

## Original Article

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# Prevalence of body-focused repetitive behaviors in a diverse population sample – rates across age, gender, race and education

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**Abstract**

**Background.** Prevalence estimates for body-focused repetitive behaviors (BFRBs) such as trichotillomania differ greatly across studies owing to several confounding factors (e.g. different criteria). For the present study, we recruited a diverse online sample to provide estimates for nine subtypes of BFRBs and body-focused repetitive disorders (BFRDs).

**Methods.** The final sample comprised 1481 individuals from the general population. Several precautions were taken to recruit a diverse sample and to exclude participants with low reliability. We matched participants on gender, race, education and age range to allow unbiased interpretation.

**Results.** While almost all participants acknowledged at least one BFRB in their lifetime (97.1%), the rate for BFRDs was 24%. Nail biting (11.4%), dermatophagia (8.7%), skin picking (8.2%), and lip-cheek biting (7.9%) were the most frequent BFRDs. Whereas men showed more lifetime BFRBs, the rate of BFRDs was higher in women than in men. Rates of BFRDs were low in older participants, especially after the age of 40. Overall, BFRBs and BFRDs were more prevalent in White than in non-White individuals. Education did not show a strong association with BFRB/BFRDs.

**Discussion.** BFRBs are ubiquitous. More severe forms, BFRDs, manifest in approximately one out of four people. In view of the often-irreversible somatic sequelae (e.g. scars) BFRBs/BFRDs deserve greater diagnostic and therapeutic attention by clinicians working in both psychology/psychiatry and somatic medicine (especially dermatology and dentistry).

**Introduction***Symptomology and classification of body-focused repetitive behaviors (BFRBs)*

Body-focused repetitive behaviors (BFRBs) are characterized by a strong urge to manipulate the outer shell of one's body in a harmful way (e.g. nail biting, trichotillomania). The majority of the population engage in such behavior at some point in their lives, according to prevalence studies (in the study by Houghton, Alexander, Bauer, & Woods, 2018, 59.55% of the sample reported occasional engagement in subclinical BFRBs).

These conditions have, however, been shown to cause distress in many individuals, leading to reduced quality of life (Ricketts et al., 2022), presumably via depression (Houghton et al., 2016). In chronic forms, irreversible long-term sequelae such as scars, extreme hair loss, infected lesions/wounds, missing nails, pathological changes to the lips and (tissue-related) developmental problems can result from the disorder (Christenson, Pyle, & Mitchell, 1991; Houghton et al., 2018; Kang, Lee, Ro, & Lee, 2012; Modh, 2018; Odlag & Grant, 2008; Thompson, 2013).

In the DSM-5, BFRBs are subsumed under the section 'obsessive-compulsive and related disorders' (APA, 2013); only skin picking and trichotillomania are explicitly mentioned as diagnoses; other BFRBs are mentioned only cursorily (e.g. lip chewing) or not at all, thus obscuring their real psychological, medical and societal importance.

*Prevalence rates and moderators*

Prior studies have reported divergent prevalence estimates of body-focused repetitive behavior disorders (BFRDs) owing to different recruitment methods (e.g. student *v.* community samples), target conditions, criteria (pertaining to symptoms and reference periods), and mode of assessment (interview *v.* online). As researchers have noted (Houghton et al., 2018),

there is no established cut-off for the number of times one must engage in a daily BFRB for it to be considered clinically relevant or a body-focused repetitive behavior disorder (BFRD). Accordingly, some studies largely relied on DSM-5 criteria (Grant, Dougherty, & Chamberlain, 2020, on trichotillomania), while others created new instruments (Pacan, Grzesiak, Reich, Kantorska-Janiec, & Szepietowski, 2014), set cut-offs on established scales (e.g. Solley & Turner, 2018) or adopted behavioral cut-offs (e.g. behavior displayed at least five times a day; Houghton et al., 2018). The population age and reference periods also tend to differ. Such differences are known to impact prevalence rates in general as rates often change across the lifespan and, at times, must fulfill certain time criteria (Kessler, Petukhova, Sampson, Zaslavsky, & Wittchen, 2012; Tam, Mezuk, Zivin, & Meza, 2020). There is now tentative evidence suggesting the disorder may be more prevalent among women (depending on the kind of BFRB, e.g. Solley & Turner, 2018), those with specific somatic problems (e.g. atopic dermatitis and psoriasis, Spitzer et al., 2022), and younger people (Grant et al., 2020), as well as evidence suggesting that being a member of an ethnic minority group may be associated with increased symptom severity and reduced access to treatment (Grant, Valle, Aslan, & Chamberlain, 2021).

Typically, BFRBs are associated with shame (Singh, Wetterneck, Williams, & Knott, 2016) and many individuals are not aware of their diagnosis or the condition's treatability, which is also true for many clinicians (Houghton et al., 2018; Jafferany, Vander Stoep, Dumitrescu, & Hornung, 2010). Help-seeking is thus low and many individuals with BFRBs do not receive effective treatment (e.g. Franklin et al., 2008; Houghton et al., 2018).

### The present study

This study aimed to determine the prevalence of repetitive behaviors, which involve habits with no or minor psychological or somatic consequences (i.e. BFRBs), as well as body-focused repetitive behavior disorders (i.e. BFRDs), which have more severe psychological or somatic consequences. We aimed to recruit a large and diverse sample of participants to learn about differences in prevalence rates for key sociodemographic variables for these 'hidden disorders'.

## Methods

### Data collection

We recruited participants from the United States via prime panels, an aggregate of several online crowdsourcing panels. Prime panels samples approximate representativeness (Chandler, Rosenzweig, Moss, Robinson, & Litman, 2019) by matching the US general population on data provided by the United States Census Bureau (Moss et al., 2023). Prime panels includes several measures to ensure reliable data. Participants were sampled with preselected quotas on age, gender, Hispanic origin (yes or no), and race (White, Black/African American, Asian, some other race, or American Indian/Alaska Native). The invitation to the study did not contain any clue that the main purpose of the survey was to ask about BFRBs. Interested parties were informed that the survey would deal with various psychological experiences and would take approximately 20 min. The study was approved by the local ethics committee of the University Medical Center Hamburg (Germany, LPEK-0524).

### Assessment of BFRB and BFRD

We posed several questions for nine BFRBs (i.e. nail biting, trichotillomania, dermatophagia, skin picking, teeth grinding (awake), joint cracking, thumb sucking, lip-cheek biting, nose picking). First, using a novel scale, we asked if individuals had ever displayed a specific behavior (1 = never; 2 = in the past but not in the last two months; 3 = occasionally, but only when under stress; 4 = approximately once a week; 5 = several times a week; 6 = daily or almost daily). If 1 or 2 was endorsed, the survey proceeded to the next target behavior. If a rating between 2 and 6 was chosen, this was counted as the presence of a *lifetime* BFRB, whereas a rating between 3 and 6 was rated as the presence of a *current* BFRB. When ratings between 3 and 6 were endorsed, we asked whether the behavior causes visible damage (1 = no; 2 = hardly visible; 3 = yes; 4 = very much, with lasting physical consequences). Response options 3 and 4 were taken as indicators of a more serious BFRD. We also inquired whether individuals had ever received a psychiatric diagnosis. Questions on sociodemographic variables (e.g. age, gender, race) were asked in the final section.

### Exclusion criteria

We captured careless responding via two items embedded at the beginning of the survey: 1. 'Have you ever felt sick in your life?' and 2. 'I cannot hear, smell or see anything.' Further, following the design of prior surveys (Scheunemann et al., 2020), we included an implicit attention test in the demographic question section at the end of the survey (Oppenheimer, Meyvis, & Davidenko, 2009). If participants failed on at least one of the three items, they were excluded. Additionally, participants self-rated their attentiveness (for analysis, we only included participants with a score of at least five on a 7-point Likert scale, with higher scores designating better subjective attentiveness). Finally, participants with response times of 50% or less than the median completion time were excluded (see Greszki, Meyer, & Schoen, 2014) due to the probable increase in unreliable responses (cut-off: 9.12 min).

### Determination of the final sample

A total of 2344 participants initially entered the survey, of whom 2008 completed it. Then, blind to results, 96 participants were excluded due to poor results on the implicit attention check and an additional 253 were excluded due to poor self-rated attentiveness during the study; 178 participants were excluded due to excessive speeding. Exclusions totaled 527 participants (26%), and 1481 participants were included in the final analyses.

### Strategy of data selection

For moderator analyses pertaining to gender, age, race, and education, we ran analyses with four subsamples matched for each of the other variables. To allow unbiased comparisons, we matched samples based on propensity scores using the 'nearest' method of the MatchIt function in R (Randolph, Falbe, Manuel, & Balloun, 2014): For each of the cases in the smallest group, the program automatically identifies the best match from all other groups based on the remaining sociodemographic variables (e.g. for each participant in the age group 30–39, a match from all other age groups was selected so that both groups had the same sample

sizes and best fit regarding gender, race and education). We created four matched subsamples (see Results for subsample sizes) on age, gender, race and education. After matching, no significant differences emerged between the respective matched groups on any sociodemographic variable ( $p > 0.05$ ).

## Results

### Full sample

As shown in Table 1, lifetime prevalence for BFRBs was over 50% for nose picking (78.9%), lip-cheek biting (75.3%), nail biting (71.3%), and joint cracking (62.3%). Virtually all individuals affirmed at least one BFRB in their lifetime (97.1%), with an average number of at least four BFRBs (Table 1 shows the number of BFRBs/BFRDs for the entire sample and those with at least one condition). For BFRDs, the following four conditions had a prevalence rate of over 5%: nail biting (11.4%), dermatophagia (8.7%), skin picking (8.2%), and lip-cheek biting (7.9%); 24% showed at least one BFRD during their lifetime.

### Comparisons across gender (matched sample)

Table 2 shows that current prevalence was higher in women for lip-cheek biting and dermatophagia but lower for nose picking relative to men, with no overall differences ( $p = 0.569$ ,  $d = 0.032$ ). Lifetime prevalence rates for BFRBs were higher for men than women for nose picking, joint cracking and skin picking. Forms with visible/noticeable damage (i.e. BFRDs) were more prevalent in women for skin picking, nail biting and lip-cheek biting; thumb sucking was more prevalent in men. Women showed an overall lower number of lifetime BFRBs ( $p = 0.001$ ,  $d = 0.196$ ) but higher BFRDs rates ( $p = 0.001$ ,  $d = 0.189$ ) than men (both at a small effect size).

### Comparisons across age (matched sample)

Table 3 indicates that current BFRBs (lifetime BFRBs are not shown as confounded with age) and BFRDs are more prevalent in younger than older participants across all conditions (matched subsample). This is qualified by Fig. 1 in the Online Appendix,

showing that the prevalence for BFRDs peaks for nail biting and dermatophagia between the ages of 18 and 29, while for skin picking and lip-cheek biting, it is almost equal for the 18–29 and 30–39 age groups. For trichotillomania, teeth grinding, joint cracking, and nose picking, there is a peak after 30; for thumb sucking, similar estimates appear for age groups 30–39 and 40–49. As a result, younger adults (below 39) also had more current BFRBs ( $p < 0.001$ ,  $d = 1.10$ ) and BFRDs ( $p < 0.001$ ,  $d = 0.612$ ) than older adults at a large and medium effect size, respectively. While only 10.3% of the older showed BFRDs, the rate was 38.2% in those below 40 ( $p < 0.001$ ).

### Comparisons for different ethnicities (matched sample)

Overall prevalence was higher for Whites than non-Whites (matched subsamples) with respect to current lip-cheek biting, dermatophagia, teeth grinding, and nail biting (see Table 3 of the Online Appendix). Lifetime BFRBs were more frequent in Whites for teeth grinding and nail biting compared to non-Whites. For BFRDs, Whites showed higher rates for nail biting, dermatophagia, skin picking, and lip-cheek biting. Accordingly, Whites also showed more overall current BFRBs ( $p < 0.001$ ,  $d = 0.248$ ), overall lifetime BFRBs ( $p = 0.01$ ,  $d = 0.176$ ), and overall BFRDs ( $p < 0.001$ ,  $d = 0.276$ ) at small effect sizes.

### Comparisons across different levels of education (matched sample)

Concerning the overall frequency of conditions across the three prevalence categories ( $p > 0.4$ ,  $d < 0.042$ ), those with lower and higher levels of education (not higher than high school *v.* at least university degree) did not differ greatly (see Online Appendix Table 4), although the rate of at least one current BFRB was higher in those with a higher than a lower level of education (86.4% *v.* 82.1%). Individuals with a lower level of education showed more present and lifetime BFRBs for trichotillomania and thumb sucking but lower rates for joint cracking. For BFRDs, those with a high level of education showed less thumb sucking than those with a lower level of education but more nail biting at trend level.

**Table 1.** Prevalence rates of the total sample ( $N = 1481$ ) for current and lifetime presence of BFRBs and lifetime presence of BFRDs

Condition	BFRB		BFRD
	Current	Lifetime	Current
Nail biting	41.5%	71.3%	11.4%
Trichotillomania	11.2%	19.2%	2.8%
Lip-cheek biting	37.3%	75.3%	7.9%
Dermatophagia	25.6%	46.3%	8.7%
Skin picking	25.7%	48.7%	8.2%
Thumb sucking	4.7%	7.3%	1.3%
Teeth grinding (awake)	26.5%	37.7%	3.7%
Joint cracking	45.6%	62.3%	2.8%
Nose picking	51.9%	78.9%	1.4%
Mean number (SD) of conditions entire sample; % with at least one condition	2.70 (2.09); 84.3% (for those with BFRD: $M = 3.20$ (1.90))		0.48 (1.12); 24.0% (for those with BFRD: $M = 4.60$ (1.95))

**Table 2.** Prevalence rates by gender (women v. men, matched)

Condition	BFRB				BFRD	
	Current		Lifetime		Current	
	Women (n = 634)	Men (n = 634)	Women (n = 634)	Men (n = 634)	Women (n = 634)	Men (n = 634)
Nail biting	41.5%	37.7%	69.7%	70.8%	14.7%	7.6%****
Trichotillomania	11.0%	12.1%	18.1%	21.0%	3.2%	2.4%
Lip-cheek biting	40.1%	33.0%**	73.3%	77.1%	9.6%	6.5%*
Dermatophagia	30.6%	19.9%****	47.3%	44.0%	11.5%	6.3%
Skin picking	26.2%	25.7%	45.9%	53.3%**	10.9%	5.5%****
Thumb sucking	3.8%	5.8%+	6.3%	8.7%	0.5%	2.1%*
Teeth grinding (awake)	29.0%	26.8%	37.2%	41.3%	4.3%	3.2%
Joint cracking	41.6%	46.7%+	55.5%	67.5%***	2.8%	3.2%
Nose picking	47.9%	57.3%****	74.4%	85.0%****	1.6%	1.3%
Mean number (SD) of conditions entire sample; % with at least one condition	2.71 (2.08) [83.1%]	2.65 (2.16) [85.2%]	4.28 (2.05) [97.0%]	4.69 (2.13)**** [97.6%]	0.59 (1.09) [30.6%]	0.38 (1.15)**** [16.9%****]

+ \* p ≤ 0.1; \* p ≤ 0.05; \*\* p ≤ 0.01; \*\*\* p ≤ 0.005; \*\*\*\* p ≤ 0.001.

**Comorbid diagnoses**

Online Appendix Table 1 lists comorbid disorders across BFRD subtypes, while Online Appendix Table 2 contrasts our findings with lifetime morbid risk rates from a large US epidemiological study (Kessler et al., 2012) for matching disorders. Lifetime prevalence was almost one-third for depression and anxiety. Comorbidity with OCD exceeded 10% for the following conditions: thumb sucking (15.8%), awake teeth grinding (12.7%), joint cracking (11.9%), and lip-cheek biting (10.3%).

**Discussion**

Our study demonstrates the ubiquity of BFRBs. Virtually all participants (97.1%) acknowledged at least one lifetime body-focused repetitive habit, with an average of four to five different types. The rate dropped to 24% for more severe cases with visible consequences. Nail biting (11.4%), dermatophagia (8.7%), skin picking (8.2%), and lip-cheek biting (7.9%) were the most common. We deem it a strength of this study that we recruited a large and heterogeneous sample (in terms of age, race, and education) and that we examined subsamples matched for important background aspects for key variables.

**Prevalence across conditions**

The observed lifetime rate of BFRD for trichotillomania of 2.8% is in fact very close to that found by Grant et al. (2020; 2.8% v. 2.5%), who also reported enhanced rates of comorbid psychiatric conditions. In contrast, we found much higher lifetime skin picking rates than Grant et al. (2020), 8.2% v. 3.1%, which may reflect the use of different criteria.

Our observed rate of 11.4% for lifetime nail biting is higher than scores found by Solley and Turner (2018), who adopted a modified version of the Massachusetts General Hospital Hairpulling Scale (Keuthen et al., 1995) for nail biting. In contrast, a study conducted in Turkey (Erdogan et al., 2021) reported much higher rates among university (17.6%) and high school (29.2%) students. However, possible differences in procedures compared to our study deserve attention (e.g. participants potentially knew what the study was about; less anonymity). A Polish study (Pacan et al., 2014) on 339 medical students reported high rates of current or past nail biting (46.9%).

Like our study, Houghton et al. (2018) assessed a set of different BFRBs concurrently. Our observed rates are higher than those found by Houghton et al., who used different criteria for ‘pathological BFRBs’ burdening comparisons. Our focus lay on visible damage rather than frequency and thus also included participants who did not engage five times or more a day as required by Houghton et al. (2018).

For awake bruxism, we found largely comparable rates to those of a Dutch study (Wetselaar, Vermaire, Lobbezoo, & Schuller, 2019) for men (3.2%) and slightly lower rates for women (4.3% v. 6.4%) when considering pathological behavior. However, these authors assessed for BFRBs rather than BFRDs.

Much higher rates of awake bruxism were found in a sample of Italian students (Cavallo, Carpinelli, & Savarese, 2016). However, the criteria referred to BFRB rather than BFRD and the study was comprised of a young sample, for which higher prevalence rates can be assumed.

**Gender, age, race, and comorbidity**

By matching samples, we carefully adjusted for confounding effects. Corroborating results by other studies (Grant &

**Table 3.** Prevalence rates by age (below 40 or greater than or equal to 40 years of age, matched)

Condition Dichotomy by Years	Current BFRB		BFRD	
	Older (40+) ( <i>n</i> = 474)	Younger (18–39) ( <i>n</i> = 474)	Older (40+) ( <i>n</i> = 474)	Younger (18–39) ( <i>n</i> = 474)
Nail biting	24.1%	62.0%****	6.1%	18.1%****
Trichotillomania	4.6%	20.9%****	0.6%	5.3%****
Lip-cheek biting	22.2%	57.6%****	1.5%	15.0%****
Dermatophagia	13.9%	40.3%****	1.9%	16.9%****
Skin picking	19.4%	34.8%****	3.8%	14.6%****
Thumb sucking	1.7%	9.1%****	0.6%	2.1%*
Teeth grinding (awake)	18.6%	35.2%****	1.3%	5.9%****
Joint cracking	23.2%	69.4%****	0.6%	4.9%****
Nose picking	45.6%	53.8%*	0.6%	2.5%*
Mean number (SD) of conditions entire sample; % with at least one condition	1.73 (1.68) [73.2%]	3.83 (2.08) **** [95.6% ****]	0.17 (0.60) [10.3%]	0.85 (1.45) **** [38.2% ****]

\*  $p \leq 0.05$ ; \*\*  $p \leq 0.01$ ; \*\*\*  $p \leq 0.005$ ; \*\*\*\*  $p \leq 0.001$ .

Chamberlain, 2020; Odlaug *et al.*, 2013; Siddiqui, Naeem, Naqvi, & Ahmed, 2012), BFRDs as whole were more prevalent in women (for lip-cheek biting see also Khan, Khan, Khan, Sethi, & Irfan, 2018) with one exception, which is that men engaged more often in adult thumb sucking than women; no significant differences emerged for trichotillomania (see also Grant *et al.*, 2020). Unlike a Dutch study (Wetselaar *et al.*, 2019), women in our study did not engage more in awake bruxism than men. However, for lifetime BFRBs, men exceeded women.

We observed a steep decline in prevalence across the lifespan, which underlines the importance of assessing prevalence rates across all age ranges and not confining studies to student populations as proxy for the entire population. While nail biting and dermatophagia in adults peaked between the ages of 20 and 29, most other BFRD rates were higher after age 30. Race also played a role. White individuals showed more severe nail biting, dermatophagia, skin picking and lip-cheek biting than non-White individuals. Here, our results contrast with those of Grant *et al.* (2021). Education did not influence results much.

Our study corroborates prior studies reporting high comorbidity with other mental disorders, particularly depression and anxiety disorders (Caragata, Rancès, O'Neill, & McGraw, 2014; Fatima, Abid, Baig, & Ahsan, 2019; Grant & Chamberlain, 2020; Lewin *et al.*, 2009; Odlaug *et al.*, 2013; Solley & Turner, 2018), while our rates for comorbid OCD are lower than those reported in other studies (Lin *et al.*, 2023).

### Limitations and comparison to previous studies

As mentioned, discrepancies most likely reflect different reference periods and specific questions/criteria to identify BFRBs/BFRDs. While we carefully chose our questions, a more fine-grained exploration asking for multiple criteria and setting clear cut-offs might arrive at slightly different results. Our estimates can only claim validity for the United States, and only within the scope of the BFRBs/BFRDs definitions we adopted. For many disorders, geographic differences have been reported; for example, higher rates of depression are reported in the Middle East, Africa and

Asia, according to Shorey, Ng, & Wong, (2022), especially in conflict-affected settings (Charlson *et al.*, 2019).

The overall prevalence rate for depression in our sample (33.8%) appears high when compared, for example, to Lim *et al.* (2018), who report a prevalence rate of 10.8%. Yet, other studies, especially those taking into account biases, particularly underreporting, at times also arrive at high rates (e.g. 20.6% in Hasin *et al.*, 2018; 20.9% in Kessler *et al.*, 2012; 30% of men and 40% of women in Kruijshaar *et al.*, 2005; 23.9% in Tam *et al.*, 2020). Our results resemble those of a large US study (Kessler *et al.*, 2012) using lifetime morbid risk (LMR) adjusted for biases such as forgetting or conscious nondisclosure; estimates are even lower than those in Kruijshaar *et al.* (2005). Moreover, our initial invitation indicated no clues about the nature of our study and thus was not likely to bias people (with or without BFRBs/BFRDs or mental disorders in general) to participate.

One may object that we relied on self-report using a novel scale (which may lead to underestimation in those with primarily automatic behaviors); however, shame and poor help-seeking behavior would also have likely resulted in an underestimation of rates in studies using interviews. Additionally, there is good evidence from depression, for example, that self-report can arrive at valid estimates (Bot *et al.*, 2017). The online service also allowed us to exclude participants with unreliable responses because of, for example, overly fast completion, further improving the validity of the data. Nonetheless, excluding participants who sped through the questionnaire and provided implausible responses may have decreased the number of participants with attentional and neurodevelopmental disorders. Finally, we suggest longitudinal studies to confirm that behaviors subside over time using ecological momentary assessment, which may inform researchers about the antecedents and risk factors for the behaviors (e.g. stress, negative mood, itching).

### Conclusion

The present study demonstrates the ubiquity of BFRBs; at least one condition affects almost everyone. Like depression (Hasin *et al.*, 2018; Santomauro *et al.*, 2021), BFRDs are more common

in White individuals, women, and younger people. BFRDs are found in almost one in four individuals, and we would like to remind readers that BFRDs can result in very severe and irreversible conditions, including life-threatening incidents (Thompson, 2013). As chronic forms will ultimately require concurrent treatment by different specialists to address both the urge and its somatic sequelae (e.g. psychologists or psychiatrists as well as dentists, dermatologists, neurologists, surgeons and internists), thus challenging the health system considerably, we call for greater attention to this underresearched and undertreated population with a focus on prevention. In particular, better therapist training (e.g., [www.clinical-neuropsychology.de/bfbr-e-training/](http://www.clinical-neuropsychology.de/bfbr-e-training/)) and availability of low-threshold self-help treatment strategies are needed, and whether the present allocation in the OCD section of the DSM is justified in view of the low prevalence rates of OCD and functional differences between the disorders.

**Supplementary material.** The supplementary material for this article can be found at <https://doi.org/10.1017/S0033291723003392>.

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