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Premonitory urge and tic severity, comorbidities, and quality of life in chronic tic disorders

Valerie Brandt, PhD^{1,2} Jana Essing, MD² Ewgeni Jakubovski, PhD² Kirsten Müller-Vahl, MD²

¹ School of Psychology, Centre for Innovation in Mental health, University of Southampton, Southampton, UK

² Clinic of Psychiatry, Social Psychiatry and Psychotherapy, Hannover Medical School, Hanover, Germany

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Corresponding author: Valerie Brandt, University of Southampton, Building 44, University Road, SO17 1BJ Southampton, UK, Phone: +44 23 8059 1375, E-Mail: v.c.brandt@soton.ac.uk

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26 *Abstract*

27 **Background:** Tics are intimately associated with premonitory urges (PU) but knowledge about
28 urges is still limited, with small sample sizes often limiting the generalizability of findings.

29 **Objectives:** This study addressed the following open questions: a) is tic severity associated with
30 urge severity, b) how common is relief, c) which comorbidities are associated with urges, d) are
31 urges, tics, and comorbidities associated with lower quality of life, and e) can complex and simple,
32 motor and vocal tics be differentiated based on PU?

33 **Methods:** N = 291 patients who reported a confirmed diagnosis of chronic primary tic disorder
34 (age=18-65, 24% female) filled out an online survey assessing demographic data, comorbid
35 conditions, location, quality and intensity of PU, as well as quality of life. Every tic was
36 recorded, and whether the patient experienced a PU, the frequency, intensity, and quality of that
37 urge.

38 **Results:** PU and tic severity were significantly associated, and 85% of urge-related tics were
39 followed by relief. A diagnosis of attention deficit/hyperactivity disorder (ADHD) or depression,
40 female gender, and older age increased the likelihood of experiencing PU, while more obsessive
41 compulsive (OCD) symptoms and younger age were associated with higher urge intensities. PU,
42 complex vocal tics, ADHD, OCD, anxiety, and depression were related to lower quality of life.
43 Motor and vocal, complex and simple tics did not differ regarding PU intensity, frequency, and
44 quality, or relief.

45 **Conclusions:** The results shed light on the relationship between PU, tics, comorbidities, age,
46 gender, and quality of life in tic disorders.

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50 Chronic primary tic disorders, including Tourette syndrome (TS), are characterized by multiple
51 motor and/or vocal tics.¹ A preceding sensory or premonitory urge (PU) is considered a hallmark
52 of tics.²⁻⁴ The urge to tic has been compared to the urge to scratch – a build-up in tension or an
53 uncomfortable feeling that is relieved after an action. The estimate for the prevalence of PU varies,
54 with approximately 77% of patients over 13 years and approximately 90% of patients over 18
55 years reporting to experience PU.^{2, 5-8} Adults with TS report urges more frequently than children
56 do, but it is unclear whether urges develop as a consequence of tics or precede tics in development;
57 alternatively, young children may simply lack awareness or the ability to describe PU.⁹ A recent
58 study of 291 patients confirmed that PU tend to occur in the same body part where a tic is about
59 to occur.¹⁰ The results indicated that, like tics¹¹, urges most commonly occur in the face and head.¹⁰
60 Different qualities of urges (e.g. pressure) can be differentiated, for instance with the premonitory
61 urges for tics scale (PUTS).^{3, 12} There is evidence that the urge increases before a tic or a bout of
62 tics, and that the urge then decreases in the majority of patients^{13, 14} but a minority experiences the
63 reverse pattern.¹⁴ A recent study conducted in the same sample that is utilized in this study showed
64 that 97% of patients who experienced urges also experienced relief for at least one of their tics.¹⁰
65 However, it has not been investigated how many tics are associated with a sense of relief on
66 average, i.e. do patients experience a sense of relief with every tic or only for a subset of tics?
67 Patients with TS who seek diagnosis or treatment typically have at least one comorbidity, the most
68 common are attention deficit/hyperactivity disorder (ADHD), obsessive compulsive disorder
69 (OCD), depression, and anxiety.¹⁵ Evidence on whether comorbidities are associated with urge
70 severity has been mixed,^{8, 12, 16-20} specifically, it is unclear whether or not comorbid OCD, ADHD,
71 depression, and anxiety are associated with the occurrence or intensity of PU. There is also some
72 evidence that different urge qualities may be related to comorbidities in different ways, e.g. OCD
73 may be associated with just-right feelings and ADHD may be related to feelings of tension.¹⁶ PU
74 have been found to be associated with lower quality of life^{8, 21} but it has not been investigated
75 whether different urge qualities are associated with lower quality of life.
76 While tics can be successfully treated with behavioral therapy,²²⁻²⁶ pharmacotherapy (most
77 commonly anti-dopaminergic drugs,^{27, 28} cannabis-based medicine including tetrahydrocannabinol

78 (THC),²⁹⁻³¹ and - in rare and otherwise treatment resistant cases – with surgical therapy using deep
79 brain stimulation (DBS),³² it is less clear how different treatments may affect PU.³³
80 The current study aims to address whether urge severity and tic severity are associated, by using
81 data from a survey that assessed each tic and associated PU individually. This detailed data allows
82 us to investigate which urge qualities may be more common than others and how comorbidities
83 are related to different urge qualities. Moreover, the sample is large enough to assess the impact
84 of tics, urges, and comorbidities on quality of life, while controlling for age and gender. Finally,
85 the association between anti-dopaminergic medication and urge occurrence (yes / no) and severity
86 is investigated.

87

88 *Methods*

89 N = 291 patients (age = 18-65 years, 24% female) who reported a confirmed diagnosis of chronic
90 primary tic disorder and who determined this diagnosis (e.g., Psychiatrist, neurologist) filled out
91 an online survey. The data was mainly collected as part of a study that aimed to investigate how
92 urges are distributed across the body.¹⁰ However, the dataset provides rich information on a number
93 of unanswered questions in the field and thus serves for further analyses. For information on patient
94 recruitment, survey procedure and demographic characteristics please see.¹⁰

95

96 **Are urge and tic frequency and intensity associated?**

97 Using the adult tic questionnaire (ATQ),³⁴ patients reported for each single tic they experienced (i)
98 how frequently they experienced the tic (1=sometimes, 2=multiple times a day, 3=once per hour,
99 4=all the time), (ii) how intense the tic was ('how intense was the tic in the last week?' 1 [barely
100 noticeable] -4 [clearly noticeable by others, potentially painful]), (iii) how frequently they
101 experienced an urge (never, sometimes, always) with every tic, and (iv) how intense this urge was
102 (1 [very low intensity]-11 [very high intensity]). Pearson's correlations were conducted to explore
103 the association between these variables separately in motor and vocal tics, single and complex tics.

104

105 **How common is a momentary sense of relief after a tic?**

106 For each tic, patients reported whether they experienced a sense of relief (yes=1, no=0). The
107 percentage of tics that were associated with a sense of relief was calculated.

108

109 **Which urge qualities are most common?**

110 Patients reported different PU qualities, reflecting the six PUTS urge quality categories¹² (feeling
111 itchy, pressure, tension, not just-right, incomplete, energy) and an additional two items that break
112 down the last PUTS item into two separate questions (the feeling that something is building before
113 a tic, feeling discomfort) for different tics, i.e. a certain quality for each tic. Whether a patient
114 experienced a certain urge quality with at least one tic was coded as yes/no (1/0). Percentages of
115 tics associated with different urge quality are reported overall and split by simple and complex as
116 well as motor and vocal tics. Chi-square tests were run between the different urge quality
117 categories on tics overall and corrected for multiple testing. Only $p < .001$ was considered
118 significant.

119 The number of patients who experienced different urge qualities were entered as the dependent
120 variable in a repeated measures ANOVA. Contrasts were calculated between the different urge
121 qualities. Mean urge intensity was calculated across tics within each patient per urge quality. Only
122 nine patients reported experiencing every urge quality. Therefore, paired-t-tests were computed,
123 comparing each urge quality to all others and these were corrected for multiple comparisons. Only
124 $p < .001$ was considered significant.

125

126 **Are comorbidities associated with the urge to tic?**

127 Comorbidities were assessed in two different ways. Patients filled out the Obsessive Compulsive
128 Inventory-Revised (OCI-R)³⁵, a self-report scale with good reliability, convergent and divergent
129 validity.^{36, 37} Current ADHD symptoms were assessed with the German ADHD self-rating scale
130 (ADHS-SB),³⁸ symptoms of depression were assessed with the Beck Depression Inventory (BDI-
131 II),³⁹ and symptoms of anxiety were assessed using the Beck Anxiety Inventory (BAI).⁴⁰⁻⁴² Patients
132 were also asked to report any of the following comorbid diagnoses: ADHD (N=41; impulsivity,
133 hyperactivity, and inattention were also reported separately), OCD (N=157), anxiety disorders
134 (N=61), depression (N=73), sleeping disorders (N=40), eating disorders (N=14), personality
135 disorders (N=18) and addiction disorders (N=5). The diagnoses were entered into a binary logistic
136 regression (except addiction disorders and eating disorders, due to low prevalence) to predict the
137 likelihood of experiencing urges. Total number of comorbidities was correlated with urge
138 intensity.

139 A structural equation model (SEM) was used to test the association of ADHD, OCD, anxiety, and
140 depression, with the number of tics in each patient that were associated with a particular urge
141 quality.

142

143 **Symptom severity and quality of life**

144 Linear regression was used to predict quality of life from urge qualities, comorbidities, and
145 different types of tics, age and gender. Frequency of tics in different body areas were averaged
146 according to the following body areas: eyes, nose/lips, grimacing, mouth/jaw, head, body, arms
147 and legs as well as when classified as complex motor / vocal tics, e.g. copropraxia, echolalia.

148

149 **Treatment**

150 Independent t-tests were used to compare different current treatments (anti-dopaminergic
151 medication (N = 126) to no treatment (N=137). Behavioral therapy (N=11), and cannabis-based
152 treatment (N=16) were not analyzed due to low numbers.

153

154

155 *Results*

156 **Is urge frequency and intensity associated with tic frequency and intensity?**

157 A significant repeated measures ANOVA $F(3,396)=9.90, p<.001, \eta^2=.07$ showed that patients
158 executed complex motor tics $F(1,132)=20.49, p<.001, \eta^2=.13$, and complex vocal tics
159 $F(1,132)=13.28, p<.001, \eta^2=.09$ less frequently than simple motor tics, but not simple vocal tics
160 $F(1,132)=1.13, p<.289, \eta^2=.01$. In contrast, tic intensity did not differ significantly across simple
161 and complex motor and vocal tics $F(3,396)=2.42, p<.065, \eta^2=.02$.

162 On average, tic frequency was significantly associated with urge frequency ($r=.27, p<.001$), for
163 both motor tics ($r=.27, p<.001$), and vocal tics ($r=.30, p<.001$). If the frequency of all urges and
164 tics were considered and used as a sum score, the correlation was much higher ($r=.84, p<.001$).

165 Considering all tics, more frequent motor tics ($r=.82, p<.001$), and more frequent vocal tics ($r=.76,$
166 $p<.001$) were significantly associated with more frequent urges. Similar effect sizes were found
167 for simple ($r=.80, p<.001$), and complex tics ($r=.80, p<.001$).

168 On average, urge intensity was associated with tic intensity ($r=.37, p<.001$), similar effect sizes
169 were found for motor ($r=.39, p<.001$), and vocal tics ($r=.47, p<.001$), and for simple ($r=.40,$
170 $p<.001$) and complex tics ($r=.30, p<.001$).

171

172 **How common is a sense of relief?**

173 Of those patients who reported PUs, 97% (N = 224/232) reported a feeling of relief for a least one
174 of their tics. In those patients who did report a sense of relief, 85% of tics were associated with
175 relief. Eighty-eight percent of simple motor tics, 90% of complex motor tics, 86% of simple
176 phonetic tics, and 81% of complex phonetic tics were associated with relief.

177

178 **Which urge qualities are most common?**

179 Different urge qualities were experienced with decreasing frequencies of patients in the following
180 order, in a significant linear fashion: feelings of tension, pressure and the feeling that something
181 was building up, a feeling of energy that needs to be released, a just-right feeling, feeling
182 discomfort, an itch or incompleteness (Figure 1A, Supplementary Table 1); $F(1,290)=161.49,$
183 $p<.001, \eta^2=.28$. Tension was experienced by significantly more patients than all other urge
184 qualities (contrast between tension and pressure: $F(1,290)=34.77, p<.001, \eta^2=.11$), and a feeling
185 of incompleteness was experienced by significantly fewer patients than all other urge qualities
186 (contrast between incompleteness and itch: $F(1,290)=6.05, p=.015, \eta^2=.02$). The pattern was the
187 same across simple and complex, as well as motor and vocal tics (Figure 1B).

188 Urge intensity did not differ across urge qualities $F(1,8)=.02, p=.896, \eta^2=.002$ (Figure 1C).

189 A similar pattern was reflected in urge quality associated with tics. Most tics were associated with
190 feelings of tension, while fewest tics were associated with a feeling of incompleteness. Correcting
191 for multiple testing, only those two occurred at significantly different rates ($t(290)=10.37, p=.001,$
192 $d = .61$). Again, the pattern was reflected in simple and complex as well as in motor and vocal tics
193 (Figure 1D, Supplementary Table 1).

194

195 **Are Comorbidities associated with the urge to tic?**

196 Having comorbid depression or anxiety, being older, and being female were associated with being
197 more likely to experience urges ($\chi^2=49.52, p<.001$, Nagelkerkes $r^2=.25$; Table 1). Having more
198 comorbidities was not associated with more intense urges ($r=.09, p=.183$) but with a higher

199 likelihood to experience urges ($r = .19, p = .001$). Higher urge intensity was only predicted by more
200 OCD symptoms and younger age (Table 1).

201 The SEM showed that different comorbidities were related to experiencing more intense urges of
202 different qualities, e.g., ADHD was related to higher intensities of tension and the feeling of
203 something building up before a tic, OCD was related to not-just-right feelings, tension, and energy,
204 depression was associated with pressure, tension, energy, and the feeling that urges build up, while
205 anxiety was associated with tension, not-just-right feelings, incompleteness, energy, and the
206 feeling of something building up before a tic (Figure 2, Table 2).

207

208 **Symptom severity and quality of life**

209 Lower Quality of life (QoL) was associated with higher urge intensity ($r = .28, p < .001$) and higher
210 tic frequency ($r = .13, p = .045$). Linear regression showed that more complex vocal tics, and having
211 comorbid OCD, ADHD, anxiety or depression were associated with lower QoL ($F(18,272) = 59.17,$
212 $p < .001, r^2 = .80$; Table 3).

213 Tics in different body parts were not related to differences in quality of life $F(9,21) = .47, p = .876$.

214

215 **Treatment**

216 Patients who were taking anti-dopaminergic medication were significantly less likely to experience
217 an urge ($N = 126$) than those who were not $t(261) = -2.92, p = .004$. There were no differences in urge
218 intensity between patients who took anti-dopaminergic medication and those who did not receive
219 treatment $t(202) = -.52, p = .605$.

220

221 *Discussion*

222 **Is urge frequency and intensity associated with tic frequency and intensity?**

223 The results show that simple tics were executed more frequently than complex tics but that tic
224 intensity did not differ between simple and complex tics. The results confirm that urge and tic
225 frequency and urge and tic intensity are correlated. This is an important result because previous
226 findings were mixed regarding the association between urges and tics.^{3, 12, 14, 17, 18, 43, 44} It has been
227 unclear whether the relationship between urges and tics was not as close as assumed or whether
228 the instruments to measure urges and tics influenced the association found. The majority of studies
229 have found small-medium correlations between urges and tics,^{3, 12, 17, 43, 44} while others found no

230 relationship.¹⁸ Our data from a large sample of patients clarifies that urges and tics are indeed
231 closely linked.

232 The current study did not use questionnaires asking about general tic and urge frequencies across
233 all tics. Instead, patients reported each tic and reported how frequent the tic was and how frequently
234 the associated urge occurred. This also disentangles frequency and intensity, concepts that are
235 convoluted when using overall questionnaire scores assessing urge or tic severity^{12, 45}. Regarding
236 frequency, the association between average urge frequency and tic frequency was small-medium
237 but when all tics per patient were considered, the relationship was high (explained variance was
238 70%). Effects were of similar size for motor and vocal tics, as well as for simple and complex tics.
239 The results confirm that there is a close association between tic and urge frequency, i.e. tics that
240 occur more frequently are also associated with frequent urges.

241 Regarding intensity, correlations showed a medium relationship between urge intensity and tic
242 intensity on average. Again, this was true for motor and vocal as well as for simple and complex
243 tics. The result suggests that more intense urges are followed by more intense tics. This leads back
244 to the question whether an intense urge ‘requires’ an intense tic to lead to relief or whether intense
245 tics become associated with an intense urge to match the tic.

246

247 **How common is a sense of relief?**

248 In patients who experienced urges, over 80% of tics were associated with a sense of relief. Previous
249 research showed that on average, urges increase before tics and decrease after a bout of tics.¹³ This
250 pattern was found only in two thirds of patients, albeit in a small sample.¹⁴ Previous papers have
251 focused on how many patients experience relief after executing a tic and have found that >80% of
252 patients experience a sense of relief with at least one tic.^{17, 21, 46} These results show that in patients
253 who do experience relief > 80% of tics are associated with a sense of relief. Again, there were no
254 substantial differences between simple and complex or motor and vocal tics. Therefore, it remains
255 an open question what determines whether a tic is associated with a feeling of relief, and it poses
256 the question of whether it is sensible to categorize tics in this manner.

257

258 **Which urge qualities are most common?**

259 Regarding urge quality, tension was the most commonly experienced PU, while incompleteness
260 was the least common one. Again, there were no differences between vocal and motor tics, simple

261 and complex tics. Furthermore, different urge qualities were not associated with different
262 intensities. As far as we are aware, this is the first study to explore which urge qualities are most
263 commonly associated with tics. It is interesting that most tics were associated with general feelings
264 of energy, tension, and discomfort, while more specific qualities such as an itch, feelings of
265 incompleteness and not just-right feelings were less common. This poses a problem regarding the
266 assessment of PU with the PUTS.¹² The PUTS treats all qualities equally, and patients who score
267 higher on more different qualities, receive a higher urge severity score based on the questionnaire.
268 This would result in patients with high urge scores to have an unusual, rather than a usual
269 presentation of urges. Future versions should disentangle urge quality and intensity⁴⁷.

270

271 **Are Comorbidities associated with the urge to tic?**

272 When considering comorbid diagnoses, ADHD and depression were associated with a higher
273 likelihood to experience urges, while OCD was associated with higher urge intensities in those
274 that experienced urges. ADHD, OCD, and depression are common comorbidities in TS.¹⁵ Previous
275 findings on the association between urges and comorbidities have been mixed.^{12, 17-19} No
276 relationship was found between PU severity and severity of ADHD and OCD in a sample of 122
277 adolescents and young adults,¹⁷ while a study in 42 youths found significant relationships between
278 PU and OCD, ADHD, and anxiety/depression.¹² Significant relationships between PU and OCD
279 symptoms and depression but not anxiety and ADHD were found in children older than 10 years,¹⁸
280 and correlations of PU intensity with OCD but not ADHD were also found in 22 adults.¹⁶ The
281 results in this large sample of adults clarify that adult patients with ADHD and depression are more
282 likely to experience PU, and that patients who do experience PU, experience higher intensities
283 with more OCD symptoms, when age and gender effects are controlled for. Interestingly, having
284 more comorbidities was not associated with more intense urges but it was associated with a slightly
285 higher risk to experience urges in the first place.

286 Regarding urge quality, symptoms of ADHD were significantly associated with more intense
287 feelings of tension. It might be assumed that inattention could lead to a reduced ability to perceived
288 urges, therefore, the result is surprising. It is possible that the result reflects the difficulty to
289 disentangle symptoms and experience of disorders that we currently regard as distinct, such as TS
290 and ADHD. However, if ADHD patients experience an increased inner restlessness or tension
291 overall, it may not be a distinct experience from the phenomena associated with tics.

292 OCD was related to more intense feelings of tension, not just-right feeling, and energy. The results
293 are in line with previous literature, showing that comorbid OCD was associated with not just-right
294 feelings and feelings of incompleteness, and comorbid ADHD was associated with feelings of
295 tension.¹⁶ In addition, our results showed that anxiety was related to more intense feelings of
296 tension, not-just-right feelings, incompleteness, and energy. Depression was related to more
297 intense feelings of pressure, tension, energy and a build-up of urges.

298 Further, older age and female gender were associated with a higher likelihood of experiencing
299 urges in many^{2, 7, 8} but not all studies.¹⁷ This study shows that the likelihood of urges increases
300 across adulthood as well, not only across early development. In contrast, urge intensity decreased
301 with older age. The data suggest that if tics continue in a patient, the likelihood to experience urges
302 increases during adulthood. This would support the view that tics drive the generation of the urge
303 to tic over time, not the other way around. Regarding gender, there could be differences in attention
304 to inner states⁴⁸ or the ability to identify inner states between males and females. However, very
305 little is known about gender differences and symptom development into older adult age in patients
306 with TS.

307

308 **How are urges related to quality of life?**

309 Lower quality of life was related to higher urge intensity and tic frequency. Higher symptom load
310 for ADHD, OCD, depression, and anxiety, and more complex vocal tics were all significantly
311 associated with lower quality of life. This is in line with the literature, showing that tic severity,
312 urges,^{8,21} depression,⁴⁹ ADHD, and complex tics⁵⁰ are associated with lower quality of life. Specific
313 urge qualities were not associated with lower quality of life once comorbidities were accounted
314 for.

315

316 **Treatment**

317 Anti-dopaminergic medication was associated with a lower likelihood to experience urges but not
318 lower urge intensity. Although no causal conclusions can be drawn due to the cross-sectional
319 nature of the study, it seems unlikely that only patients with a lower likelihood to experience urges
320 would choose medication as treatment. Anti-dopaminergic medication has a variety of effects,
321 such as feeling sleepy or drowsy, that could affect the ability to perceive urges by decreasing

322 interoceptive awareness.⁴⁸ It is also possible that anti-dopaminergic medication decreases the urge
323 to tic but possible mechanisms need to be further investigated.

324

325 **Limitations**

326 Patients who participated in this study reported that they were pre-diagnosed, however, they were
327 not seen by a clinician for this study to confirm their diagnosis. This was also true for the comorbid
328 diagnoses that were reported by participants. However, patients were recruited via TS outpatient
329 groups and TS advocacy groups, and patients who reported that their diagnosis was not confirmed
330 by a clinician were excluded from the analyses. Patients received €25 for their participation, and
331 this poses a small risk of multiple participation but we would consider that risk small, due to the
332 time it took to fill out the questionnaire.

333

334 **Conclusions**

335 Results from this large dataset clarify that urges and tics are closely associated, and that most tics
336 are followed by a feeling of relief. While the likelihood to experience urges appears to increase for
337 females, as well as across the adult lifespan, urge intensity decreases with age. Quality of life was
338 impacted by PU, comorbid ADHD, OCD, anxiety, and depression, as well as the number of
339 complex tics but not by motor tics or simple tics, confirming that as a rule, comorbid disorders and
340 PU are more detrimental to quality of life than tics are. Motor and vocal, complex and simple tics
341 did not differ with regard to urge intensity, urge frequency, relief, and urge quality, posing the
342 question whether it is sensible to differentiate between these specific categories regarding tic
343 disorder diagnosis.

344

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348 analysis, or manuscript writing.

349

350 **Ethical Compliance Statement**

351 The Hanover Medical School ethics committee reviewed and approved the research (7631). The
352 research was conducted online, patients gave their informed consent to participate by ticking the

353 consent box on the SocSci Survey platform. We confirm that we have read the Journal's position
354 on issues involved in ethical publication and affirm that this work is consistent with those
355 guidelines. We confirm that we have read the Journal's position on issues involved in ethical
356 publication and affirm that this work is consistent with those guidelines.

357

358

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398

399 **Authors' Roles**

- 400 1) Research project: A. Conception, B. Organization, C. Execution
401 2) Statistical Analysis: A. Design, B. Execution, C. Review and Critique
402 3) Manuscript: A. Writing of the first draft, B. Review and Critique

403

404 Valerie Brandt: 1A, 2A, 2B, 31

405 Jana Essing: 1A, 1B, 1C, 2C, 3B

406 Ewgeni Jakubovski: 1A, 1B, 2C, 3B

407 Kirsten R Müller-Vahl: 1A, 1B, 2C, 3B

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409

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538 **Figure Legends**

539 Figure 1A: Number of patients (\pm Standard Error) experiencing urge quality associated with at
540 least one tic.

541 B: Percentage of patients reporting each urge quality for at least one tic (multiple responses
542 possible).

543 C: average urge intensity associated with tics.

544 D: Percentage of tics associated with different types of urge quality.

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547 Figure 2. Structural equation model. Significant beta values are displayed in the model.

548 Correlations amongst the predictors are also displayed. ADHD = attention deficit hyperactivity
549 disorder OCD = obsessive compulsive disorder.

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553 **Supplementary Table Legend:**

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555 Supplementary Table 1. Quality of urges: N of patients. The first row shows urge quality per
556 patient for at least one tic. Second row: number of tics associated with different urge qualities.

557 SD=standard deviation. Lower part: total number and percentages of tics associated with
558 different urge qualities.

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Table 1. Regression predicting urges from comorbidities

	B	S.E.	Wald	OR	<i>p</i>
Constant	-2.83	1.15	6.04	.06	.014
OCD	-.63	.34	3.38	1.88	.066
Anxiety	.21	.51	.17	.81	.683
Depression	2.07	.78	7.03	.13	.008
ADHD	2.66	1.05	6.49	.07	.011
Sleep	.37	.83	.20	.69	.653
Personality	-.25	.90	.08	1.28	.783
Age	.55	.19	8.37	1.73	.004
Gender	2.76	1.04	7.10	15.83	.008
	B	S.E.		Beta	<i>p</i>
Constant	5.66	.43			.000
ADHD	.02	.03		.04	.613
OCD	.03	.01		.22	.017
Anxiety	.01	.01		.06	.550
Depression	.00	.01		-.02	.774
Age	-.24	.10		-.16	.017
Gender	.38	.26		.10	.150

562

563 The upper panel shows a binary logistic regression with diagnosis (yes / no) as predictor
 564 variables and experiencing urges (yes / no) as the dependent variable. Having a depression or
 565 ADHD diagnosis significantly increased the likelihood to experience urges. Significant results
 566 are marked in bold.

567 The lower panel shows the results of a linear regression, predicting urge intensity from
 568 questionnaire data. Attention deficit hyperactivity disorder (ADHD) and younger age were
 569 associated with more intense urges. OCD = obsessive compulsive disorder.

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Table 2. Association between different urge qualities and comorbidities

		Estimate	S.E.	z	p
Itch	ADHD-SB	.07	.04	1.66	.097
	OCI-R	.03	.02	1.75	.080
	BAI	-.03	.02	-1.18	.239
	BDI-II	.03	.02	1.25	.211
Pressure	ADHD-SB	.09	.05	1.76	.078
	OCI-R	.03	.02	1.44	.151
	BAI	.04	.03	1.57	.118
	BDI-II	.06	.03	2.22	.027
Tension	ADHD-SB	.11	.04	2.64	.008
	OCI-R	.05	.02	2.79	.005
	BAI	.05	.02	2.03	.042
	BDI-II	.05	.02	2.12	.034
Just right	ADHD-SB	.07	.04	1.72	.086
	OCI-R	.04	.02	2.47	.014
	BAI	.08	.02	4.05	<.001
	BDI-II	.01	.02	.56	.573
Incompleteness	ADHD-SB	.00	.04	.10	.918
	OCI	.02	.02	1.12	.263
	BAI	.05	.02	2.60	.009
	BDI-II	.01	.02	.29	.771
Energy	ADHD-SB	.03	.05	.49	.627
	OCI-R	.06	.02	2.67	.008
	BAI	-.09	.03	-3.14	.002
	BDI-II	.08	.03	2.79	.005
Discomfort	ADHD-SB	.08	.05	1.76	.079
	OCI-R	.00	.02	.10	.924
	BAI	-.07	.02	-2.89	.004
	BDI-II	.10	.03	3.98	<.001
Build-up	ADHD-SB	.12	.05	2.70	.007
	OCI-R	.02	.02	.75	.455
	BAI	-.06	.02	-2.67	.008
	BDI-II	.07	.02	2.77	.006

581 The table shows which comorbidities are associated with different urge qualities. Significant
582 associations are highlighted in bold. ADHD-SB = attention deficit hyperactivity disorder self-
583 rating scale, OCI-R = obsessive compulsive inventory, BDI-II = Beck Depression Inventory II,
584 BAI=Beck Anxiety Inventory.

Table 3. Variables that predict quality of life

	B	S.E.	β	<i>t</i>	<i>p</i>
(Constant)	1.08	2.24		.48	.632
N Simple Motor Tics	.10	.21	.02	.49	.625
N Complex Motor Tics	.50	.29	.09	1.69	.091
N Simple Vocal Tics	-.12	.31	-.02	-.39	.699
N Complex Vocal Tics	1.85	.55	.14	3.34	.001
ADHD-SB	1.10	.15	.29	7.51	<.001
OCI-R	.17	.06	.11	2.60	.010
BAI	.36	.08	.23	4.52	<.001
BDI-II	.63	.08	.32	8.10	<.001
Itch	.47	1.38	.01	.34	.734
Pressure	.66	1.47	.02	.45	.652
Tension	-.58	1.62	-.01	-.36	.720
Just right	.20	1.58	.00	.12	.901
Incomplete	-3.00	1.63	-.06	-1.85	.066
Energy	-.47	1.32	-.01	-.35	.725
Discomfort	.35	1.85	.01	.19	.852
Build-up	-1.11	1.99	-.03	-.56	.576
Age	-.39	.52	-.02	-.76	.450
Gender	-.67	1.44	-.01	-.47	.641

587

588 A linear regression showed that a higher number of complex vocal tics, and higher symptoms of
589 attention deficit hyperactivity disorder (ADHD-SB), obsessive compulsive disorder (OCD-R),
590 anxiety, and depression were associated with lower quality of life. BDI-II = Beck Depression
591 Inventory II, BAI=Beck Anxiety Inventory.

592