A.J.,…Nestadt, G. (2009). Sapap3 and pathological grooming in humans: results from the OCD collaborative genetics study. *American Journal of Medical Genetics B Neuropsychiatric Genetics, 150B*, 710-20.

Brocq, M.L. (1889). L´acné excoriée des jeunes filles: et son traitment. *Journal Des Praticiens 12*, 193-197.

Burguiere, E., Monteiro, P., Mallet, L., Feng, G., & Graybiel, A.M. (2015). Striatal circuits, habits, and implications for obsessive-compulsive disorder. *Current Opinion in Neurobiology, 30*, 59-65.

Button, K.S., Ioannidis, J.P.A., Mokrysz, C., Nosek, B.A., Flint, J., Robinson, E.S.J., & Munfao, M.R. (2013). Power failure: why small sample size undermines the reliability of neuroscience. *Nature Reviews Neuroscience 14*, 365-376.

Cannon, T.D.,& Keller, M.C. (2006). Endophenotypes in the genetic analyses of mental disorders. *Annual Review of Clinical Psychology, 2*, 267–290.

Cannon, T.D., & Rosso, I.M. (2002). Levels of analysis in etiological research on schizophrenia. *Development and psychopathology, 14*, 653-666.

Carrasco, M., Harbin, S.M., Nienhuis, J.K. et al. (2013). Increased error-related brain activity in youth with obsessive-compulsive disorder and unaffected siblings. *Depression and Anxiety, 30*, 39-46.

Coles, M.E., Frost, R.O., Heimberg, R.G., & Rhéaume, J. (2003). "Not just right experiences": perfectionism, obsessive-compulsive features and general psychopathology. *Behaviour Research and Therapy, 41*, 681-700.

Coles, M.E., Heimberg, R.G., Frost, R.O., & Steketee, G. (2005). Not just right experiences and obsessive-compulsive features: experimental and self-monitoring perspectives. *Behaviour Research and Therapy, 43*, 153-167.

Coles, M.E., Johnson, E.M., & Schubert, J.R. (2012). Retrospective reports of the development of obsessive compulsive disorder: extending knowledge of the protracted symptom phase. *Behavior and Cognitive Psychotherapy, 39*, 579-589.

Conway, C.C., Hammen, C., Espejo, E.P., Wray, N.R., Najman, J.M., & Brenna, P.A. (2011). Appraisals of stressful life events as a genetically-linked mechanism in the stress-depression relationship. *Cognitive Therapy and Research, 36*, 338-347.

Cougle, J.R., Fitch, K.E., Jacobson, S., & Lee, H-J. (2013). A multi-method examination of the role of incompleteness in compulsive checking. *Journal of Anxiety Disorders, 27*, 231-239.

Cougle, J. R., Goetz, A. R., Fitch, K. E., & Hawkins, K. A. (2011). Termination of washing compulsions: A problem of internal reference criteria or 'not just right' experience? *Journal of Anxiety Disorders, 25*, 801–805.

Ecker, W., Kupfer, J., & Gönner, S. (2013). Incompleteness as a link between obsessive-compulsive personality traits and specific symptom dimensions of obsessive-compulsive disorder. *Clinical Psychology and Psychotherapy*.

Endrass, T., & Ullsperger, M. (2014). Specificity of performance monitoring changes in obsessive-compulsive disorder. *Neuroscience and Biobehavioral Reviews, 25*, 11730-11737.

Fergus, T.A. (2013). Are "Not Just Right Experiences" (NJREs) Specific to Obsessive-

Compulsive Symptoms?: Evidence that NJREs Span across Symptoms of Emotional Disorders. *Journal of Clinical Psychology, 70*, 353-363.

Ferrao, Y.A., Miguel, E., & Stein, D.J. (2009). Tourette´s syndrome, trichotillomania, and obsessive-compulsive disorder: How closely are they related? *Psychiatry Research, 170*, 32-42.

Ferrao, Y.A., Shavitt, R.G., Prado, H., Fontenelle, L.F., Malavazzi, D.M., de Mathis, M.A.,… Rosario, M.C. (2012). Sensory phenomena associated with repetitive behaviors in obsessive-compulsive disorder: An exploratory study of 1001 patients. *Psychiatry Research, 197*, 253-258.

Flessner, C.A., Berman, N., Garcia, A., Freeman, J.B., & Leonard, H.L. (2009). Symptom profiles in pediatric obsessive-compulsive (OCD): The effects of comorbid grooming conditions. *Journal of Anxiety Disorders, 23*, 753-759.

Flessner, C.A. & Woods, D.W. (2006). Phenomenological characteristics, social problems, and the economic impact associated with chronic skin picking. *Behavior Modification, 30*, 944-963.

Foa, E. B., Abramowitz, J. S., Franklin, M. E., & Kozak, M. J. (1999). Feared consequences, fixity of belief, and treatment outcome in patients with obsessive–compulsive disorder. *Behavior Therapy, 30*, 717–724.

Foa, E.B., Huppert, J.D., Leiberg, S., Langner, R., Kichic, R., Hajcak, G. et al. (2002). Obsessive-Compulsive Inventory: Development of a short version. *Psychological Assessment, 14*, 485-496.

Fontenelle, L.F., Mendlowicz, M.V., & Versiani, M. (2005). Impulse control disorders in patients with obsessive-compulsive disorder. *Psychiatry and Clinical Neuroscience, 59*, 30-37.

Ghisi, M., Chiri, L.R., Marchetti, I., Sanavio, E., & Sica, C. (2010). In search of specificity:

"not just right experiences" and obsessive-compulsive symptoms in non-clinical and clinical Italian individuals. *Journal of Anxiety Disorders, 24*, 879-886.

Goldsmith, H.H., Van Hulle, C.A., Arneson, C.L., Schreiber, J.E., & Gernsbacher, M.A. (2006). A population-based twin study of parentally reported tactile and auditory defensiveness in young children. *Journal of Abnormal Child Psychology, 34*, 393–407.

Gottesman, I.I., & Gould, T.D. (2003). The endophenotype concept in psychiatry: Etymology and strategic intensions. *American Journal of Psychiatry, 160*, 636-654.

Gottesman, I.I., & Shields, J. (1972). *Schizophrenia and genetics: A twin study vantage point*. New York: Academic.

Grant, J.E., Leppink, E., & Chamberlain, S. (2015). Body focused repetitive behavior disorders and perceived stress: Clinical and cognitive associations. *Journal of Obsessive-Compulsive and Related Disorders, 5*, 82-86.

Grant, J.E., Menard,W., & Phillips, K.A. (2006). Pathological skin picking in individuals with body dysmorphic disorder. *General Hospital Psychiatry, 28*, 487–493.

Grant, J.E., Odlaug, B.L., & Kim, S.W. (2010). A clinical comparison of pathologic skin picking and obsessive-compulsive disorder. *Comprehensive Psychiatry, 51*, 347-352.

Grant, J.E., Williams, K.W., & Potenza, M.N. (2007). Impulse-control disorders in adolescent psychiatric inpatients: Co-occurring disorders and sex differences. *Journal of Clinical Psychiatry, 68*, 1584-1594.

Griesmer, R.D. (1978). Emotionally triggered disease in a dermatologic practice. *Psychiatric Annals, 8*, 407-412.

Hajcak, G., Franklin, M.E., Simons, R.F. & Keuthen, N.J. (2006). Hairpulling and skin picking in relation to affective distress and obsessive-compulsive symptoms. *Journal of Psychopathology and Behavioural Assessment, 28*, 179-187.

Hayes, S.L., Storch, E.A., & Berlanga, L. (2009). Skin picking behaviors: An examination of

62

the prevalence and severity in a community sample. *Journal of Anxiety Disorders, 23*, 314-319.

Hollander, M.B. (1951). Excoriated acne controlled by post-hypnotic suggestion. *American Journal of Clinical Hypnosis, 1*, 122-123.

Jafferany, M.J., Stoep, A.V., Dumitrescu, A., & Hornung, R.L. (2010a). The knowledge, awareness, and practice patterns of dermatologist toward psychocutaneous disorders: results of a survey study. *International Journal of Dermatology, 49*, 784-789.

Jafferany, M.J., Stoep, A.V., Dumitrescu, A., & Hornung, R.L. (2010b). Psychocutaneouos disorders: A survey study of psychiatrist' awareness and treatment patterns. *Southern Medical Journal, 103*, 1199-1203.

Janet, P. (1903). *Les obsessions et la psychasténie*. Paris: Alcan.

Jakes, I. (1996). *Theoretical approaches to obsessive-compulsive disorder*. Cambridge: Cambridge University Press.

Jonas, K.G., & Markon, K.E. (2014). A meta-analytic evaluation of the endophenotype hypothesis: Effects of Measurement Paradigm in the Psychiatric Genetics of Impulsivity. *Journal of Abnormal Psychology, 123*, 660-675.

Jorgensen, L., Castle, D., Roberts, C., & Groth-Marnat, G. (2001). A clinical validation of the dysmorphic concern questionnaire. *Australian and New Zealand Journal of Psychiatry, 35*, 124-128.

Karakus, G., & Tamam, L. (2011). Impulse control disorder comorbidity among patients with bipolar I disorder. *Comprehensive Psychiatry, 52*, 378-385.

Kendler, K.S.,& Neale, M.C. (2010). Endophenotype: A conceptual analysis. *Molecular Psychiatry, 15*, 789–797.

Keuthen, N.J., Altenburger, E.M., & Pauls, D. (2014). A family study of trichotillomania and chronic hair pulling. *American Journal of Medical Genetics Part B: Neuropsychiatric*

Genetics, 165, 167-174.

Keuthen, N.J., Deckersbach, T., Wilhelm, S., Hale, E., Fraim, C., Bear, L., O´Sullivan, R.L.
and Jenike, M.A. (2000). Repetitive skin-picking in a student population and comparison
with a sample of self-injurious skin-pickers. *Psychosomatics, 41*, 210- 215.

Keuthen, N.J., Koran, L.M., Aboujaoude, E., Large, M.D., & Serpe, R.T. (2010). The
prevalence of pathologic skin picking in US adults. *Comprehensive Psychiatry, 51*, 183-
186.

Keuthen, N.J., Deckersbach, T., Wilhelm, S., Engelhard, I., Forker, A., O'Sullivan, R.L….
Baer, L. (2001). The Skin Picking Impact Scale (SPIS): Scale development and
psychometric analyses. *Psychosomatics, 42*, 397-403.

Keuthen, N.J., Koran, L.M., Aboujaoude, E., Large, M.D., & Serpe, R.T. (2010). The
prevalence of pathologic skin picking in US adults. *Comprehensive Psychiatry, 51*, 183-
186.

Kim, D.I., Garrison, R.C., & Thompson, G. (2013). A near fatal case of pathological skin
picking. *American Journal of Case Reports, 14*, 284-287.

Leckman, J. F., Walker, D. E., Goodman, W. K., Pauls, D. L., & Cohen, D. J. (1994). "Just
right" perceptions associated with compulsive behavior in Tourette's syndrome.
American Journal of Psychiatry,151, 675–680.

Lovato, L, Ferrao, Y.A., Stein, D.J., Shavitt, R.G., Fontenelle, L.F., Vivan, A.,… Corioli,
A.V. (2012). Skin picking and trichotillomania in adults with obsessive-compulive
disorder. *Comprehensive Psychiatry, 53*, 52-568.

MacKee, G.M. (1920). Neurotic excoriations. *Archives of Dermatology and Syphilology, 1*,
256-269.

Menzies, L., Achard, S., Chamberlain, S.R., Fineberg, N., Chen, C-H., del Campo, N.,…
Bullmore, E. (2007). Neurocognitive endophenotypes of obsessive-compulsive disorder.

Brain, 130, 3223-3236.

Moulding, R., Anglim, J., Nedeljkovic, M., Doron, G., Kyrios, M., & Ayalon, A. (2011). The Obsessive Beliefs Questionnaire (OBQ): Examination in nonclinical samples and development of a short version. *Assessment, 18*, 357–374

Miller, G.A., & Rockstroh, B. (2013). Endophenotypes in psychopathology research: where do we stand? *Annual Review of Clinical Psychology, 9*, 177-213.

Monzani, B., Rijsdijk, F., Cherkas, L., Harris, J., Keuthen, N.J., & Mataix-Cols, D. (2012). Prevalence and heritability of skin picking in an adult community sample: A twin study. *American Journal of Medical Genetics Part B, 159B*, 605-610.

Monzani, B., Rijsdijk, F., Harris, J., & Mataix-Cols, D. (2014). The structure of genetic and environmental risk factors for dimensional representation of DSM-5 obsessive-compulsive spectrum disorders. *JAMA Psychiatry, 71*, 182-189.

Moore, J., Smith, G.W., Shevlin, M., & O'Neill, F.A. (2010). Alternative factor models and heritability of the short Layton obsessional inventory-children's version. *Journal of Abnormal Child Psychology, 38*, 921-934.

Müller, A., Rein, K., Kollei, I., Jacobi, A., Rotter, A., Schütz, P., … de Zwaan, M. (2011). Impulse control disorders in psychiatric inpatients. *Psychiatry Research, 15*, 434-438.

Neziroglu, F., Rabinowitz, D., Breytman, A., & Jacofsky, M. (2008). Skin picking phenomenology and severity comparison. *Primary Care Companion to the Journal of Clinical Psychiatry, 10*, 306-312.

Insel, T., Cuthbert, B., Garvey, M., Heinssen, R., Pine, D.S., Quinn K., Sanislow, C., & Wang, P. Research domain criteria (RDoC): toward a new classification framework for research on mental disorders. (2010). *i*, 748-51

Odlaug, B.L., & Grant, J.D. (2008). Clinical characteristics and medical complications of pathologic skin picking. *General Hospital Psychiatry, 30*, 61-66.

Odlaug, B.L., Kim, S.W., & Grant, J.E. (2010). Quality of life and clinical severity in pathological skin picking and trichotillomania. *Journal of Anxiety Disorders, 24*, 823-829.

O'Sullivan, R.L., Phillips, K.A.,. Keuthen, N.J., & Wilhelm, S. (1999). Near-fatal skin picking from delusional body dysmorphic disorder responsive to fluvoxamine. *Psychosomatics, 40*, 79-81.

Phillips, K.A., Stein, D.J., Rauch, S.L., Hollander, E., Fallon, B.A., Barsky, A.,… Leckman, J. (2010). Should an obsessive-compulsive spectrum grouping of disorders be included in DSM-V? *Depression and Anxiety, 27*, 528-555.

Pitman, R. (1987). Pierre Janet on obsessive-compulsive disorder (1903). *Archives of General Psychiatry, 44*, 226-232.

Pusey, W.A., & Senear, F.E. (1920). Neurotic excoriations with report of cases. *Archives of Dermatology and Syphilology, 1*, 256-269.

Ravid, A., Franklin, M.E., Khanna, M., Storch, E.A. Coles, M.E. (2014). "Not Just Right Experiences" in Adolescents: Phenomenology and Associated Characteristics. *Child Psychiatry & Human Development, 45*, 193-200.

Riesel, A., Endrass, T., Auerbach, L.A., & Kathmann, N. (2015). Overactive performance monitoring as an endophenotype for obsessive-compulsive disorder: evidence from a treatment study. *American Journal of Psychiatry*.

Riesel, A., Endrass, T., Kauffmann C., et al. (2011). Overactive error-related brain activity as a candidate endophenotype for obsessive-compulsive disorder: evidence from unaffected first-degree relatives. *American Journal of Psychiatry, 168*, 317-324.

Rothermund, K. (2003). Automatic vigilance for task-related information: Perseverance after failure and inhibition after success. *Memory & Cognition, 31*, 343-352.

Schmidt, F., Körber, S., de Zwaan, M., et al. (2012). Impulse control disorders in obese

patients. *European Eating Disorders Revive, 20*, 144-147.

Schuck, K., Keijsers, G., & Rinck, M. (2012). Implicit processes in pathological skin
picking: responses to skin irregularities predict symptom severity and treatment
susceptibility. *Journal of Behavior Therapy and Experimental Psychiatry, 43*, 685-691.

Sheehan, D. V., Lecrubier, Y., Sheehan, K. H., Janavs, J., Weiller, E., Keskiner, A., et al.
(1997). The validity of the Mini International Neuropsychiatric Interview (MINI)
according to the SCID-P and its reliability. *European Psychiatry, 12*, 232–241.

Sahin, E., Kalyoncu, A., Pektas, O., Tan, D., Mirsal, H., & Beyazyurek, M. (2004). Near-
fatal skin-picking due to obsessive compulsive disorder responding to combined
fluoxetine and cognitive-behavioral therapy: a case report. *Bulletin of Clinical
Psychopharmacology, 14*, 88-91.

Sica, C., Caudek, C., Chiri, L.R., Ghisi, M., & Marchetti, I. (2013). "Not just right
experiences" predict obsessive-compulsive symptoms in non-clinical Italian individuals: a
one-year longitudinal study. *Journal of Obsessive-Compulsive and Related Disorders, 1*,
159-167.

Sica, C., Caudek, C., Bottesi, G., De Fazio, E., Ghisi, M., Marchetti, I., & Orsucci, A.
(2013). Fathers "not just right experiences" predict obsessive-compulsive symptoms in
their sons: a family study on non-clinical Italian sample. *Journal of Obsessive-
Compulsive and Related Disorders, 2*, 263-272.

Snorrason, I., Belleau, E., & Wood, D. (2012). How related are hair pulling disorder
(trichotillomania) and skin picking disorder? a review of evidence for comorbidity,
similarities and shared etiology. *Clinical Psychology Review, 32*, 618-629.

Snorrason, I., Berlin, G.S., & Lee, H.-J. (2015). Optimizing Psychological Interventions for
Trichotillomania (Hair-Pulling Disorder): An Update on Current Empirical Status.
Psychology Research and Behavior Management, 8, 105-113.

Snorrason, I., Olafsson, R.P., Flessner, C.A., Keuthen, N.J., Franklin, M.E., & Woods, D.W. (2012). Skin Picking Scale-Revised: Factor structure and psychometric properties. *Journal of Obsessive-Compulsive and Related Disorders,1*, 133-137.

Snorrason, I., Ricketts, E.J., Flessner C.A., Franklin, M.E., Stein, D.J., & Woods, D.W. (2012). Skin picking disorder is associated with other body focused repetitive behaviors: Findings from an Internet study. *Annals of Clinical Psychiatry, 24*, 292-299.

Snorrason, I., Smari, J., & Olafsson, R.P. (2010). Emotion regulation in pathological skin picking: Findings from a non-treatment seeking sample. *Journal of Behavior Therapy and Experimental Psychiatry, 41*, 238-245.

Snorrason, I., Smari, J., & Olafsson, R.P. (2011). Motor inhibition, reflection impulsivity and trait impulsivity in pathological skin picking. *Behavior Therapy, 42*, 521-532.

Stein, D. J., Grant, J. E., Franklin,M. E., Keuthen, N., Lochner, C., Singer, H. S., &Woods, D.W. (2010). Trichotillomania (hair pulling disorder), skin picking disorder, and stereotypic movement disorder: Toward DSM-V. *Depression and Anxiety, 27*, 611–626.

Stein, D.J., Hutt, C.S., Spitz, J. L., & Hollander, E. (1993). Compulsive picking and obsessive-compulsive disorder. *Psychosomatics, 34*, 177–180.

Summerfeldt, L.J. (2004). Understanding and treating incompleteness in obsessive-compulsive disorder. *Journal of Clinical Psychology, 60*, 1155-1168.

Summerfeldt, L.J., Kloosterman, P.H., Antony, M.M., & Swinson, R.P. (2014). Examining an obsessive-compulsive core dimensions model: structural validity of harm avoidance and incompleteness. *Journal of Obsessive-Compulsive and Related Disorders, 3*, 83-94

Summers, B.J., Fitch, K.E., & Cougle, J.R. (2014). Visual, tactile, and auditory "not just right" experiences: Associations with obsessive-compulsive symptoms and perfectionism. *Behavior Therapy, 45*, 678-689.

Taylor, S. (2011). Etiology of obsessions and compulsions: A meta-analysis and narrative

review of twin studies. *Clinical Psychology Review, 31*, 1361-1372.

Taylor, S., McKay, D., Crowe, K.G., Abramowitz, J.S., Conelea, C.A., Calamari, J.E., & Sica, C. (2014). The sense of incompleteness as a motivator of obsessive-compulsive symptoms: An empirical analysis of concepts and correlates. *Behavior Therapy, 45*, 254-262.

Tops, M. & Wijers, A.A. (2012). Doubts about action and flanker incongruity-related potentials and performance. *Neuroscience Letters, 516*, 130-134.

Tozzi, F., Aggen, S.H., Neale, B.M.., Anderson, C.B., Mazzeo, S.E., Neale, M.C., & Bulik, C.M. (2004). The structure of perfectionism: a twin study. *Behavior Genetics, 34*, 483-494.

Tucker, B.T., Woods, D.W., Flessner, C.A., Franklin, S.A., & Franklin, M.E. (2010). The skin picking impact project: Phenomenology, interference, and treatment utilization of pathological skin picking in a population based sample. *Journal of Anxiety Disorders, 25*, 88-95.

Walther, M.R., Flessner, C.A., Conelea, C.A., & Woods, D.W. (2009). The Milwaukee inventory for the dimensions of adult skin picking (MIDAS): Initial development and psychometric properties. *Journal of Behavior Therapy and Experimental Psychiatry, 40*, 127-135.

Walters, J.T.,& Owen, M.J. (2007). Endophenotypes in psychiatric genetics. *Molecular Psychiatry, 12*, 886–890.

Welch, J.M., Lu, J., Rodriguiz, R.M., Trotta, N.C., Peca, J., Ding, J.D., … Feng, G. (2007). Cortico-striatal synaptic defects and OCD-like behaviours in Sapap3-mutant mice. *Nature, 448*, 894-900.

Wichers, M., Myin-Germeys, I., Jacobs, N., Peeters, F., Kenis G., Derom, C., … van Os., J. (2007). Genetic risk of depression and stress-induced negative affect in daily life. *British*

69

Journal of Psychiatry, 191, 218-223.

Wilhelm, S., Keuthen, N. J., Deckersbach, T., Engelhard, I. M.,Forker, A. E., Bear, L., …
  Jenike, M.A. (1999). Self-injurious skin picking: Clinical characteristics and comorbidity.
  Journal of Clinical Psychiatry, 60, 454–459.

Wilson E. (1875). *Lectures on dermatology: Delivered in the Royal College of Surgeons of
  England in 19874-1875*. London, UK: Kessinger Publishing.

Wrong, N.M. (1954). Excoriated acne of young females. *Archives of dermatology and
  syphilology, 70*, 576-582.

Curriculum Vitae

General Information

Name: Ivar Snorrason
Nationality: Icelandic

University Education

2010-   *University of Wisconsin-Milwaukee: Ph.D. in Clinical Psychology*
Dissertation title: Heightened Sense of Incompletness as a Candidate
Endophenotypic Marker for Excoriation (Skin-Picking) Disorder
Advisor: Han-Joo Lee, Ph.D.

2006-2008 *University of Iceland: Master of Arts (M.A.) in Psychology*
Thesis title: The Interaction Effect of Impulsivity and Responsibility in
Relation to Obsessive-Compulsive Symptoms
Advisor: Jakob Smári, Ph.D.

2002-2006 *University of Iceland: Bachelor of Arts (B.A.) in Psychology*
Thesis title: Negative Dysfunctional Attitudes Influence Beliefs about Voices
in Individuals with Auditory Hallucinations
Advisor: Jakob Smári, Ph.D.

Awards

2014   *Distinguished Dissertation Fellowship* ($16,500 + $1,000 travel award). Award
supporting dissertation research at the University of Wisconsin-Milwaukee.

2014   *Department of Psychology Summer Graduate Research Fellowship* ($3,178). Award
supporting a summer research project at the University of Wisconsin-Milwaukee.

2013   *Distinguished Graduate Student Fellowship* ($13,750 + $1,000 travel award). Award
supporting graduate studies at the University of Wisconsin-Milwaukee.

2011   *Trichotillomania Learning Center (TLC) Travel Grant* ($1,000). Awarded supporting
the presentation of research findings at the 20th annual TLC national conference.

2011   *Thor Thors Memorial Fund* ($4,275). Awarded by the American-Scandinavian
Foundation in support of continued studies at a U.S. university.

2010   *Fulbright Award* ($15,000). Awarded by the Fulbright commission in Iceland to
commence graduate studies at a U.S. university.

Publications

Peer-reviewed journal articles

Snorrason, I., Berlin, G.S., & Lee, H.-J. (2015). Optimizing Psychological Interventions for Trichotillomania (Hair-Pulling Disorder): An Update on Current Empirical Status. *Psychology Research and Behavior Management, 8*, 105-113.

Capriotti, M.R., Ely, L.J., **Snorrason, I**., & Woods, D.W. (2015). Acceptance-enhanced behavior therapy for excoriation (skin-picking) disorder in adults: A clinical case series. *Cognitive and Behavioral Practice*, 22, 230-239.

Ólafsson, R.P., **Snorrason, I**., Bjarnason, R.K., Emmelkamp, P.M.G., Ólason, D.Þ., & Kristjánsson, Á. (2014). Replacing intrusive thoughts: Investigating thought control in relation to OCD symptoms. *Journal of Behavior Therapy and Experimental Psychiatry, 45,* 506-515.

Snorrason, I, & Woods, D.W. (2014). Nail picking disorder (Onychotillomania): A case report. *Journal of Anxiety Disorders, 28*, 211-214.

Walther, M.R., **Snorrason, I**., Flessner, C.A., Franklin, M.E., Burkel, R., & Woods, D.W. (2014). The trichotillomania impact project in young children (TIP-YC): Clinical characteristics, comorbidity, functional impairment, and treatment utilization. *Child Psychiatry and Human Development, 45*, 24-31.

Snorrason, I., Stein, D.J., & Woods, D.W. (2013). Classification of excoriation (skin picking) disorder: Current status and future directions. *Acta Psychiatrica Scandinavica, 128*, 406-407.

Snorrason, I., Olafsson, R.P., Flessner C.A., Keuthen, N.J., Franklin, M.E., & Woods, D.W. (2013). Skin picking impact scale: Factor structure, validity and development of a short version. *Scandinavian Journal of Psychology, 54*, 344-348.

Ricketts, E.J., Bauer, C., Van der Fluit, F., Capriotti, M.R., Espil, F.M., **Snorrason, I**., Ely, L.J., Walther, M.R., & Woods, D.W. (2013). Behavioral therapy for stereotypic movement disorders in typically functioning children: A clinical case series. *Cognitive and Behavioral Practice, 20*, 544-555.

Snorrason, I., Ricketts, E.J., Flessner C.A., Franklin, M.E., Stein, D.J., & Woods, D.W. (2012). Skin picking disorder is associated with other body focused repetitive behaviors: Findings from an Internet study. *Annals of Clinical Psychiatry, 24*, 292-299.

Snorrason, I., Belleau, E.L., & Woods, D.W. (2012). How related are hair pulling disorder (trichotillomania) and skin picking disorder? A review of evidence for comorbidity, similarities and shared etiology. *Clinical Psychology Review, 32*, 618-629.

Snorrason, I., Ólafsson, R.P., Flessner C.A., Keuthen, N.J., Franklin, M.E., & Woods, D.W. (2012). The Skin Picking Scale-Revised: Factor structure and psychometric properties. *Journal of Obsessive-Compulsive and Related Disorders, 1*, 133-137.

Snorrason, I., Smári, J., & Ólafsson, R.P. (2011). Motor inhibition, reflection impulsivity and trait impulsivity in pathological skin picking. *Behavior Therapy, 42*, 521-532.

Snorrason, I., Smári, J., & Ólafsson, R.P. (2011). Interaction effects of impulsivity and responsibility in relation to obsessive-compulsive symptoms. *Cognitive Therapy and Research, 35*, 79-86.

Snorrason, I., Smári, J., & Ólafsson, R.P. (2010). Emotion regulation in pathological skin picking: Findings from a non treatment-seeking sample. *Journal of Behavior Therapy and Experimental Psychiatry, 41*, 238-245.

Ólafsson, R. P., **Snorrason, I**. & Smári, J. (2010). Yale-Brown Obsessive Compulsive Scale: Psychometric properties of the self-report version in a non-clinical sample. *Journal of Psychopathology and Behavioral Assessment, 32*, 226-235.

Peer-reviewed journal articles in Icelandic

Snorrason, Í. & Björgvinsson, Þ. (2012). Greining og meðferð hárrplokkunar- og húðkroppunaráráttu [Diagnosis and treatment of hair pulling- and skin picking disorder]. *Icelandic Journal of Medicine, 98*, 155-162.

Snorrason, Í., Smári, J., & Ólafsson, R.P. (2009). Húðkroppunarárátta: Klínísk einkenni og tengls við geðraskanir. [Clinical characteristics and comorbitity of pathological skin picking in a non-treatment seeking sample. *Icelandic Journal of Psychology, 14*, 105-115.]

Snorrason, Í. (2008). Húðkroppunarárátta: Klínísk einkenni, tengsl við aðrar geðraskanir og flokkun í DSM. [Pathological skin picking: Clinical characteristics, relationship with other psychiatric disorders and categorization within the DSM. (Review article). *Icelandic Journal of Psychology, 13*, 9-26.]

Snorrason, Í., & Guðnason, H.I. (2008). Um hugræna atferlismeðferð og athafnassemismeðferð við þunglyndi. [Behavior activation and cognitive behavior therapy for depression. *Icelandic Journal of Psychology, special issue on depression, 13*, 199-211.]

Reports in Icelandic

Sturludóttir, G.J., **Snorrason, Í**., Guðmundsdóttir, M., & Jónsson, F.H. (2008). Ungt fólk, samfélagið og verkalýðshreyfingin: Viðhorfskönnun í maí til júlí 2008. [*Yong people, the society and the trait union movement: Attitude survey conducted in May to June 2008*]. Reykjavík: Social Science Research Institute.

Book chapters

Snorrason I., Goetz, A., & Lee, H.-J. (in press). Psychological treatment of excoriation disorder. In J. Abramowitz, J., D. McKay E.A., & E.A. Storch (Eds.), *Handbook of Obsessive-Compulsive Related Disorders*. Wiley Publishing.

73

Houghton, D.C., **Snorrason I**., & Woods, D.W. (in press). Disorders of impulse control. In H. Friedman (Ed.), *Encyclopedia of Mental Health, Second edition*.

Snorrason I., Houghton, D.C., & Woods, D.W. (2015). Trichotillomania (hair-pulling disorder). In D.J. Stein & K. Phillips (Eds.), *Handbook on Obsessive-Compulsive and Related Disorders* (pp. 135-160). Washington, DC: American Psychological Association.

Piacentini, J., Chang, S., **Snorrason, I**., & Woods, D.W. (2014). Obsessive-compulsive spectrum disorders. In E. J. Mash & R.A. Barkley (Eds.), *Child psychopathology, third edition* (pp. 429-475). New York: The Guilford Press.

Snorrason I., & Woods, D.W. (2013). Hair pulling, skin picking and other body focused repetitive behaviors. In E.A. Storch & D. McKay (Eds.), *Obsessive-compulsive disorder and its spectrum: A life-span approach* (pp. 163-184). Washington, DC: American Psychological Association.

Woods, D.W., **Snorrason, I**., & Espil, F.M. (2011). Cognitive behavior therapy of trichotillomania and skin picking in adults. In J.E. Grant, D.J. Stein, D.W. Woods, & N.J. Keuthen (Eds.), *Trichotillomania, skin-picking, and other body-focused repetitive behaviors* (pp.175-192). Washington, DC: American Psychiatric Publishing, Inc.

Snorrason, I., Smári J., & Ólafsson, R.P. (2008). The interaction between impulsivity and responsibility in relation to obsessive-compulsive symptoms. In G.T. Jóhannesson, & H. Björnsdóttir H. (editors). *Researches in the Social Sciences IX* (pp. 547-558). Reykjavík: Social Science Research Institute – University Press.

Conference Presentations

Snorrason, I., Lee, H.-J., & Woods, D.W. (2015, April). Tengsl geðshræringar og hvatísi í húðkroppunaráráttu. [*Emotion Based Impulsivity in Pathological Skin Picking*]. Presentation at the 7th annual convention of the Icelandic Psychology Association and the psychology department at the University of Iceland, Reykjavík, Iceland.

Aspinall, Z., **Snorrason, I**., Chandler-Hudson, A.C., Rohde, M.M., & Lee, H.-J. (2015, April). *Excoriation (Skin-Picking) Disorder Co-Occurs and Shares Family History with other Body Focused Repetitive Behaviors*. Poster presented the annual convention of the Wisconsin Psychological Association, Wisconsin, USA.

Snorrason, I., Olafsson, R.P., Flessner C.A., Houghton, D.C., Woods, D.W., & Lee, H.-J. (2014, November). *'Wanting' and 'liking' Skin Picking: A Validation of the Skin Picking Reward Scale*. Poster presented at the 48th annual convention of Association for Behavioral and Cognitive Therapies, Philadelphia, USA.

Aspinall, Z., Kohloff, R.E., **Snorrason, I**., & Lee, H.-J. (2014, April). *The role of appearance concerns in pathological skin picking*. Poster presented at the UW System Symposium for Undergraduate Research and Creative Activity, Wisconsin, USA.

Snorrason, I., de Wit, S., Lee, H.-J., & Woods, D.W. (2013, November). *Stress and habit learning in chronic skin picking*. Poster presented at the 47th annual convention of Association for Behavioral and Cognitive Therapies, Nashville, USA.

Snorrason, I., Ingolfsdottir, H. Ran, D. Olafsson, R.P., Hansdottir, I., & Woods, D.W. (2012, November). *Body Focused Repetitive Behaviors: Co-occurrence, similarities and shared family history*. Poster presented at the 46th annual convention of Association for Behavioral and Cognitive Therapies, Maryland, USA.

Snorrason, I., Olafsson, R.P., Flessner C.A., Keuthen, N.J., Franklin, M.E., & Woods, D.W. (2012, November). *Skin picking impact scale: Factor structure, validity and development of a short version*. Poster presented at the 46th annual convention of Association for Behavioral and Cognitive Therapies, Maryland, USA.

Ricketts, E.J., **Snorrason, I**., Flessner C.A., Franklin, M.E., & Woods, D.W. (2011, November). *Body focused repetitive behaviors among individuals with pathological skin picking*. Poster presented at the 45th annual convention of Association for Behavioral and Cognitive Therapies, Toronto, Canada.

Snorrason, I., Olafsson, R.P., Flessner C.A., Keuthen, N.J., Franklin, M.E., & Woods, D.W. (2011, November). *Skin picking scale: Factor structure and psychometric properties*. Poster presented at the 45th annual convention of Association for Behavioral and Cognitive Therapies, Toronto, Canada.

Olafsson, R.P., **Snorrason, I**., Smari J., & Emmelkamp, P.M.G. (2011, April). Hugsanastjórn í áráttu og þráhyggju: Að fjarlægja uppáþrengjandi hugsanir. [*Thought dismissal and obsessive compulsive symptoms: Removing obsessive, negative and neutral thoughts*]. Presentation at the 2nd annual convention of the Icelandic Psychology Association and the psychology department at the University of Iceland, Reykjavík, Iceland

Snorrason, I., Smari, J., & Olafsson, R.P. (2011, May). *Motor inhibition, reflection impulsivity and trait impulsivity in pathological skin picking*. Poster presented at the 20th annual Trichotillomania Learning Center national conference, San Francisco, USA.

Snorrason, I., Capriotti, M., Franklin, S., Tucker, B.T.P., Franklin, M.E., & Woods, D.W. (2010, November). *Pathological skin picking and negative affect: The mediational role of experiential avoidance*. Poster presented at the 44th annual convention of Association for Behavioral and Cognitive Therapies, San Francisco, USA.

Walther, M.R., **Snorrason, I.**, Flessner, C.A., Burkel, R., Woods, D.W., & Franklin, M.E. (2010, November). *The trichotillomania impact project in young children (TIP-YC)*. Poster presented at the 44th annual convention of Association for Behavioral and Cognitive Therapies, San Francisco, USA.

Snorrason, I., Sigurvinsdóttir, E., Smári, J. and Ólafsson, R.P. (2009, June). *Skin picking and its relationship with obsessive-compulsive symptoms, perfectionism and "not just right" experiences*. Poster presented at the 11th European Congress of Psychology, Oslo, Norway.

Ólafsson, R.P., **Snorrason, I**., Smári, J. Thorsteinsdóttir, G., Hreinsdóttir, E.B. and Bjarnadóttir, B.K. (2009, May). Áráttu-og þráhyggjuróf geðraskana: Tengsl átraskana við áráttu- og þráhyggjueinkenni í úrtaki sjúklinga. [*Obsessive-compulsive symptoms and impulsiveness in eating disorders*]. Poster presented at the annual convention at the Landspitali University Hospital, Reykjavík, Iceland.

Snorrason, I., Hansdóttir, I. and Tyrfingsson, T. (2009, April). Hvatvísi meðal amfetamínfíkla: Tengsl við ofskammta og notkun óhreinna áhalda við neysluna. [*Impulsivity among amphetamine addicts: Relation with overdose and needle sharing*]. Poster presented at the 1st annual convention of the Icelandic Psychology Association and the psychology department at the University of Iceland, Reykjavík, Iceland.

Ernudóttir, G.B., Ólafsdóttir, L., **Snorrason, I**. and Smári, J. (2009, April). Tengsl sjálfskaða og áfalla í æsku: Miðlunaráhrif tilfinninganæmis og sjálfsálits. [*Relationship between self-injurious behaviors and childhood trauma: Mediating and moderating role of emotion reactivity and self-esteem*]. Poster presented at the 1st annual convention of the Icelandic Psychology Association and the psychology department at the University of Iceland, Reykjavík, Iceland.

Guðmundsdóttir, B.G., **Snorrason, I**. and Smári, J. (2009, April). Tengsl tilfinningaólæsis, líkamsvitundar og húðkroppunaráráttu. [*Alexithymia, somatic awareness and pathological skin picking*]. Poster presented at the 1st annual convention of the Icelandic Psychology Association and the psychology department at the University of Iceland, Reykjavík, Iceland.

Snorrason, I. (2008, October) Samvirkniáhrif hvatvísi og hugrænna þátta á áráttu og þráhyggjueinkenni. [*Interaction between impulsivity and cognitive factors in obsessive-compulsive disorder*]. Presentation at the 8th conference on research in the social sciences at the University of Iceland, Reykjavík, Iceland.

Snorrason, I., Sigurvinsdóttir, E., Smári, J., & Ólafsson, R.P. (2008, October). Húðkroppunarárátta: Áætluð tíðni, tengsl við tilfinningastjórnun, áráttu/þráhyggju og fullkomnunaráráttu. [*Pathological skin picking: Estimated prevalence, relation with obsessive-compulsive symptoms and perfectionism*]. Poster presented at the 8th conference on research in the social sciences at the University of Iceland, Reykjavík, Iceland.

Snorrason, I., Smári J., & Ólafsson R.P (2008, September). *The interaction between impulsivity and responsibility in relation to obsessive compulsive symptoms*. Poster presented at the 38th congress of the European Association for Behavioral and Cognitive Therapy, Helsinki, Finland.

Snorrason, I., Ólafsson, R.P., & Smári, J. (2007, December). *Yale-Brown Obsessive Compulsive Scale: Psychometric properties of the self-report version in a non-clinical sample*. Poster presented at the 7th conference on research in the social sciences at the University of Iceland, Reykjavík, Iceland.

Research Grants (Principal Investigator)

2009   Landspitali University Hospital Research Fund
Title: *Self-injurious behavior and emotion regulation*
Direct costs: 410.000 kr. (≈$3200)

2008   Trichotillomania Learning Center, Inc.
Title: *Impulsivity and emotion regulation in pathological skin picking*
Direct costs: $13,000

2008   Landspitali University Hospital Research Fund
Title: *Thought shape fusion in eating disorders*
Direct costs: 265.000 kr. (≈$2100)

2008   Assistantship Fund of the University of Iceland
Title: *Yale-Brown Obsessive Compulsive Scale-Self-report: Psychometric analysis.* Direct costs: 90.000 kr. (≈$720)

2007   Assistantship Fund of the University of Iceland
Title: *Yale-Brown Obsessive Compulsive Scale-Self-report: Psychometric analysis.* Direct costs: 90.000 kr. (≈$720)

2006   Assistantship Fund of the University of Iceland
Title: *Yale-Brown Obsessive Compulsive Scale-Self-report: Psychometric analysis.* Direct costs: 90.000 kr. (≈$720)

2006   The Icelandic Student Innovation Fund
Title: *Yale-Brown Obsessive Compulsive Scale: Translation & psychometrics.*
Direct costs: 220.000 kr. (≈$1750)

Ad Hoc Reviewer

Psychiatry Research	The Cognitive Behaviour Therapist
Journal of Psychiatric Research	Comprehensive Psychiatry
Journal of Obsessive-Compulsive and Related Disorder	Journal of Behavior Therapy and Experimental Psychiatry
Behavioral and Cognitive Psychotherapy	Journal of Psychiatry
Research in Developmental Disabilities	Expert Review of Neurotherapeutics
Child Psychiatry and Human Development	Scandinavian Journal of Psychology
Spanish Journal of Psychology	Icelandic Journal of Psychology
Journal of Consulting and Clinical Psychology*	Journal of Anxiety Disorders*
Clinical Psychology Review*	Journal of Child Psychology and Psychiatry*

77

| International Journal of Psychiatry in Medicine* | Journal of Clinical Psychology* |
| Behaviour Research and Therapy* | Journal of Anxiety Disorders* |

* With Douglas W. Woods, PhD

Employment

2014 –2015	*University of Wisconsin-Milwaukee* Semester I: Teaching Assistant (Research Method) Semester II: Associate Lecturer (Introduction to Psychology)
2013 –2014	*University of Wisconsin-Milwaukee* Semester I: Associate Lecturer (Introduction to Psychology) Semester II: Associate Lecturer (Introduction to Psychology)
2012 –2013	*University of Wisconsin-Milwaukee* Semester I: Teaching Assistant (Research Methods) Semester II: Teaching Assistant (Research Methods)
2011 –2012	*University of Wisconsin-Milwaukee* Semester I: Grader Semester II: Teaching Assistant (Research Methods)
2010 –2011	*University of Wisconsin-Milwaukee* Semester I: Grader Semester II: Teaching Assistant (Research Methods)
2010 (summer)	*University of Iceland* Research Assistant (on a RANNÍS grant)
2008 –	*University of Iceland* BS-Thesis Supervisor.
2008	*University of Iceland* Teaching Assistant (Statistics & Introduction to Psychology).
2008 (single project)	*Social Science Research Institute – University of Iceland* Data processing and statistical analysis.
2008 – 2010	*SAA National Center for Addiciton Medicine* Researcher conducting research on amphetamine addiction.
2006 – 2008	*Decode Genetics* Interviewer for a research on the genetics of alcoholism and drug addiction. I completed 230 diagnostic (SSAGA-II) interviews (approximately 550 hours).

78

2005	*Landspitali-University Hospital, Department of Psychiatry* Instructor at a day unit for people with chronic depression/anxiety and/or personality disorders.
2002 – 2006	*Landspitali-University Hospital, Department of Psychiatry* General employee at different inpatient psychiatric wards.

Mentoring (BS-Thesis Supervision)

2013 spring	Student: Heiða Ingólfsdóttir. BS-thesis (University of Iceland): *Co-occurrence, shared family history and clinical characteristics of problematic hair pulling, skin picking, nail biting and cheek/biting*. Instructors: **Ivar Snorrason**, Ragnar P. Ólafsson, and Ingunn Hansdóttir.
2012 spring	Student: Ástríður Halldórsdóttir. BS-thesis (University of Iceland): *Body focused repetitive behaviors: Estimated prevalence and relation to obsessive-compulsive symptoms and body image concerns*. Instructors: **Ivar Snorrason** and Halldór Guðmundson.
2009 fall	Student: Erna Sigurvinsdóttir. BS-thesis (University of Iceland): *Skin picking and its relationship with obsessive-compulsive symptoms, perfectionism and "not just right" experiences*. Instructors: **Ivar Snorrason**, Ragnar P. Ólafsson and Jakob Smári.
2009 spring	Students: Gabríela Bryndís Ernudóttir and Lára Ólafsdóttir. BS-thesis (University of Iceland): *The relationship between childhood trauma and self-injurious behavior: the mediating and moderating role of emotion reactivity and self-esteem*. Instructors: **Ivar Snorrason** and Jakob Smári.
2009 spring	Student: Bergljót Gyða Guðmundsdóttir. BS-thesis (University of Iceland): *The relationship between skin picking, alexithymia, boredom and somatic awareness*. Instructors: **Ivar Snorrason** and Jakob Smári.
2008 fall	Students: Júlía Ocares and Katrín Magnúsdóttir. BS- thesis (University of Iceland): *Psychometric properties of the Emotion Reactivity Scale and the Difficulties in Emotion Regulation Scale*. Instructors: Ragnar P. Ólafsson, **Ivar Snorrason** and Jakob Smári.

Translation of Instruments

I have translated the following instruments from English into Icelandic. (I did some of this work in collaboration with others).

Self-Injurious Thoughts and Behaviors Interview (SITBI, long and short version)

UPPS- Impulsive Behaviour Scale (UPPS)

Barratt´s Impulsiveness Scale (BIS-11)

Boredom Proneness Scale (BPS)

Difficulties in Emotion Regulation Scale (DERS)

Emotion Reactivity Scale (ERS)

Body Image Concern Inventory (BICI)

Thought Shape Fusion Questionnaire (TSFQ)

Pennebaker Inventory of Limbic Languidness (PILL)

Skin Picking Scale-Revised (SPS-R)

Skin Picking Scale (SPS)

Skin Picking Impact Scale (SPIS)

Milwaukee Inventory for the Dimensions of Adult Skin Picking (MIDAS)

Milwaukee Inventory for the Subtypes of Trichotillomania-Adult version (MIST-A)

Massachusetts General Hospital-Hair-pulling Scale (MGH-HS)

Habit Questionnaire (HQ)

Yale-Brown Obsessive Compulsive Scale (Y-BOCS)

Yale-Brown Obsessive Compulsive Scale-Self-Report version (Y-BOCS-SR)

Internal, Personal and Situational Attributions Questionnaire (IPSAQ)

Topography of Voices Rating Scale (TVRS)

Revised Belief about Voices Questionnaire (BAVQ-R)

Oxford-Liverpool Inventory of Feelings and Experiences (O-LIFE)

Collective Self-Esteem Scale (CSS)

Stigma Consciousness Questionnaire-Women (SCQ-W)